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Role of Latissimus Dorsi–Thoracolumbar Fascia Complex Stretching on Pain and Pain-Related Parameters in Patients With Chronic Low Back Pain: A Randomised Clinical Trial

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ABSTRACT

Background: Fascial stretching is gaining interest as a potential intervention for pain management. However, evidence regarding the effect of latissimus dorsi–thoracolumbar fascia (LD-TLF) complex stretching in patients with chronic low back pain (CLBP) remains limited. Therefore, this study aimed to investigate the effects of LD-TLF complex stretching on pain-related factors and disability in patients with CLBP.

Methods: Thirty patients with CLBP were randomly assigned to a study group ($n = 15$; 7 men, 8 women) and a control group ($n = 15$; 7 men, 8 women). The study group received 4 weeks of LD-TLF complex stretching in combination with conventional physiotherapy, while the control group received conventional physiotherapy only. Outcomes were assessed before and after the interventions, including primary measures of pain pressure thresholds (PPT) at thoracolumbar fascia levels (L1, L3 and 12th costa), and secondary measures included the Pain Sensitivity Questionnaire (PSQ), the effects of pain on daily activities measured by the Brief Pain Inventory (BPI), and disability assessed by the Oswestry Disability Questionnaire (ODQ).

Results: Pre- and post-treatment PPTs, at the L1, L3 vertebrae and 12th costa levels, demonstrated significant differences between the study group and control groups. Post-treatment thresholds were significantly higher compared to pre-treatment thresholds ($p < 0.001$, $\eta p^2 = 0.67$; $p < 0.001$, $\eta p^2 = 0.61$; $p < 0.001$, $\eta p^2 = 0.74$). Additionally, significant improvements were found in PSC, BPI and ODQ scores in the study group compared to the control group ($p < 0.05$).

Conclusion: The results of this study suggest that stretching the LD-TLF complex may be a beneficial addition to the conventional physiotherapy approach for patients with CLBP. Specifically, LD-TLF complex stretching, when used in combination with conventional physiotherapy, appears to provide improved pain thresholds, decreased pain sensitivity and pain during activity, as well as reduced disability compared to conventional physiotherapy alone in patients with CLBP.

Significance Statement: Chronic low back pain (CLBP) is a multifactorial condition, with the thoracolumbar fascia increasingly recognized as a potential contributing factor. This study suggests that stretching the latissimus dorsi-thoracolumbar fascia complex in combination with conventional physiotherapy, enhances pain thresholds, reduces pain sensitivity, and decreases disability in individuals with CLBP. Incorporating fascia-specific interventions into CLBP treatment programs could offer significant benefits for both patients and clinicians.

1 | Introduction

Low back pain (LBP) is one of the most common causes of morbidity worldwide, with a prevalence ranging from 30% to 80% across different populations (Shokri et al. 2023). It has a significant social and economic impact due to productivity loss and increased healthcare costs (Li et al. 2023). Approximately 90% of LBP cases are considered non-specific, highlighting the diagnostic challenge of linking symptoms to a specific underlying pathology (Maher et al. 2017).

The thoracolumbar fascia (TLF) is a vital connective tissue structure in the back that forms a biomechanical linkage between the pelvis and shoulders (Willard et al. 2012). An increasing body of evidence suggests that fascia may play a role in chronic pain, particularly in non-specific LBP (Wilke et al. 2017). Reflecting these insights, an interactive model of the TLF and the pathophysiology of LBP was proposed by Langevin et al. (2009). The TLF is a complex myofascial and aponeurotic girdle around the torso, which is thought to help maintain the stability of the lumbar vertebrae relative to the sacrum (Bergmark 1989). Additionally, as the largest fascial structure in the body, the TLF connects the latissimus dorsi and gluteus maximus muscles (Abe et al. 2021).

Numerous muscles of the trunk and extremities, varying in thickness and shape, integrate into the connective tissue planes of the TLF. It is known that those muscles can influence the tension and stiffness of the structure (Schuenke et al. 2012; Vleeming and Stoeckart 2007). An additional study has shown that patients with LBP show 25% greater TLF thickness (Bell et al. 2018), and are more likely to have LBP than other patients. Evidence suggests that increased thickness of the TLF, potentially resulting from structural alterations in the connective tissue, is associated with increased pain severity (Wilke et al. 2017).

