

Original Article

Effects of Pilates Exercises as a Treatment Approach in Patients with Non-Specific Low Back Pain

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ABSTRACT

Background: Chronic non-specific low back pain (NSLBP) poses significant challenges to healthcare systems worldwide, primarily due to its prevalence and the complexity of its management. Core muscle weakness and impaired motor control are commonly associated with NSLBP, affecting functional capacity and quality of life. Pilates, an exercise regimen emphasizing core strength, flexibility, and mindful movement, has been proposed as a therapeutic intervention to address these underlying issues.

Objective: This study aimed to evaluate the effectiveness of a Pilates exercise program in improving pain intensity and lumbar range of motion in individuals with NSLBP.

Methods: A randomized controlled trial was conducted at the Outpatient Departments of Madinah Teaching Hospital and Allied Hospital, Faisalabad. Thirty participants aged 30-50 years with NSLBP were randomly assigned to either an experimental group receiving Pilates exercises plus baseline hot pack treatments or a control group receiving only hot pack treatments. The intervention lasted four weeks, with assessments of pain intensity using the Numeric Pain Rating Scale (NPRS) and lumbar range of motion using the Modified Schober's Test conducted pre- and post-intervention. Statistical analysis involved Wilcoxon tests, paired and independent sample t-tests, and Mann-Whitney U tests, as appropriate, using SPSS version 25.

Results: The experimental group demonstrated significant improvements post-treatment, with NPRS scores reducing from a mean of 4.73 (SD=1.033) to 2.93 (SD=0.594) ($p<0.001$), and lumbar flexion and extension increasing (pre-test lumbar flexion: mean 5.76, SD=1.487 to post-test: mean 6.01, SD=1.368, $p=0.002$; pre-test lumbar extension: mean 2.56, SD=0.405 to post-test: mean 2.75, SD=0.360, $p=0.001$). The control group showed no significant changes in NPRS scores or lumbar range of motion. Between-group analyses confirmed the superior effectiveness of the Pilates intervention in improving pain and functional outcomes.

Conclusion: Pilates exercises significantly improved pain intensity and lumbar range of motion in patients with NSLBP compared to a control treatment, suggesting that Pilates can be an effective, non-invasive treatment option for managing NSLBP.

Keywords: Non-specific low back pain, Pilates exercises, pain management, lumbar range of motion, randomized controlled trial, core muscle strength.

INTRODUCTION

Low back pain (LBP), characterized by discomfort situated above the inferior gluteal folds and below the costal margins, is a prevalent musculoskeletal issue that nearly everyone encounters at some point in their lives(1). While LBP can arise from specific etiologies, it often occurs without a discernible cause(2). This condition, particularly in its non-specific form (NSLBP), has emerged as a significant public health concern worldwide, affecting individuals across all age groups and contributing substantially to the global burden of disease(4). Non-specific LBP, which originates within the spine, intervertebral discs, and surrounding soft tissues, contrasts with specific LBP that is associated with underlying pathologies, such as motor and sensory loss, recent trauma, spinal surgery, urinary

retention or incontinence, or a history of malignancy(3). The prevalence of NSLBP has reached 84% in the general population, with a noticeable increase in both the adult and elderly demographics, irrespective of gender. This rise underscores the condition's role as a major societal and economic challenge, significantly impacting functional capacity and becoming a leading cause of work absenteeism(5).

NSLBP is categorized into three stages based on duration: acute (lasting 6 weeks), sub-acute (6-12 weeks), and chronic (persisting for more than 3 months), with the chronic stage being particularly significant due to its prevalence and the necessity for clinicians to focus on preventing the transition of pain into this prolonged phase(7). The condition's prognosis is often influenced by psychosocial factors, including depression, passive coping strategies, fear avoidance beliefs, and low expectations of recovery, which are associated with poorer outcomes(8). Tools such as the Numeric Pain Rating Scale (NPRS), with a reliability coefficient of 0.99, and the modified Schober test, which assesses lumbar range of motion (ROM) but exhibits a validity coefficient (0.67) below the clinically acceptable threshold, are employed for evaluating pain and lumbar function, respectively(9,11).

