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EFFECTS OF MEZIERES METHOD ON MUSCLE IMBALANCE, BODY AWARENESS AND POSTURAL ALIGNMENT IN ATHLETES WITH LOWER BACK PAIN

Original Research (ID: 1687)

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ABSTRACT

Background: Low back pain is a frequent musculoskeletal complaint among athletes and may interfere with training, performance, posture, and daily function. Repeated loading, poor movement control, muscle imbalance, and altered postural awareness are common contributing factors. Conventional physiotherapy often focuses on core stabilization; however, global postural re-education approaches such as the Mezieres Method may offer additional benefits by addressing muscle-chain tightness, postural deviation, and body awareness together.

Objective: To compare the effectiveness of the Mezieres Method combined with core stabilization versus routine physiotherapy on muscle imbalance, body awareness, and postural alignment in athletes with lower back pain.

Methods: This randomized controlled trial was conducted at the Physiotherapy and Sports Unit, Pakistan Rugby Academy, Lahore, over nine months after synopsis approval. A total of 36 athletes with lower back pain were included and equally allocated into Group A and Group B, with 18 participants in each group. Group A received the Mezieres Method with core stabilization exercises, while Group B received routine physiotherapy based on core stabilization exercises. Pain, muscle imbalance, body awareness, and postural alignment were assessed before and after intervention. Data were analyzed using Shapiro–Wilk normality testing, paired-samples t-test, and independent-samples t-test.

Results: Both groups were comparable at baseline for muscle imbalance, body awareness, and posture, while baseline pain was higher in Group A ($p < 0.001$). Overall, pain decreased from 6.42 ± 1.811 to 2.72 ± 1.386 ($p = 0.002$), muscle imbalance decreased from 5.67 ± 4.523 to 2.25 ± 3.148 ($p = 0.008$), body awareness improved from 48.67 ± 5.456 to 61.92 ± 8.449 ($p = 0.002$), and postural alignment improved from 57.75 ± 3.865 to 71.53 ± 6.914 ($p = 0.011$). Post-intervention scores favored Group A for pain (1.67 ± 0.970 vs. 3.78 ± 0.808, $p < 0.001$), muscle imbalance (1.17 ± 2.176 vs. 3.33 ± 3.630, $p = 0.037$), body awareness (68.44 ± 5.490 vs. 55.39 ± 5.158, $p < 0.001$), and postural alignment (76.89 ± 4.764 vs. 66.17 ± 3.854, $p < 0.001$), with reported large effect sizes.

Conclusion: The Mezieres Method combined with core stabilization was more effective than routine physiotherapy in reducing pain and improving muscle imbalance, body awareness, and postural alignment in athletes with lower back pain.

Keywords: Athletes; Exercise Therapy; Low Back Pain; Muscle Stretching Exercises; Physical Therapy Modalities; Postural Balance; Proprioception.

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INTRODUCTION

Low back pain is one of the most frequent musculoskeletal complaints affecting athletes and remains a major concern in sports rehabilitation because it can disturb training continuity, reduce physical performance, and affect quality of life. Athletes are exposed to repeated mechanical loading, sudden directional changes, spinal rotation, impact forces, prolonged training schedules, and sport-specific postural demands, all of which may increase stress on the lumbar spine. Although low back pain is common in the general population, its burden is often greater in athletic groups because even mild discomfort can interfere with movement efficiency, endurance, balance, and competitive performance. Previous literature has reported that low back pain may affect a large proportion of individuals during life, while athletic populations may show higher rates depending on the type of sport, training intensity, conditioning level, and biomechanical demands (1). The development of low back pain in athletes is rarely due to a single cause. It is usually associated with a combination of muscle imbalance, reduced lumbopelvic control, altered spinal mechanics, poor flexibility, inadequate core stability, and impaired body awareness. When one group of muscles becomes shortened, tight, or overactive, the opposing or stabilizing muscles may become inhibited or weak, producing unequal tension around the pelvis and lumbar spine. This imbalance can disturb postural alignment and increase mechanical strain during running, jumping, twisting, lifting, or sport-specific repetitive movements. Over time, athletes may develop compensatory movement patterns, altered proprioception, and inefficient load distribution, which can contribute to recurrent pain and functional limitation (2).