The TLF is thought to be richly innervated with sensory nerves, including free nerve endings of nociceptors. This may explain why it could serve as a source of nociceptive input in patients with chronic low back pain (CLBP) (Gumruk Aslan et al. 2023). Consistent with this theoretical basis, pain intensity has been found to correlate with increased TLF thickness, likely due to structural alterations in the connective tissue (Benjamin 2009). These alterations may cause pain by stimulating nociceptors associated with A and C fibres (Willard et al. 2012).

Stretching of the fascia may represent an important component of manual and movement therapies, as the TLF is thought to be one of the affected tissues and a potential source of pain in individuals with LBP. Notably, alterations in the TLF may persist even after addressing the factors thought to contribute to these changes (Langevin et al. 2018). In this context, interventions targeting the TLF may offer therapeutic value. The application of mechanical forces to soft tissues—such as compression, stretching, tension, bending, friction, twisting and percussion—may help restore the fascial structure (Cullen et al. 2021; Langevin et al. 2009). However, directly stretching fascial structures can be difficult in clinical practice. Therefore, muscles associated with the TLF become particularly relevant. One of the key muscles contributing to the superficial lamina of the posterior layer of the TLF is the latissimus dorsi (LD) (Willard et al. 2012). However, research to date has not yet determined the effects of latissimus dorsi–thoracolumbar fascia (LD-TLF) complex stretching on CLBP patients in terms of pain characteristics, pain interference with participants' ability to function in daily living, and disability (Dydyk and Sapra 2024). Therefore, this prospective study was designed to investigate the effects of indirectly influencing the TLF through LD-TLF complex stretching exercises by comparing pain-related outcomes between patients receiving LD-TLF complex stretching exercises in combination with conventional physiotherapy and those receiving conventional physiotherapy alone.

2 | Methods

2.1 | Design

This study was designed as a randomised controlled trial with follow-up and conducted at X University's Physiotherapy and Rehabilitation Department, Turkey. The study was approved by the University's Human Research Ethics Committee (Approval Number: E-59394181-604.01-79246). All participants provided informed consent prior to study contribution. The study was registered on ClinicalTrials.gov under the registration number NCT06310096.

2.2 | Participants

Thirty volunteer patients (16 women [%53.33] and 14 men [%46.67]), aged between 20 and 60 years, who were registered for physiotherapy and had been previously diagnosed with CLBP, participated in this study. The study was conducted from November 2023 to January 2024. Randomization was performed using an online randomization tool (www.randomization.com). An independent researcher sequentially numbered the recruited participants and placed the group assignments in sealed, opaque envelopes. The individuals were randomly assigned to two groups: the study group ($n = 15$; 7 men, 8 women) and the control group ($n = 15$; 7 men, 8 women), with a 1:1 allocation ratio for each group. The participants were blinded to all measurements and interventions throughout the study. The medical diagnosis of CLBP was made by an orthopaedic physician at X Hospital. The orthopaedic physician referred patients who met the inclusion criteria and had no contraindications for participation in the study to the X University's physiotherapy and rehabilitation department for further assessment and treatment. Inclusion criteria for patients with CLBP were as follows: individuals aged between 20 and 60 years, with CLBP lasting longer than 3 months, and who had not received any interventional treatment prior to recruitment. The following criteria were used to exclude patients with CLBP: history of surgery to the thoracolumbar region or spine, neurological disease history, radiating pain and diagnosed specific causes of CLBP (herniated disc, spinal fractures, tumours or infections). Flowchart of the participants according to CONSORT 2010 is presented in Figure 1 (Cuschieri 2019).

2.3 | Intervention

The study group received a 4-week LD-TLF complex stretching in addition to a conventional physiotherapy program, while the control group only received the same conventional physiotherapy program. The study intervention was administered by a physiotherapist with a master's degree and over 10 years of experience in musculoskeletal physiotherapy. During the interventions, all patients were told not to use any pain relief medications and not to receive any other rehabilitation treatments. Both groups were evaluated in terms of pain intensity, pressure pain threshold (PPT), temporal summation, pain sensitivity and effects of pain on activity. The outcome measures were recorded before and right after the treatment (4th week). Design and the overall assessments are presented in Figure 2.

