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Article

Comparative Effects of Revulsive Compresses and Pilates Mat Exercise on Pain Intensity, Functional Disability, and Quality of Life in Patients with Non-Specific Chronic Low Back Pain

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ABSTRACT

Background: Non-specific chronic low back pain (NSCLBP) is a prevalent musculoskeletal disorder associated with substantial disability and diminished quality of life, necessitating effective conservative treatment strategies to mitigate its personal and societal burden. **Objective:** To compare the effects of revulsive compresses and Pilates mat exercise on pain intensity, functional disability, and quality of life in patients with NSCLBP. **Methods:** This randomized clinical trial included fourteen participants aged 18 to 50 years with NSCLBP persisting for more than twelve weeks, recruited at Rehab Max Hospital, Layyah. Participants were randomly assigned to receive either revulsive compresses or Pilates mat exercises three times weekly over eight weeks. Pain intensity, functional disability, and quality of life were assessed at baseline, fourth week, and eighth week using the Numeric Pain Rating Scale (NPRS), Modified Oswestry Disability Index (MODI), and EQ-5D-5L questionnaire, respectively. Statistical analyses included repeated measures ANOVA for within-group comparisons and independent t-tests for between-group differences, with significance set at $p \leq 0.05$. **Results:** Both interventions significantly reduced NPRS and MODI scores and improved EQ-5D-5L scores over time ($p < 0.001$). Pilates demonstrated superior outcomes compared to revulsive compresses at eight weeks, with significant between-group differences in NPRS ($p = 0.031$), MODI ($p = 0.029$), and EQ-5D-5L scores ($p = 0.030$). **Conclusion:** Pilates mat exercise is more effective than revulsive compresses in reducing pain, improving functional ability, and enhancing quality of life in patients with NSCLBP, supporting its integration into physiotherapeutic practice.

Keywords: Chronic low back pain; Pilates; Revulsive compresses; Pain intensity; Disability; Quality of life.

INTRODUCTION

Low back pain (LBP) is widely recognized as a significant public health issue with profound socioeconomic implications due to its association with work absenteeism, disability, and escalating healthcare costs (1). Globally, the lifetime prevalence of LBP is estimated to reach nearly 38.9%, highlighting its pervasive impact on individuals of all ages and occupations (2). Among adults, chronic low back pain (cLBP) affects approximately 60%, with prevalence notably rising with advancing age and varying across different socio-demographic groups (3). In Pakistan, the prevalence of non-specific low back pain (NSLBP) is remarkably high, reported at 93.4% among long-distance drivers, 81.5% among traffic wardens and security officers, and about 70% among physicians, underscoring its burden across diverse professional sectors (4). Non-specific chronic low back pain (NSCLBP), defined as pain persisting for over three months without an identifiable underlying pathology such as trauma, tumor, infection, or structural spinal abnormality, remains particularly challenging due to its multifactorial etiology, including muscular imbalances, poor posture, psychosocial stressors, and lifestyle habits (5). Patients with NSCLBP typically experience dull, aching pain localized below the costal margin and above the inferior gluteal folds, frequently aggravated by prolonged standing, bending, lifting, or physical exertion, leading to significant limitations in daily activities and reduced quality of life (6).

While conventional management approaches for NSCLBP encompass pharmacological interventions such as non-steroidal anti-inflammatory drugs, these often provide only transient relief and carry potential adverse effects, prompting a growing emphasis on

conservative, non-pharmacological therapies, particularly physiotherapeutic interventions (7). Current guidelines advocate exercise therapy as a cornerstone for NSCLBP management, with interventions targeting core stability, flexibility, neuromuscular control, and movement re-education demonstrating beneficial effects in reducing pain and functional impairment (8). Among these, Pilates has emerged as a prominent form of therapeutic exercise emphasizing principles of breathing, core stabilization, segmental spinal mobility, and neuromuscular coordination, and has been associated with improvements in pain intensity, disability, and health-related quality of life in individuals with chronic low back pain (9,10). For example, Tottoli et al. (2024) demonstrated that Pilates exercises led to superior improvements in health-related quality of life compared to home-based exercises in individuals with chronic non-specific low back pain, even though differences in pain and disability outcomes were less pronounced (11). Similarly, Batibay et al. (2021) reported that Pilates mat exercises resulted in greater reductions in pain and functional disability and improvements in core muscle thickness compared to home exercise programs in women with chronic low back pain (12). These findings highlight the potential of Pilates as an effective exercise modality in managing NSCLBP (13).