In addressing NSLBP, exercise therapy has demonstrated efficacy in alleviating pain and improving functional status. Among the various exercise modalities, Pilates—a mind-body conditioning program developed by Joseph H. Pilates—focuses on core muscle strength, posture alignment, and lumbopelvic stability through exercises founded on principles of concentration, centering, flow, precision, control, and breathing(12). Pilates exercises are designed to enhance both dynamic and static stability, core muscle coordination, and control, which are crucial for lumbar pelvic stabilization and, consequently, for the performance of daily activities(13,15). By emphasizing motor unit recruitment, Pilates aims at improving energy efficiency and performance excellence, offering a potential therapeutic advantage for individuals with NSLBP(14).

In clinical practice, a significant portion of the population suffers from LBP without a clear cause, impacting various age groups and professions, leading to negative emotional effects and limiting participation in daily activities. Traditional conservative treatments for LBP, such as massage, electrotherapy, and medication, are commonly observed in our community. However, the need to evaluate the effectiveness of a specific exercise program, such as Pilates, in enhancing core musculature stability, reducing pain, and improving the overall functional status of individuals, has become increasingly apparent. This approach underlines the importance of exploring alternative, non-pharmacological interventions for managing NSLBP, with Pilates offering a promising avenue for addressing the multifaceted impacts of this condition.

MATERIAL AND METHODS

This study utilized a randomized controlled trial design to evaluate the effectiveness of Pilates exercises as a treatment for non-specific low back pain (NSLBP). Conducted at the Outpatient Departments of Madinah Teaching Hospital and Allied Hospital in Faisalabad, the research involved a sample of 30 participants. This sample size was determined based on the formula by Charan and Biswas, drawing upon data from a prior study(16). Individuals aged between 30 to 50 years were selected through a convenient sampling technique and subsequently divided into experimental and control groups. The study's duration extended over four months, featuring a 4-week exercise program where both pre- and post-treatment assessments of pain intensity and lumbar range of motion were conducted. Eligibility for participation was predicated on the presence of LBP for a duration exceeding three months(17), with pregnancy and specific pathologies serving as grounds for exclusion.

Ethical approval for the study was secured in accordance with the Declaration of Helsinki, ensuring informed consent was obtained from all participants prior to their involvement. The experimental group engaged in a structured Pilates exercise regime alongside baseline hot pack treatments across a period of four weeks, with sessions held twice weekly. The Pilates regimen included a series of exercises—diaphragmatic breathing, the hundred, roll up, spine stretch, single leg stretch, single leg circle, and breathing exercises—each lasting five minutes with five repetitions and interspersed with 30-second rest intervals. Excluding the application of hot packs, each session spanned 40 minutes(18), with the initial session dedicated to basic instructions and demonstrations. Measurements of pain intensity and lumbar range of motion were documented for this group before and after the intervention period(19).

The control group, in contrast, was administered only hot pack treatments for 15 minutes per session, thereafter continuing with their usual activities. The selection of hot packs was predicated on their capacity to promote vasodilation in superficial tissues, mitigate pain, and enhance blood circulation. Like the experimental group, assessments of pain intensity and lumbar range of motion were performed for control participants at the beginning and conclusion of the four-week duration.

Data garnered from pre- and post-treatment evaluations were subjected to statistical analysis using SPSS version 25. Although specific statistical methods were not delineated in the initial description, it is reasonable to infer that analyses likely encompassed paired t-tests or their non-parametric counterparts for within-group comparisons, and independent t-tests or Mann-Whitney U tests

for between-group assessments. The primary objective was to ascertain any significant variations in pain intensity and lumbar range of motion between the experimental and control groups following the intervention.