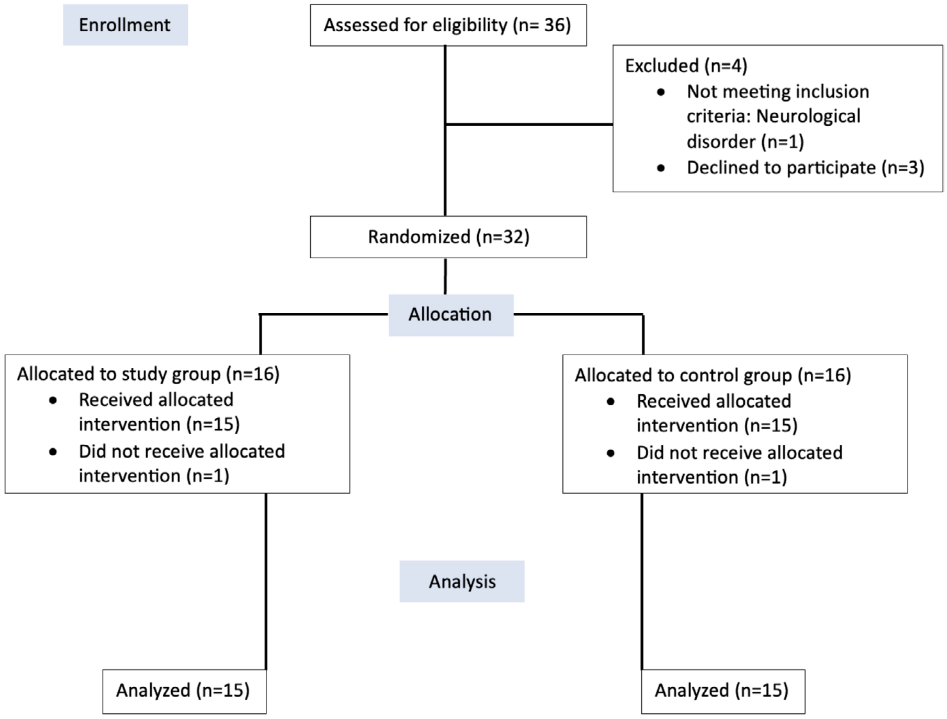

FIGURE 1 | Flowchart (CONSORT 2010).