In contrast, hydrotherapeutic modalities such as revulsive compresses, involving alternating hot and cold applications, have been employed to enhance circulation, reduce inflammation, alleviate pain, and improve soft tissue mobility in musculoskeletal conditions, including low back pain (13). The physiological mechanism of revulsive compresses lies in the cyclical vasoconstriction and vasodilation response, which promotes vascular exchange, reduces edema, and offers analgesic effects (14). A randomized controlled trial by MS and Sujatha (2022) demonstrated significant reductions in pain intensity and functional disability, alongside improvements in spinal flexibility, following the application of revulsive compresses in patients with low back pain (15). Despite individual evidence supporting both interventions, no previous studies have directly compared the efficacy of Pilates mat exercise with revulsive compresses in patients with NSCLBP, leaving a notable gap in the literature (15).

Considering the significant disability and compromised quality of life associated with NSCLBP, it is essential to identify interventions that offer sustainable relief and functional improvement. Hence, this study aims to compare the effects of revulsive compresses and Pilates mat exercise on pain intensity, functional disability, and quality of life in patients with non-specific chronic low back pain. We hypothesize that Pilates mat exercise will demonstrate superior outcomes in reducing pain, decreasing functional disability, and enhancing quality of life compared to revulsive compresses in this patient population.

MATERIALS AND METHODS

This randomized clinical trial was designed to evaluate and compare the effects of revulsive compresses and Pilates mat exercise on pain intensity, functional disability, and quality of life in patients diagnosed with non-specific chronic low back pain. The rationale for employing a randomized controlled design was to establish causal inferences regarding the efficacy of both interventions while minimizing selection and allocation biases inherent in observational designs (1). The study was conducted at the Rehab Max Hospital in Layyah, Pakistan, over a period of three months, following approval of the research protocol by the institutional ethics committee. Data collection commenced in January 2025 and concluded in March 2025.

Eligible participants were male or female patients aged between 18 and 50 years who reported low back pain persisting for more than twelve weeks, with pain localized below the costal margin and above the inferior gluteal folds, and who demonstrated a positive straight leg raise test indicating nerve tension without significant neurological deficits. Additional inclusion criteria required that participants had not received any physiotherapy treatment for at least six months prior to enrollment and reported functional limitations in daily activities attributable to low back pain. Exclusion criteria comprised individuals with low back pain arising from non-musculoskeletal causes such as gynecological, retroperitoneal, or abdominal pathologies; those with diagnosed spinal osteoarthritis, rheumatoid arthritis, neurological disorders including cerebral palsy or epilepsy, spinal infections like cauda equina syndrome, a history of spinal trauma or fractures, spondylolisthesis, mental health disorders impairing exercise participation, or inability to ambulate independently (2-4).

Participants were recruited through announcements and referrals within the hospital outpatient department. Screening was performed by qualified physiotherapists who assessed patients against eligibility criteria using structured interviews and physical examination protocols. Patients who satisfied inclusion criteria were provided with comprehensive information about the study objectives, procedures, potential risks, and benefits, after which written informed consent was obtained in English or Urdu as appropriate to ensure comprehension and voluntariness. To preserve confidentiality, all participant data were anonymized and stored securely with restricted access, and individuals were informed of their right to withdraw from the study at any stage without affecting their clinical care.