Conventional physiotherapy for athletes with low back pain commonly includes pain-relieving modalities, stretching, strengthening, manual therapy, and core stabilization exercises. Core stabilization is widely used because it targets deep trunk muscles such as the transversus abdominis, multifidus, pelvic floor, and diaphragm, which are important for segmental spinal support and dynamic control. Evidence suggests that core-based rehabilitation may improve spinal stability, reduce pain, and help prevent recurrent episodes of low back pain (3). However, many athletes continue to experience persistent or recurring symptoms despite routine rehabilitation, which indicates that local strengthening alone may not fully address global muscle-chain restrictions, postural asymmetry, and reduced body awareness (4). The Mezieres Method is a postural re-education approach developed by Françoise Mézières in 1947. It is based on the concept that the body functions as an interconnected system and that shortened muscle chains, particularly the posterior chain, may create compensatory postural deviations in distant body regions. Unlike isolated muscle treatment, this method emphasizes global stretching, controlled breathing, postural correction, proprioceptive awareness, and restoration of muscular symmetry. It aims to lengthen shortened muscles, reduce excessive tension, correct compensatory alignment, and improve the individual's conscious control of posture and movement (5,6).

Body awareness is an important but often under-addressed component of sports rehabilitation. It refers to the ability to recognize body position, movement quality, muscular tension, and postural control during functional activity. Poor body awareness may cause athletes to continue faulty movement patterns even after pain decreases, thereby increasing the risk of reinjury. The Mezieres Method may be particularly useful in this context because it does not only focus on flexibility or pain reduction but also trains the athlete to perceive posture, breathing, muscular tension, and alignment more consciously. This awareness-based correction may support more efficient movement strategies and long-term postural control (7-9). Recent studies have shown encouraging findings regarding the use of the Mezieres Method in athletes and individuals with chronic low back pain. Research on rhythmic gymnasts and other athletic populations has reported improvements in pain, trunk mobility, flexibility, spinal alignment, postural control, and functional performance following Mezieres-based intervention (10). Some randomized trials have also suggested that this method may improve neuromuscular coordination and movement efficiency, which are highly relevant for athletes who require precise control, balance, and repeated high-level physical performance (11). These findings indicate that the Mezieres Method may offer benefits beyond symptom relief by targeting the underlying postural and muscular factors associated with low back pain.

Despite these promising outcomes, there remains a clear gap in the literature. Most available studies have focused mainly on pain, flexibility, or performance outcomes, while relatively fewer have examined the combined effects of the Mezieres Method on muscle imbalance, body awareness, and postural alignment in athletes with low back pain. In addition, many previous studies have been conducted on small samples or specific sports groups, which limits generalizability to broader athletic populations. There is also limited comparative evidence assessing whether adding the Mezieres Method to core stabilization provides greater benefits than routine physiotherapy or core stabilization alone (12). Therefore, the present study is based on the research question of whether the Mezieres Method combined with core stabilization is more effective than routine physiotherapy involving core stabilization alone in improving muscle imbalance, body awareness, and postural alignment among athletes with low back pain. It is hypothesized that athletes receiving the Mezieres Method with core stabilization will show greater improvement in muscle balance, body awareness, and postural alignment compared with those receiving routine physiotherapy alone. The objective of this study is to compare the effectiveness of the Mezieres

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Method plus core stabilization versus routine physiotherapy on muscle imbalance, body awareness, and postural alignment in athletes with low back pain, with the rationale that a global postural re-education approach may provide additional rehabilitative benefits by addressing both mechanical dysfunction and conscious postural control.