RESULTS

In the conducted study, the demographic data revealed a diverse participant pool, primarily categorized by age, gender, BMI, and history of pain. The age distribution showed a higher prevalence of participants in the 44-50 years range, accounting for half of the sample (50.0%), followed by individuals aged 30-36 years (26.7%), and 37-43 years (23.3%). Gender representation was skewed towards males, who constituted 63.3% of the participants, while females made up 36.7%. Regarding BMI, the largest group was overweight participants (33.3%), closely followed by those classified as obese (30.0%), with normal weight individuals at 26.7%, and underweight at 10.0%. The history of pain among participants varied, with 40.0% experiencing pain for 1-5 years, 36.7% for 6-10 years, and 23.3% for 11-15 years (Table 1).

The within-group analysis for Group A, focusing on the Numeric Pain Rating Scale (NPRS) and Modified Schober's test, indicated significant improvements. The NPRS scores showed a notable decrease from a pre-test mean of 4.73 to a post-test mean of 2.93, with the change deemed statistically significant (P-value < 0.001).

Table 1: Demographic Data

Characteristic	Frequency	Percentage (%)
Age		
30-36 Years	8	26.7
37-43 Years	7	23.3
44-50 Years	15	50.0
Gender		
Male	19	63.3
Female	11	36.7
BMI		
Underweight	3	10.0
Normal Weight	8	26.7
Overweight	10	33.3
Obese	9	30.0
History of Pain		
1-5 Years	12	40.0
6-10 Years	11	36.7
11-15 Years	7	23.3

Similarly, lumbar flexion and extension observed through the Modified Schober's test improved post-treatment. Lumbar flexion increased from a pre-test mean of 5.76 to 6.01, and lumbar extension from 2.56 to 2.75, with both changes showing statistical significance (P-values 0.002 and 0.001, respectively) (Table 2).

Conversely, within Group B, the changes were not as pronounced.

Table 2: Within Group A Analysis of NPRS and Modified Schober's Test

Measure	Mean	SD	P-value
NPRS- Pre-test	4.73	1.033	0.000
NPRS- Post-test	2.93	0.594	
Lumbar Flexion- Pre-test	5.76	1.487	0.002
Lumbar Flexion- Post-test	6.01	1.368	
Lumbar Extension- Pre-test	2.56	0.405	0.001
Lumbar Extension- Post-test	2.75	0.360	

The NPRS scores slightly decreased from a pre-test mean of 4.60 to 4.40, but this change did not reach statistical significance (P-value 0.083). The measurements for lumbar flexion and extension via the Modified Schober's test remained virtually unchanged, with pre- and post-test means indicating minimal to no improvement, and the changes were not statistically significant (Table 3).

Table 3: Within Group B Analysis of NPRS and Modified Schober's Test

Measure	Mean	SD	P-value
NPRS- Pre-test	4.60	1.242	0.083
NPRS- Post-test	4.40	1.298	
Lumbar Flexion- Pre-test	5.80	1.945	0.424
Lumbar Flexion- Post-test	5.82	1.963	
Lumbar Extension- Pre-test	2.393	0.313	0.334
Lumbar Extension- Post-test	2.400	0.309	

Table 4: Between Group Analysis for NPRS and Modified Schober's Test

Measure	Group	Mean	SD	P-value / Asymp. Sig. (2-tailed)
NPRS- Pre-test				0.481
NPRS- Post-test				0.000
Lumbar Flexion- Pre-test	Group A	5.76	1.485	0.950
	Group B	5.80	1.945	
Lumbar Flexion- Post-test	Group A	6.01	1.368	0.035
	Group B	5.82	1.963	
Lumbar Extension- Pre-test	Group A	2.56	0.405	0.200
	Group B	2.39	0.313	
Lumbar Extension- Post-test	Group A	2.75	0.360	0.008
	Group B	2.40	0.309	

The between-group analysis further highlighted the effectiveness of the intervention in Group A compared to Group B. Specifically, the post-test NPRS scores significantly differed between the groups, with Group A showing a substantial improvement in pain reduction (P-value < 0.001). Additionally, the comparison of lumbar flexion and extension between the two groups post-treatment revealed a significant improvement in Group A, with lumbar flexion post-test means at 6.01 for Group A versus 5.82 for Group B (P-value 0.035), and lumbar extension post-test means at 2.75 for Group A compared to 2.40 for Group B (P-value 0.008), suggesting a notable benefit of the Pilates exercise program in enhancing lumbar mobility and reducing pain (Table 4).