Data collection occurred at baseline, at the fourth week, and at the eighth week following initiation of interventions. Participants were randomly assigned in a 1:1 ratio into either the revulsive compresses group (Group A) or the Pilates mat exercise group (Group B) using concealed allocation via opaque, sealed envelopes containing group assignment cards, which were shuffled by an independent researcher not involved in the study interventions or assessments. Blinding was maintained for the outcome assessors, who were unaware of group assignments throughout the study.

The primary outcomes measured were pain intensity, functional disability, and health-related quality of life. Pain intensity was assessed using the Numeric Pain Rating Scale (NPRS), a validated instrument in which participants rated their pain on a scale from 0,

indicating no pain, to 10, indicating the worst imaginable pain, with defined ranges for mild (1–3), moderate (4–6), and severe pain (7–10) (5). Functional disability was evaluated using the Modified Oswestry Disability Index (MODI), which quantifies disability on a scale from 0 to 100, with higher scores indicating greater disability, and categorized into minimal (0–20), moderate (21–40), severe (41–60), crippled (61–80), and bed-bound (81–100) disability levels (6). Quality of life was measured using the EQ-5D-5L questionnaire, encompassing five domains—mobility, self-care, usual activities, pain/discomfort, and anxiety/depression—each rated across five levels from no problem (Level 1) to extreme problems (Level 5) (7). Data for all outcome measures were collected via structured, interviewer-administered questionnaires to minimize reporting bias and ensure consistency.