METHODS

This study was designed as a randomized controlled trial to compare the effects of the Mezieres Method combined with core stabilization exercises versus routine physiotherapy based on core stabilization exercises alone in athletes with chronic non-specific low back pain. The study was conducted at the Physiotherapy and Sports Unit, Pakistan Rugby Academy, Lahore, over a period of nine months after approval of the synopsis and ethical clearance. The sample size was calculated using G*Power version 3.1.9.7, based on an effect size of 0.447, which yielded 18 participants per group. After adding an anticipated dropout rate of 20%, the required sample size was estimated as 22 participants per group, making a total of 44 participants (13). According to the participant flow, 44 athletes were assessed for eligibility, four were excluded, including two who did not meet the inclusion criteria and two who declined participation. A total of 40 eligible athletes were randomized equally into Group A and Group B, with 20 participants in each group. During follow-up, two participants were lost from each group, and the final analysis was performed on 36 participants, with 18 participants in each group. Participants were recruited through a non-probability purposive sampling technique and were then randomly allocated to the intervention groups using a computer-generated randomization sequence. Eligible participants included male and female athletes aged 18–35 years who had chronic non-specific low back pain for at least three months, with clinical findings supported by relevant assessment procedures such as the Straight Leg Raise Test, Slump Test, and Schober's Test (14, 15). Participants were also required to show evidence of postural imbalance, muscular chain dysfunction, reduced trunk mobility, impaired postural alignment, or functional limitation related to posture and movement (16, 17). Athletes who were undergoing or were suitable for physiotherapy management for musculoskeletal low back complaints were considered eligible for participation (18). Participants were excluded if they had a history of spinal surgery, vertebral fracture, structural spinal deformity such as scoliosis or spondylolisthesis, neurological or systemic disorders affecting balance or muscle control, pregnancy, contraindications to physical activity, or current use of medications that could influence musculoskeletal performance, including corticosteroids or muscle relaxants (19-21).

Ethical approval was obtained from the Ethical Review Committee of Green International University, Lahore, before the start of data collection (Clinic trial registration no. NCT07611669). The study followed the ethical principles of the Declaration of Helsinki 2013, including respect for participant autonomy, privacy, safety, and confidentiality. Written informed consent was obtained from all participants before enrolment. Each participant was informed about the study purpose, intervention procedures, expected duration, possible benefits, minimal risks, and the voluntary nature of participation. Participants were also informed that they could withdraw from the study at any stage without penalty or loss of routine physiotherapy care. Confidentiality was maintained by assigning coded identifiers instead of personal names, and all data were stored securely with access limited to authorized members of the research team. Baseline assessment was performed before randomization, and post-intervention assessment was carried out after 12 weeks of treatment. Demographic and clinical information, including age, gender, type of sport, duration of symptoms, and baseline physical findings, was recorded on a structured data collection proforma. Pain intensity was assessed using the Visual Analogue Scale, in which participants rated pain on a 0–10 continuum, where 0 indicated no pain and 10 indicated the worst imaginable pain (22). Functional disability related to low back pain was assessed using the Oswestry Disability Index, which categorized disability from minimal to severe functional limitation (12). Body awareness was measured using the Body Awareness Questionnaire, a self-reported tool used to evaluate awareness of body position, internal bodily cues, proprioceptive perception, and movement control (13). Postural alignment and muscle imbalance were assessed using the New York Posture Rating Chart, which evaluated body segment alignment, including head, shoulders, spine, pelvis, and lower limb posture, with higher scores indicating better postural alignment (23). All assessments were conducted under standardized conditions by trained assessors who were blinded to group allocation to reduce measurement bias.

Participants in Group A received the Mezieres Method combined with core stabilization exercises. The Mezieres intervention focused on global postural re-education, progressive stretching of shortened muscle chains, controlled breathing, and correction of compensatory postural patterns. The intervention primarily targeted the posterior muscular chain, including the erector spinae, hamstrings, gluteal muscles, and related lumbopelvic structures. Each Mezieres session lasted approximately 30–35 minutes and was followed by 15–20 minutes of supervised core stabilization exercises, including abdominal hollowing, bridging, plank variations, and controlled trunk stabilization activities. The intervention was delivered three times per week for 12 weeks by a trained physiotherapist (24). Participants in Group B received routine physiotherapy based on core stabilization exercises only. These exercises targeted deep trunk stabilizers, including the transversus abdominis, multifidus, pelvic floor, and pelvic stabilizing muscles, with the aim of improving lumbopelvic control, trunk stability, and functional movement patterns. Each session lasted approximately 20–25 minutes and was conducted three times per week for 12 weeks under physiotherapist supervision to ensure correct technique, safety, and gradual progression (21). Before the main intervention, both groups performed a standardized warm-up protocol consisting of light aerobic activity, gentle dynamic stretching of the trunk, hips, and lower limbs, breathing exercises, range of motion exercises, and targeted stretching of the hamstrings,