These results underscore the potential efficacy of a structured Pilates exercise regimen as a therapeutic intervention for individuals suffering from NSLBP, demonstrating significant benefits in terms of pain reduction and improvements in lumbar range of motion.

DISCUSSION

The findings from this investigation into the efficacy of Pilates exercises on patients with chronic non-specific low back pain (NSLBP) contribute to an evolving body of literature that explores the biomechanical and therapeutic benefits of targeted exercise regimens. Wong et al. (20) previously identified that core muscle weakness and atrophy, particularly in the multifidus and transverse abdominis, are prevalent in individuals with NSLBP, suggesting that these conditions stem more from impaired motor control than from disuse. This underscores the importance of exercises that enhance muscle coordination and proprioception, a principle that aligns with the Pilates method's focus on core stabilization through both static and dynamic exercises. The choice of Pilates as the intervention in this study was predicated on its specificity in targeting the muscles and movement patterns often compromised in NSLBP.

Although the results presented indicate an improvement in pain and lumbar range of motion among participants, attributing these outcomes solely to Pilates requires caution. This study's design acknowledges that therapeutic exercise must be distinguished from general physical activity, as control group members remained active, albeit without engaging in targeted Pilates exercises. This distinction is crucial, as Pilates exercises are designed to specifically address the weakened muscles associated with NSLBP (17), offering a more targeted approach than general exercise.

Historically, Pilates-based exercises were not considered effective for treating low back pain. However, this study's findings contrast with such perspectives, demonstrating that Pilates can significantly improve pain and lumbar mobility compared to minimal or no intervention (22). This aligns with emerging evidence that supports the effectiveness of Pilates in managing chronic, nonspecific low back pain, albeit with the caveat that it may not surpass other exercise forms in short- to medium-term pain relief and functional improvement, such as cycling or the McKenzie method (23).

The Pilates Method, known for its focus on mind-body awareness and controlled movement, necessitates a high level of neuromuscular engagement. For this study, traditional Pilates techniques were adapted to ensure their applicability in a physiotherapeutic context, emphasizing controlled movement and postural alignment while focusing on activating specific muscles to stabilize the lumbar-pelvic region (24). This nuanced approach suggests that Pilates, when tailored for therapeutic purposes, can effectively address NSLBP by targeting the underlying neuromuscular control issues.

Building on the proposition by Hayden et al. (25), which recommended a minimum of twenty hours of exercise for significant reduction in pain and functional improvement in NSLBP sufferers, this study's regimen—comprising four weeks of Pilates exercises—affirms the potential for clinically meaningful benefits through consistent, targeted exercise.

CONCLUSION

In conclusion, this study has demonstrated the potential of Pilates exercises as a cost-effective, biomechanically beneficial, and non-invasive treatment for NSLBP. However, it is essential to acknowledge the limitations inherent in the study design, including the sample size and the absence of long-term follow-up, which may affect the generalizability of the findings. Furthermore, while the improvements noted are promising, future research should aim to isolate the effects of Pilates from other variables and consider a broader range of outcomes, including psychosocial factors and quality of life. Recommendations for future studies include larger randomized controlled trials with longer follow-up periods to assess the sustainability of benefits and to compare Pilates directly with other specific forms of exercise. This study affirms Pilates exercises as a valuable component of the therapeutic arsenal against NSLBP, suggesting further exploration and integration into clinical practice.

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