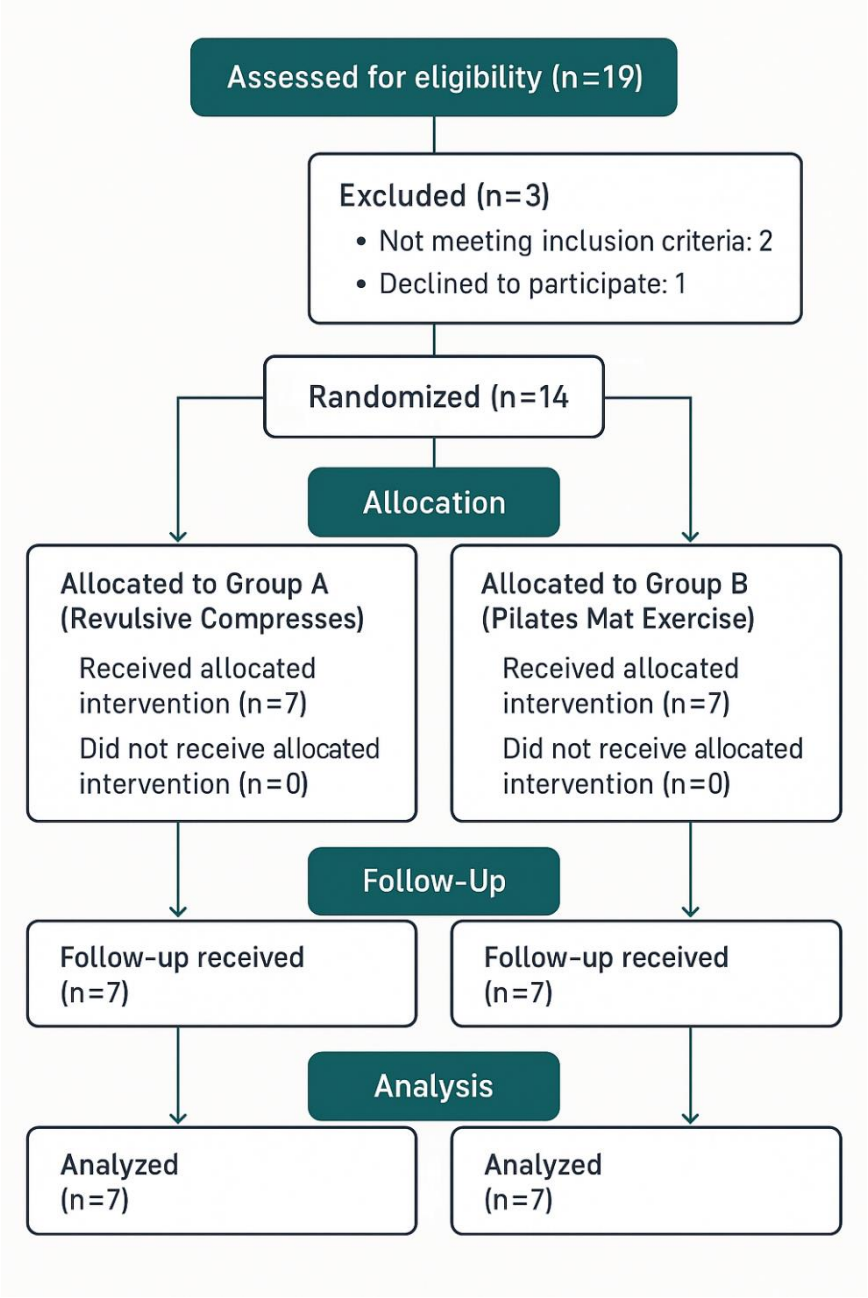

Figure 1 CONSORT flowchart

For Group A, the intervention involved revulsive compress therapy, administered three times weekly for eight weeks. Each session entailed applying a hot fomentation bag to the lower back region for five minutes, immediately followed by cold application for one minute, with the total session lasting twenty minutes. Group B received a supervised Pilates mat exercise program also conducted three times weekly for eight weeks. The initial two sessions focused on participant familiarization and instruction in proper technique. Each subsequent session lasted forty-five minutes and comprised warm-up exercises, a sequence of eight to twelve core stabilization and mobility exercises—including roll down, shoulder bridge, hip twist, abdominal preparations, oblique preparation, and others—and a cool-down phase with stretching exercises targeting spinal flexibility and lower limb musculature. Each exercise was performed with seven to eight repetitions, maintaining proper breathing and alignment principles inherent in Pilates methodology (8,9). Both groups additionally received a standardized ten-minute transcutaneous electrical nerve stimulation (TENS) session prior to their respective interventions to control for immediate analgesic effects and reduce potential confounding between groups.

The sample size calculation was performed based on detecting a difference in pain intensity between groups, assuming a mean difference of 0.6 points on the NPRS, with a pooled standard deviation of 0.4, a significance level of 5%, and a statistical power of 80%, yielding a minimum of seven participants required in each group (10). All data were entered and analyzed using SPSS software version 24 (IBM Corp., Armonk, NY). Continuous variables were presented as means with standard deviations, while categorical variables were summarized as frequencies and percentages. Normality of data distributions was assessed via both the Kolmogorov-Smirnov and Shapiro-Wilk tests. For within-group comparisons across the three time points, repeated measures analysis of variance (ANOVA) was employed to detect changes over time, with post hoc pairwise comparisons conducted using Bonferroni adjustments where significant main effects were observed. Between-group differences at each time point were analyzed using independent samples t-tests for normally distributed continuous outcomes. All statistical analyses were performed under a two-tailed significance level of 0.05. Missing data were minimal and managed via complete-case analysis, as data collection follow-up was maintained rigorously to ensure data integrity. Sensitivity analyses were not necessary due to the small sample size and the absence of missing outcome data.

Ethical approval for the study was granted by the Institutional Review Board of Government College University Faisalabad, Layyah Campus, and all study procedures adhered to the principles outlined in the Declaration of Helsinki. Measures to ensure reproducibility included the use of standardized treatment protocols, consistent intervention delivery by trained physiotherapists, thorough documentation of all procedures, and data verification checks to maintain accuracy during data entry and analysis