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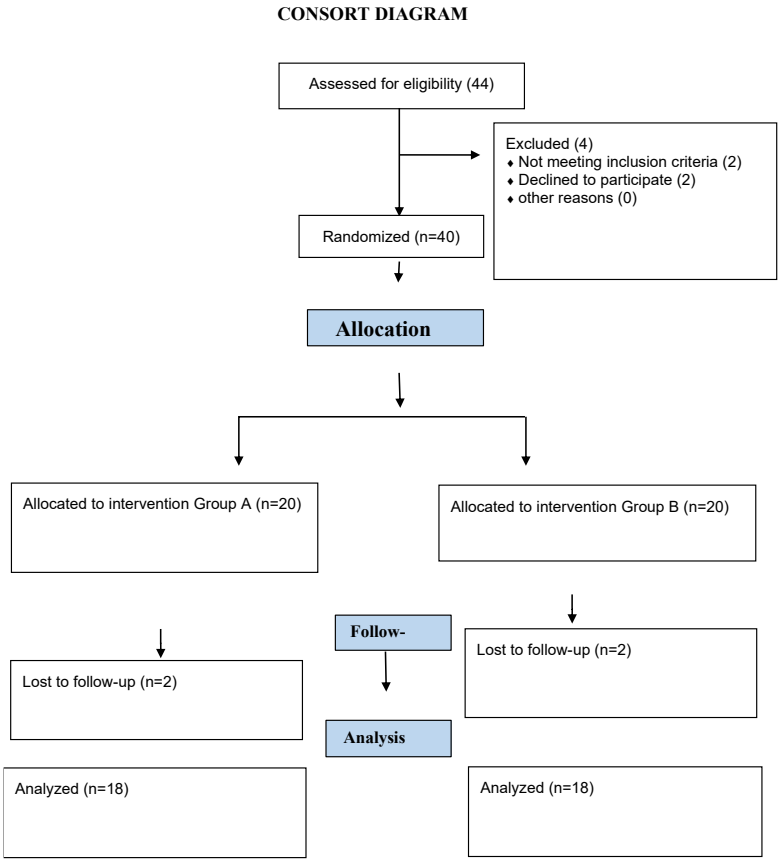
hip flexors, and paraspinal muscles. This baseline routine was kept similar across both groups so that the main difference between groups remained the addition of the Mezieres Method in Group A.

Data were analyzed using Statistical Package for Social Sciences version 27. Before inferential analysis, data were checked for completeness, coding accuracy, missing values, outliers, and normality. The Shapiro–Wilk test was used to assess the distribution of continuous variables. Descriptive statistics were calculated for all baseline characteristics. Continuous variables were presented as mean and standard deviation, while categorical variables such as gender and sport type were presented as frequencies and percentages. Baseline comparability between groups was assessed using the independent-samples t-test for normally distributed continuous variables, the Mann–Whitney U test for non-normally distributed variables, and the chi-square test or Fisher's exact test for categorical variables. Within-group changes from baseline to 12 weeks were analyzed using the paired-samples t-test for normally distributed data and the Wilcoxon signed-rank test for non-parametric data. Between-group differences in post-intervention scores and change scores were analyzed using the independent-samples t-test or Mann–Whitney U test according to data distribution. Where appropriate, analysis of covariance was considered to compare post-intervention outcomes while adjusting for baseline values. Effect sizes were calculated to determine the clinical relevance of findings, and Pearson or Spearman correlation analysis was used to explore associations among changes in body awareness, postural alignment, pain intensity, and functional disability. A p-value of less than 0.05 was considered statistically significant at a 95% confidence interval.