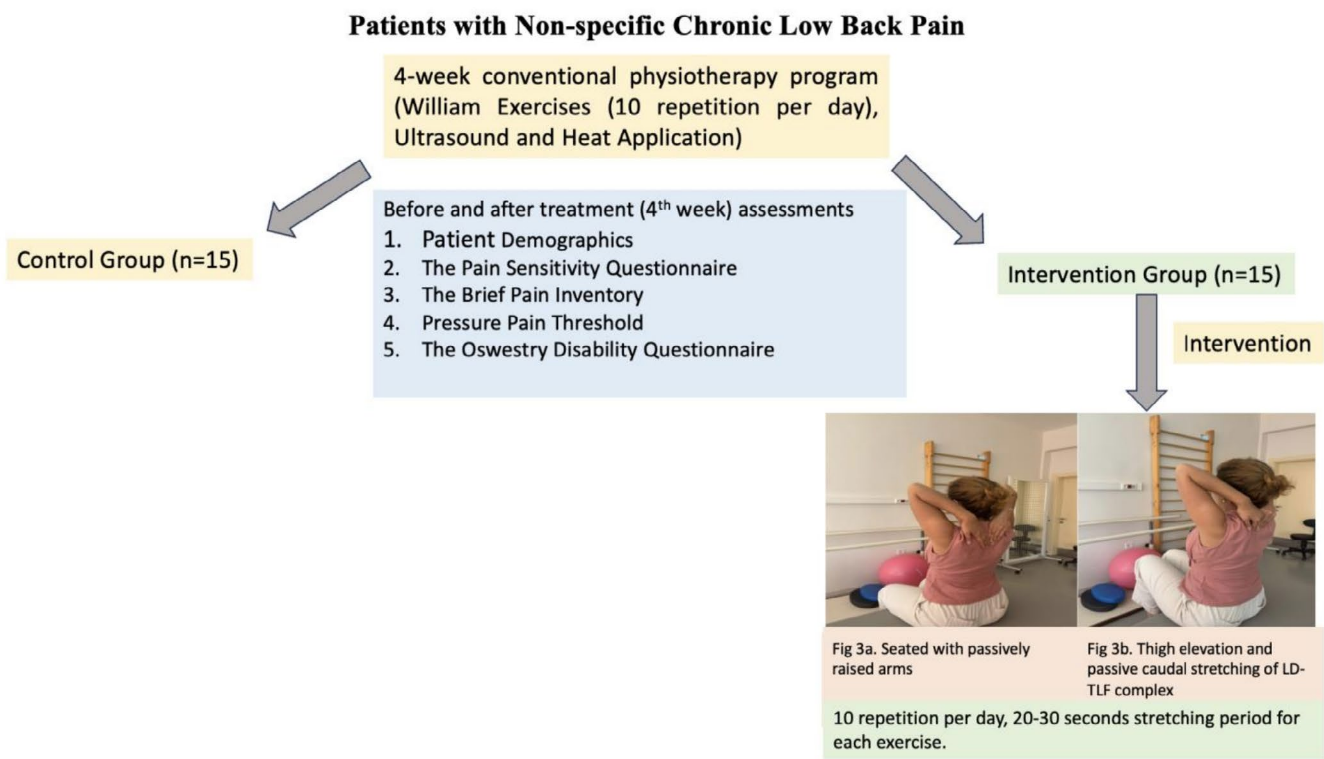

FIGURE 2 | Design of the study.

2.3.1 | The Study Group

The study group received a 4-week LD-TLF complex stretching exercise program, consisting of 10 repetitions per day, with each stretch lasting 20–30 s, which included two stretching exercises described as follows: Firstly, seated with passively raised arms (the LD-TLF complex is stretched cranially, with thigh elevation and passive caudal stretching of the LD-TLF complex). Secondly, the individuals were required to stretch the Gluteus maximus and the TLF by bending both hips while maintaining their feet on a stool that was 30 cm high. LD-TLF complex stretching exercises are shown in Figure 3 (Blain et al. 2019). The study group received the same conventional physiotherapy program as the control group, in addition to LD-TLF complex stretching.

2.3.2 | Control Group

The subjects in the control group received only a 4-week conventional physiotherapy program, including Williams exercises, ultrasound, and heat application. Each of the Williams exercises—including posterior pelvic tilt, single knee-to-chest, double knee-to-chest, partial sit-up, hamstring stretch, hip flexor stretch, and squatting—was performed for a total of 10 repetitions per day. Ultrasound therapy was applied in continuous mode at 1 MHz for 10 min. Hot packs were applied for 15 min (Noori et al. 2019).

2.4 | Outcome Measures

Before treatment and after 4-week rehabilitation, both groups were assessed with self-reported questionnaires and participated in objective measures. Patient demographics, such as gender, age, weight, and height, were recorded during the baseline evaluation.

2.4.1 | Pain Sensitivity Measurement

The Pain Sensitivity Questionnaire (PSQ) assesses pain sensitivity through hypothetically everyday scenarios encompassing various body regions. The PSQ scores range from 0, representing 'not at all painful', to 10, indicating the 'most severe pain imaginable'. Although the PSQ reflects general pain sensitivity, it does not measure experimentally induced pain intensity (Saban and Masharawi 2016; Taguchi et al. 2009).

2.4.2 | Pressure Pain Threshold (PPT) Assessment

PPT was measured using the Commander Echo algometer (USA). The algometer was applied perpendicularly to the skin, and pressure was gradually increased until the participant reported the sensation changing from pressure to pain. Participants were instructed to respond with 'OK' at this point, upon which the device was immediately withdrawn (Chesterton et al. 2007; Zicarelli et al. 2021). This procedure was performed three times alternately on the left and right sides of the lumbar region. PPT assessments targeted specific areas of the TLF: Below the 12th costa (fascia over the latissimus dorsi), 3 cm lateral to the spinous process of L1 (fascia above the paravertebral muscles), and 5 cm lateral to the spinous process of L3 (fascia above the quadratus lumborum muscle). Three measurements were taken at each site, and the mean value for each side was calculated. All PPT assessments were conducted by the same researcher to ensure consistency (Waller et al. 2015).