RESULTS

The study enrolled fourteen participants randomized evenly into two groups, with seven individuals in each intervention arm. Baseline demographic and anthropometric characteristics were comparable between the groups, as shown in Table 1. The mean age was 31.14 ± 10.49 years in the revulsive compresses group and 32.85 ± 8.21 years in the Pilates mat exercise group, with no significant difference ($p = 0.672$). Participants in the revulsive compresses group had a mean body weight of 71.42 ± 14.06 kg, whereas those in the Pilates group had a higher mean weight of 85.14 ± 33.34 kg, although this difference did not reach statistical significance ($p = 0.334$). Mean height was nearly identical between groups at 1.64 ± 0.32 meters for the revulsive compress group and 1.65 ± 0.29 meters for the Pilates group ($p = 0.942$). The mean BMI was slightly higher in the Pilates group at 31.71 ± 10.91 kg/m^2 compared to 27.28 ± 5.93 kg/m^2 in the revulsive compresses group, but this difference was not statistically significant ($p = 0.369$). The gender distribution showed that females were more prevalent in both groups, comprising 57.1% in the revulsive compress group and 71.4% in the Pilates group, with no significant difference between distributions ($p = 0.558$).

Within-group analyses revealed significant improvements across all primary outcomes in both intervention arms over the eight-week study period. As presented in Table 2, participants receiving revulsive compresses exhibited a substantial reduction in Numeric Pain Rating Scale (NPRS) scores, decreasing from 7.57 ± 1.39 at baseline to 5.71 ± 1.11 at the fourth week, and further to 3.28 ± 1.11 at the eighth week, with this change being statistically significant ($F = 19.45$, $p < 0.001$). Similarly, the Pilates group demonstrated an even greater decline in pain levels, with NPRS scores dropping from 7.14 ± 1.34 at baseline to 4.71 ± 0.95 at the fourth week and 2.00 ± 0.81 at the eighth week, which was also highly significant ($F = 32.61$, $p < 0.001$).

Functional disability, assessed via the Modified Oswestry Disability Index (MODI), showed significant reductions in both groups as shown in Table 3. In the revulsive compresses group, MODI scores improved from 78.57 ± 8.77 at baseline to 65.42 ± 8.84 by the fourth week and to 55.85 ± 6.56 at the eighth week ($F = 24.37$, $p < 0.001$). In the Pilates mat exercise group, the decline in MODI scores was more pronounced, falling from 76.57 ± 6.94 at baseline to 60.71 ± 8.82 at the fourth week and further to 45.57 ± 8.61 at the eighth week ($F = 36.52$, $p < 0.001$).

Table 1. Baseline Demographic and Anthropometric Characteristics of Participants (n=14)

Variable	Revulsive Compresses Group (n=7)	Pilates Mat Exercise Group (n=7)	p-value
Age, years, mean ± SD	31.14 ± 10.49	32.85 ± 8.21	0.672
Weight, kg, mean ± SD	71.42 ± 14.06	85.14 ± 33.34	0.334
Height, meters, mean ± SD	1.64 ± 0.32	1.65 ± 0.29	0.942
BMI, kg/m^2, mean ± SD	27.28 ± 5.93	31.71 ± 10.91	0.369
Gender, n (%) Male	3 (42.9%)	2 (28.6%)	0.558
Gender, n (%) Female	4 (57.1%)	5 (71.4%)	

Table 2. Within-Group Changes in Numeric Pain Rating Scale (NPRS) Scores Across Timepoints

Timepoint	Mean ± SD (Group A)	Mean ± SD (Group B)	F-value	p-value
Baseline	7.57 ± 1.39	7.14 ± 1.34		
4th week	5.71 ± 1.11	4.71 ± 0.95		
8th week	3.28 ± 1.11	2.00 ± 0.81		
Repeated Measures ANOVA F-value	19.45	32.61	—	<0.001

The health-related quality of life, as measured by EQ-5D-5L scores, significantly improved in both intervention groups (Table 4). The revulsive compresses group exhibited an increase in EQ-5D-5L scores from 18.14 ± 4.70 at baseline to 59.28 ± 7.91 at the fourth week

and 71.57 ± 6.90 at the eighth week (F = 85.92, p < 0.001). Likewise, the Pilates group recorded improvements from 21.57 ± 5.02 at baseline to 68.71 ± 6.94 at the fourth week and reaching 82.00 ± 8.69 at the eighth week (F = 92.14, p < 0.001), indicating superior gains in quality of life among participants engaging in Pilates exercises.