RESULTS

The study included 36 athletes with lower back pain who completed the final analysis, with 18 participants in Group A and 18 participants in Group B. Group A included 8 males (44.4%) and 10 females (55.6%), while Group B included 7 males (38.9%) and 11 females (61.1%). Overall, the sample consisted of 15 males (41.7%) and 21 females (58.3%). The mean age was 26.33 ± 5.657 years in Group A and 27.56 ± 5.316 years in Group B. Baseline normality testing showed that all pre-intervention outcome variables were normally distributed. The Shapiro–Wilk values were 0.944 for pain ($p = 0.066$), 0.976 for muscle imbalance ($p = 0.613$), 0.944 for body awareness ($p = 0.067$), and 0.964 for postural alignment ($p = 0.279$). Therefore, parametric statistical tests were applied for further analysis. At baseline, Group A had a significantly higher pain score than Group B, with mean pain scores of 7.61 ± 1.501 and 5.22 ± 1.215, respectively ($p < 0.001$). No statistically significant baseline differences were observed between Group A and Group B for muscle imbalance, body awareness, or postural alignment. Mean baseline muscle imbalance scores were 6.22 ± 4.797 in Group A and 5.11 ± 4.296 in Group B ($p = 0.469$). Mean body awareness scores were 48.56 ± 4.328 in Group A and 48.78 ± 6.522 in Group B ($p = 0.905$). Mean postural alignment scores were 57.50 ± 4.091 in Group A and 58.00 ± 3.726 in Group B ($p = 0.704$). Across the total sample, statistically significant pre- to post-intervention improvements were recorded in all measured outcomes. Pain decreased from 6.42 ± 1.811 to 2.72 ± 1.386 ($p = 0.002$). Muscle imbalance decreased from 5.67 ± 4.523 to 2.25 ± 3.148 ($p = 0.008$). Body awareness improved from 48.67 ± 5.456 to 61.92 ± 8.449 ($p = 0.002$). Postural alignment improved from 57.75 ± 3.865 to 71.53 ± 6.914 ($p = 0.011$).

Group-wise descriptive findings showed greater numerical improvement in Group A. In Group A, pain decreased from 7.61 ± 1.501 to 1.67 ± 0.970, muscle imbalance decreased from 6.22 ± 4.797 to 1.17 ± 2.176, body awareness increased from 48.56 ± 4.328 to 68.44 ± 5.490, and postural alignment increased from 57.50 ± 4.091 to 76.89 ± 4.764. In Group B, pain decreased from 5.22 ± 1.215 to 3.78 ± 0.808, muscle imbalance decreased from 5.11 ± 4.296 to 3.33 ± 3.630, body awareness increased from 48.78 ± 6.522 to 55.39 ± 5.158, and postural alignment increased from 58.00 ± 3.726 to 66.17 ± 3.854. Post-intervention between-group analysis showed statistically significant differences in all outcome variables. Group A had a lower pain score than Group B (1.67 ± 0.970 vs. 3.78 ± 0.808, mean difference = -2.111, $p < 0.001$). Muscle imbalance was also lower in Group A than Group B (1.17 ± 2.176 vs. 3.33 ± 3.630, mean difference = -2.167, $p = 0.037$). Body awareness was higher in Group A than Group B (68.44 ± 5.490 vs. 55.39 ± 5.158, mean difference

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= 13.056, $p < 0.001$). Postural alignment was also higher in Group A than Group B (76.89 ± 4.764 vs. 66.17 ± 3.854, mean difference = 10.722, $p < 0.001$). Based on the reported means and standard deviations, the approximate between-group Cohen's d values for post-intervention outcomes were 2.36 for pain, 0.72 for muscle imbalance, 2.45 for body awareness, and 2.47 for postural alignment.

Table 1. Baseline demographic and clinical characteristics of participants

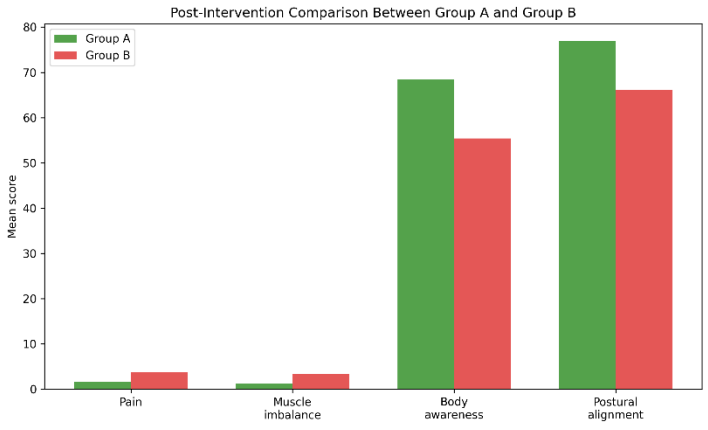
Variable	Group A, Mean ± SD / n (%)	Group B, Mean ± SD / n (%)	p-value
Age (years)	26.33 ± 5.657	27.56 ± 5.316	0.506
Male	8 (44.4%)	7 (38.9%)	0.735
Female	10 (55.6%)	11 (61.1%)	0.735
Pain score	7.61 ± 1.501	5.22 ± 1.215	<0.001
Muscle imbalance score	6.22 ± 4.797	5.11 ± 4.296	0.469
Body awareness score	48.56 ± 4.328	48.78 ± 6.522	0.905
Postural alignment score	57.50 ± 4.091	58.00 ± 3.726	0.704

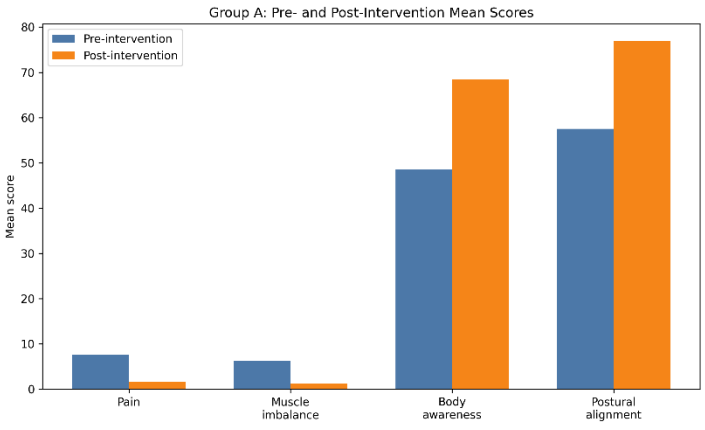
Table 2. Pre- and post-intervention outcome scores within groups

Outcome	Group A Pre, Mean ± SD	Group A Post, Mean ± SD	Mean Change	Group B Pre, Mean ± SD	Group B Post, Mean ± SD	Mean Change
Pain score	7.61 ± 1.501	1.67 ± 0.970	-5.94	5.22 ± 1.215	3.78 ± 0.808	-1.44
Muscle imbalance score	6.22 ± 4.797	1.17 ± 2.176	-5.05	5.11 ± 4.296	3.33 ± 3.630	-1.78
Body awareness score	48.56 ± 4.328	68.44 ± 5.490	+19.88	48.78 ± 6.522	55.39 ± 5.158	+6.61
Postural alignment score	57.50 ± 4.091	76.89 ± 4.764	+19.39	58.00 ± 3.726	66.17 ± 3.854	+8.17

Table 3. Post-intervention comparison between Group A and Group B

Outcome	Group A, Mean ± SD	Group B, Mean ± SD	Mean Difference	Cohen's d	p-value
Pain score	1.67 ± 0.970	3.78 ± 0.808	-2.11	2.36	<0.001
Muscle imbalance score	1.17 ± 2.176	3.33 ± 3.630	-2.17	0.72	0.037
Body awareness score	68.44 ± 5.490	55.39 ± 5.158	13.06	2.45	<0.001
Postural alignment score	76.89 ± 4.764	66.17 ± 3.854	10.72	2.47	<0.001