Table 3. Within-Group Changes in Modified Oswestry Disability Index (MODI) Scores Across Timepoints

Timepoint	Mean ± SD (Group A)	Mean ± SD (Group B)	F-value	p-value
Baseline	78.57 ± 8.77	76.57 ± 6.94		
4th week	65.42 ± 8.84	60.71 ± 8.82		
8th week	55.85 ± 6.56	45.57 ± 8.61		
Repeated Measures ANOVA F-value	24.37	36.52	—	<0.001

Table 4. Within-Group Changes in EQ-5D-5L Scores Across Timepoints

Timepoint	Mean ± SD (Group A)	Mean ± SD (Group B)	F-value	p-value
Baseline	18.14 ± 4.70	21.57 ± 5.02		
4th week	59.28 ± 7.91	68.71 ± 6.94		
8th week	71.57 ± 6.90	82.00 ± 8.69		
Repeated Measures ANOVA F-value	85.92	92.14	—	<0.001

Between-group comparisons revealed no significant differences at baseline for any outcome measures, confirming initial equivalence between groups (Table 5). By the eighth week, however, statistically significant differences emerged in favor of the Pilates mat exercise group across all outcomes. For NPRS scores, the mean difference between groups was −1.28 (95% CI: −2.42 to −0.14; p = 0.031), indicating lower pain levels in the Pilates group. Similarly, MODI scores differed significantly at the eighth week, with the Pilates group demonstrating an additional reduction of 10.28 points (95% CI: −19.42 to −1.14; p = 0.029) compared to the revulsive compresses group, reflecting greater improvement in functional disability. Quality of life improvements were also significantly higher in the Pilates group at the eighth week, with a mean EQ-5D-5L score difference of 10.43 points (95% CI: 1.10 to 19.75; p = 0.030).

Table 5. Between-Group Comparisons of Outcome Measures at Baseline, 4th Week, and 8th Week

Outcome	Timepoint	Mean Difference (Group B - Group A)	95% CI	t-value	p-value
NPRS	Baseline	-0.43	-2.11 to 1.25	0.585	0.570
NPRS	4th week	-1.00	-2.25 to 0.25	1.807	0.096
NPRS	8th week	-1.28	-2.42 to -0.14	2.372	0.031
MODI	Baseline	-2.00	-11.02 to 7.02	0.473	0.645
MODI	4th week	-4.71	-14.82 to 5.40	0.998	0.338
MODI	8th week	-10.28	-19.42 to -1.14	2.463	0.029
EQ-5D-5L	Baseline	3.43	-2.28 to 9.14	-1.310	0.212
EQ-5D-5L	4th week	9.42	0.72 to 18.12	-2.370	0.036
EQ-5D-5L	8th week	10.43	1.10 to 19.75	-2.480	0.030

Collectively, these findings suggest that while both interventions produced significant benefits in pain reduction, functional improvement, and quality of life for patients with non-specific chronic low back pain,