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DISCUSSION

The present study examined the effects of the Mezieres Method on pain, muscle imbalance, body awareness, and postural alignment in athletes with lower back pain. The findings showed that both intervention groups improved after treatment; however, the group receiving the Mezieres Method demonstrated greater post-intervention improvement across the main outcome variables. Pain was reduced more markedly in the Mezieres group, while muscle imbalance scores decreased and body awareness and postural alignment scores increased to a greater extent than in the control group. These findings suggested that a global postural re-education approach may provide additional benefit in athletes with lower back pain when compared with routine physiotherapy based mainly on core stabilization exercises. The greater reduction in pain observed in the Mezieres group was consistent with previous evidence showing that global postural re-education techniques may reduce chronic low back pain by addressing muscular chain restrictions, compensatory movement patterns, and altered neuromuscular control. A previous randomized trial reported that interventions targeting global muscle chains produced greater pain relief than approaches focused only on isolated muscle activity, possibly because postural correction reduces excessive mechanical load on the lumbar region (24). The present findings were also in agreement with studies showing that correction of postural alignment and improvement in muscle balance were associated with meaningful reductions in low back pain compared with conventional strengthening exercises (25). However, the baseline pain score was significantly higher in the Mezieres group, which should be considered when interpreting post-intervention pain differences. This baseline imbalance indicated that future studies should preferably apply adjusted analysis, such as analysis of covariance, to provide a more precise estimate of treatment effect.

The improvement in muscle imbalance after the Mezieres intervention supported the theoretical basis of the method, which considers the body as an interconnected system rather than a collection of isolated segments. In athletes, repetitive loading, asymmetrical sport-specific movements, and poor postural habits may create unequal tension between agonist and antagonist muscle groups. The Mezieres Method may have contributed to restoring muscular symmetry by using sustained global stretching, breathing control, and postural correction. Similar findings were reported in earlier work where global stretching techniques reduced trunk muscular asymmetry and improved functional movement patterns (26). In contrast, isolated stretching protocols have shown limited long-term benefit when they were not combined with postural control and neuromuscular retraining, which highlighted the value of integrated approaches for athletes with recurrent lumbar symptoms (27). The findings related to body awareness were also clinically relevant, as the Mezieres group showed a greater increase in body awareness scores than the control group. Body awareness has an important role in movement quality, injury prevention, and self-correction of faulty postural habits. Previous literature has shown that enhanced body awareness may be associated with improved movement efficiency and reduced pain perception in individuals with chronic musculoskeletal pain (18). Interventions that include proprioceptive training, controlled movement, and conscious postural correction have also been reported to improve body awareness more effectively than conventional exercise programs alone (28). In the present study, the Mezieres Method may have improved body awareness because participants were required to actively perceive body position, breathing, muscular tension, and alignment during the intervention.

Postural alignment also improved more in the Mezieres group, which was consistent with studies reporting that postural correction exercises and global postural re-education techniques may reduce musculoskeletal strain and improve spinal alignment in athletic populations (19). The Mezieres Method emphasizes elongation of shortened muscular chains, especially the posterior chain, and aims to reduce compensatory deviations that can disturb spinal and pelvic mechanics. These mechanisms may explain the greater postural gains observed in the intervention group. Nevertheless, some literature has suggested that postural correction alone may not fully explain pain reduction, as psychosocial factors, fear-avoidance beliefs, training load, sleep, and stress may also influence pain perception and recovery (20). Therefore, the relationship between posture and pain should be interpreted as clinically meaningful but not exclusively causal. The findings also contributed to the continuing debate regarding the best rehabilitation approach for athletes with lower back pain. Some studies have supported core stabilization exercises as an effective method for reducing low back pain in athletes, particularly because they improve segmental stability and activate deep trunk muscles (16). Other evidence has suggested that different exercise approaches may produce comparable improvements in some patients with low back pain, depending on patient characteristics, exercise adherence, and intervention intensity (21). The present study added to this debate by showing that the Mezieres Method produced greater improvements in several outcomes, but it did not establish that this approach was universally superior for all athletes or all types of low back pain. The findings were more appropriately interpreted as evidence that global postural re-education may be a valuable addition for athletes with postural imbalance, muscular chain dysfunction, and reduced body awareness.

The clinical implications of these findings were important for sports rehabilitation. Athletes with lower back pain often require treatment strategies that do not only reduce pain but also improve movement quality, postural control, and functional readiness for sport. The Mezieres Method may be useful because it targets flexibility, alignment, proprioception, and muscular balance within the same intervention framework. This broader approach may support more efficient movement patterns and may reduce the risk of recurrent symptoms when combined with appropriate strengthening and load management. The method also appeared to fit well within modern physiotherapy practice, where rehabilitation increasingly focuses on individualized, active, and movement-based care rather than symptom control alone (22). A key strength of the study was its randomized controlled design, which allowed comparison between two rehabilitation approaches in an athletic population. The study also used multiple clinically relevant outcome measures, including pain,

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muscle imbalance, body awareness, and postural alignment, which provided a broader picture of rehabilitation response. The inclusion of both male and female athletes and the use of standardized pre- and post-intervention assessment further strengthened the clinical value of the findings. The study also addressed an important gap in the literature because limited research has examined the combined effects of the Mezieres Method on muscle imbalance, body awareness, and postural alignment in athletes with lower back pain.

Despite these strengths, several limitations were present. The sample size was relatively small, which limited the generalizability of the findings to larger and more diverse athletic populations. The study did not include long-term follow-up, so it remained unclear whether the observed improvements were maintained after completion of treatment. Participant and therapist blinding was not feasible due to the nature of the intervention, which may have introduced performance bias. The control intervention may also have differed in treatment duration and therapeutic intensity, which could have influenced the comparison between groups. In addition, athletes' sport type, training load, recovery habits, and daily physical demands were not fully controlled, and these factors may have affected pain and postural outcomes. Psychological variables such as stress, anxiety, fear-avoidance beliefs, and pain-related confidence were also not assessed, despite their known influence on low back pain recovery. Another important methodological consideration was that muscle strength should not be overemphasized in the discussion unless it was directly measured using a strength-specific instrument. The available results supported improvement in muscle imbalance, body awareness, pain, and postural alignment, but they did not directly confirm increased muscle strength. Similarly, postural alignment was measured using clinical assessment tools rather than imaging or advanced biomechanical analysis; therefore, future studies would benefit from motion analysis systems, digital posture assessment, electromyography, or imaging-based measures to provide more objective validation. The reported large effect sizes also required careful interpretation and recalculation where necessary, as unusually high values may reflect calculation method, small sample size, or baseline variability.

Future research should include larger multicenter trials with longer follow-up periods to determine whether the benefits of the Mezieres Method are sustained over time. Further studies should compare the Mezieres Method with other established interventions such as Pilates, motor control exercises, progressive resistance training, and multimodal rehabilitation. Future protocols should also standardize treatment duration between groups, control sport-specific training loads, and include objective biomechanical measures. The integration of education, psychological support, and return-to-sport planning may provide a more complete rehabilitation model for athletes with low back pain. Overall, the study supported the Mezieres Method as a promising rehabilitation approach for improving pain, muscle imbalance, body awareness, and postural alignment in athletes with lower back pain, while also emphasizing the need for cautious interpretation and stronger future evidence.

CONCLUSION

The study concluded that the Mezieres Method was more effective than routine physiotherapy in improving key rehabilitation outcomes among athletes with lower back pain. It produced greater improvement in pain reduction, muscle imbalance, body awareness, and postural alignment, indicating that global postural re-education may address both symptoms and underlying biomechanical dysfunctions. These findings suggest that incorporating the Mezieres Method into sports rehabilitation programs may offer a practical and meaningful approach for athletes who require improved posture, better movement control, and more effective recovery from lower back pain.

AUTHOR CONTRIBUTION

Author	Contribution
Dr. Wayna Maqsood	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision
Dr. Zermeen Zerish	Methodology, Investigation, Data Curation, Writing - Review & Editing
Prof Dr Fahad Tanveer	Investigation, Data Curation, Formal Analysis, Software
Mohtishim Ahmed	Software, Validation, Writing - Original Draft
Dr Muhammad Bin Zia	Formal Analysis, Writing - Review & Editing
Dr. Sehrish Shahzad	Writing - Review & Editing, Assistance with Data Curation

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