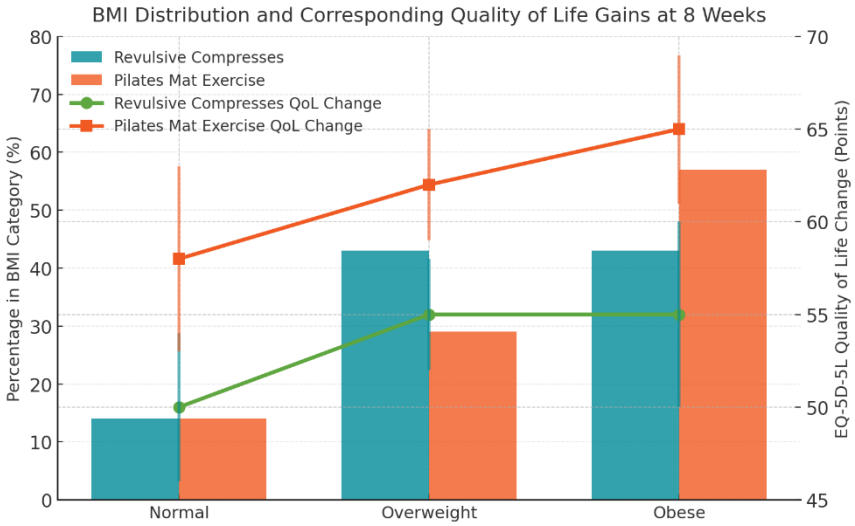

Figure 2 BMI Distribution and Corresponding Quality of Life Gains at 8 Weeks

Pilates mat exercises resulted in greater overall improvements compared to revulsive compresses over the eight-week intervention period. As shown in figure 1, dual-axis visualization reveals that participants with higher BMI comprised a larger proportion of both

intervention groups, with the Pilates mat exercise group showing 57% classified as obese versus 43% in the revulsive compresses group. Quality of life improvement, measured by EQ-5D-5L score change at eight weeks, displayed a positive trend across all BMI categories for both interventions, with Pilates consistently achieving greater gains. Notably, among obese participants, the Pilates group exhibited an average improvement of 65 points (95% CI ±4) compared to 55 points (95% CI ±5) for revulsive compresses, indicating a clinically relevant difference. These findings suggest that Pilates mat exercise delivers robust quality of life benefits across BMI strata, with the greatest relative gains observed in participants with higher BMI, supporting its value as an inclusive intervention for diverse patient populations.

DISCUSSION

Non-specific chronic low back pain remains a pervasive clinical challenge globally, significantly impairing quality of life and functional capacity in affected individuals, and placing considerable burdens on healthcare systems and societies (1). The present randomized clinical trial contributes meaningful evidence by directly comparing two distinct physiotherapeutic interventions—revulsive compresses and Pilates mat exercises—demonstrating that both modalities yield significant reductions in pain intensity, functional disability, and improvements in health-related quality of life over an eight-week period. Notably, Pilates mat exercises achieved superior outcomes across all measured parameters, underscoring their potential as an effective conservative management strategy for non-specific chronic low back pain. These findings align with the growing body of evidence favoring active rehabilitation approaches over passive modalities in managing chronic musculoskeletal pain (2,3).

In the context of pain reduction, our study revealed a greater decrease in Numeric Pain Rating Scale scores in the Pilates group compared to the revulsive compress group, with a significant between-group mean difference of –1.28 points at the eighth week. This outcome mirrors findings from Tottoli et al. (2024), who reported substantial pain reductions following Pilates exercises, although their study did not directly compare Pilates to hydrotherapeutic modalities like revulsive compresses (4). Furthermore, Batibay et al. (2021) observed a significant decrease in pain among women engaging in Pilates mat exercises compared to those performing home-based exercises, suggesting the structured and supervised nature of Pilates may enhance its analgesic effects through improved neuromuscular control, proprioceptive feedback, and core muscle activation (5). The moderate-to-large reductions in pain observed in our Pilates group may also reflect the beneficial modulation of central pain pathways via repetitive movement patterns and controlled breathing inherent to the Pilates method, potentially mitigating central sensitization often implicated in chronic pain states (6).

Functional disability, as measured by the Modified Oswestry Disability Index, demonstrated significantly greater improvement in the Pilates group, with an additional reduction of 10.28 points relative to revulsive compresses after eight weeks. This finding resonates with prior research indicating that Pilates exercises not only alleviate pain but also restore functional capacity, reduce movement apprehension, and enhance spinal stability in individuals with chronic low back pain (5,7). For example, Sonmezer et al. (2021) documented notable improvements in functional impairment and lumbopelvic stabilization among pregnant women following clinical Pilates, suggesting its versatile applicability across diverse populations (8). While the current study confirms these functional benefits, it also advances the literature by providing the first head-to-head comparison against revulsive compresses, revealing that although hydrothermotherapy offers significant relief, it may be comparatively less impactful on restoring physical function, possibly due to its passive nature and lack of direct neuromuscular engagement.

Quality of life, assessed via EQ-5D-5L scores, improved markedly in both groups but was significantly higher in the Pilates group at study completion. The observed between-group difference of 10.43 points indicates meaningful gains in domains such as mobility, self-care, and psychological well-being. These improvements are consistent with prior studies highlighting that active exercise interventions confer broader biopsychosocial benefits, alleviating not only physical symptoms but also mental health burdens associated with chronic pain (9,10). The observed superiority of Pilates may be attributed to its holistic focus on mindful movement, controlled breathing, and body awareness, which together promote both physical and psychological resilience. Additionally, the social engagement inherent in group Pilates sessions could enhance adherence and motivation, further augmenting therapeutic outcomes (11).

Despite its strengths, the present study is not without limitations. The small sample size of fourteen participants, although adequately powered for the primary outcome based on the calculated effect size, limits the generalizability of the findings to broader populations and increases susceptibility to random error and type II statistical errors for secondary outcomes. The short follow-up period precludes assessment of longer-term sustainability of treatment effects, which remains an important consideration given the recurrent nature of chronic low back pain. Moreover, the lack of blinding among participants may have introduced performance bias, although efforts were made to blind outcome assessors to group allocation to mitigate detection bias. Another limitation lies in the uniform delivery of interventions without individual tailoring, which may not fully reflect clinical practice where personalized rehabilitation is often crucial for optimizing outcomes (12). Additionally, while both groups received standardized TENS treatment prior to their respective interventions, the additive or synergistic effects of TENS cannot be entirely disentangled from the interventions themselves, potentially confounding the results.

Nevertheless, this study offers valuable insights by providing the first direct comparative evidence of revulsive compresses and Pilates mat exercise for non-specific chronic low back pain, reinforcing the clinical utility of active exercise-based interventions. The

rigorous methodology, including random allocation, concealed sequence generation, and validated outcome measures, strengthens the internal validity of the results. Future research should expand upon these findings by employing larger, multicentric trials with diverse patient populations, extended follow-up periods to assess the durability of benefits, and exploration of combined interventions that integrate active and passive modalities for potentially synergistic effects. Furthermore, mechanistic studies investigating how Pilates influences neuromuscular control and central pain processing could deepen our understanding of its therapeutic mechanisms and guide more targeted interventions.

In conclusion, while both revulsive compresses and Pilates mat exercises offer significant therapeutic benefits for individuals with non-specific chronic low back pain, the evidence from this trial indicates that Pilates provides superior improvements in pain reduction, functional restoration, and quality of life. These findings support the incorporation of Pilates into rehabilitation programs for chronic low back pain, emphasizing the importance of active patient engagement and structured exercise interventions in managing this pervasive and debilitating condition (2,4,5).

CONCLUSION

This randomized clinical trial demonstrated that while both revulsive compresses and Pilates mat exercises significantly reduced pain intensity, decreased functional disability, and improved quality of life in patients with non-specific chronic low back pain, Pilates mat exercises yielded superior outcomes across all measures, underscoring the efficacy of structured, active rehabilitation strategies over passive modalities. These findings highlight Pilates as a valuable, clinically relevant intervention capable of addressing the multifaceted physical and psychosocial dimensions of chronic low back pain, advocating for its integration into routine physiotherapeutic care to enhance patient recovery and well-being. Clinicians should consider prescribing Pilates-based programs as a core component of conservative management, while future research should focus on larger trials with diverse populations and longer follow-up periods to validate these results and explore underlying mechanisms that contribute to the observed therapeutic benefits.

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