2.4.3 | The Brief Pain Inventory (BPI)

BPI is a widely used pain assessment tool primarily developed to evaluate pain intensity (4 items) and the extent to which pain interferes with a patient's ability to function in daily living (7 items) in individuals with chronic pain (Gumruk Aslan et al. 2023). For the 7 interference items, patients rate the impact of pain on various aspects of life—such as general activity, mood, walking ability, normal work, relationships with others, sleep, and enjoyment of life—using a numerical rating scale. Each item is anchored at 0 ('no pain') and 10 ('pain as bad as you can imagine') (Ger et al. 1999).

2.4.4 | The Oswestry Disability Questionnaire (ODQ)

The ODQ is a self-reported instrument widely used to assess the degree of functional disability of a patient in clinics.

FIGURE 3 | (a) Seated with passively raised arms. (b) Thigh elevation and passive caudal stretching of LD-TLF complex.

The questionnaire consists of 10 sections, each containing six statements scored from 0 to 5, where 0 indicates no disability and 5 indicates maximum disability. The total score is calculated as a percentage, with 0% representing no disability and 100% representing the highest level of disability (Fairbank and Pynsent 2000).

2.5 | Sample Size Calculation

The algometer pain threshold values of Quadratus lumborum muscle were used to calculate the sample size with the reference of Imamura et al., using G*Power Software (Version 3.1.9.2, Düsseldorf University, Düsseldorf, Germany). The minimum required sample size was calculated to be 26 participants, assuming an effect size of 0.46, a significance level of 0.05 and statistical power of 80% [*F* test (analysis of variance): repeated measures, between factors] (Imamura et al. 2013). Considering a dropout rate of 10%, 30 participants were recruited.

2.6 | Statistical Analyses

Statistical analyses were performed using IBM SPSS 26 software. The distribution of variables was assessed using visual methods (histograms and probability plots) and analytical tests (Kolmogorov–Smirnov/Shapiro–Wilk tests). Descriptive statistics are presented as mean ± standard deviation for normally distributed data. Paired Sample *T* Test was conducted to compare pre-treatment and post-treatment outcomes within each group. Repeated measures ANOVA was applied to assess changes over time within and between groups, examining both the main effect of time and the group × time interaction.

3 | Results

Descriptive statistics for the participants in the study group and the control group are presented in Table 1. There were no significant differences between the two groups in terms of age, height, and weight, as shown in Table 1.

Main time effect and group × time interaction analysis of the outcomes of the groups is presented in Table 2. We observed significant group × time interactions for pain threshold values at the level of L3 ($p < 0.001$, $\eta p^2 = 0.52$), L1 ($p < 0.001$, $\eta p^2 = 0.47$) vertebrae and 12th costa ($p < 0.001$, $\eta p^2 = 0.74$), as well as PSQ scores ($p < 0.001$, $\eta p^2 = 0.73$), BPI scores ($p < 0.001$), and ODQ scores ($p < 0.001$, $\eta p^2 = 0.80$).

The comparison of pre-treatment and post-treatment outcomes showed significant differences in pain threshold values at the level of L3 ($p < 0.001$), L1 ($p < 0.001$) vertebrae and 12th costa ($p < 0.001$), as well as PSQ scores ($p < 0.001$) in the study group (Table 3). In contrast, no significant differences were found in the control group for pain threshold values at the level of L3 ($p = 0.517$), L1 ($p = 0.931$) vertebra, and 12th costa ($p = 0.991$), as well as PSQ scores ($p = 0.327$) (Table 2). An analysis of the BPI subscale scores (study group $p < 0.001$; control group $p < 0.001$ for all the subscales) and ODQ scores (study group $p < 0.001$; control group $p < 0.001$) revealed significant improvements within both groups from pre-treatment to post-treatment assessment. Participants in the study group demonstrated lower BPI subscale scores and ODQ scores compared to the control group (Table 2).

TABLE 1 | Descriptive characteristics of the participants in the study group and control group.

	Groups		
Descriptive characteristics	**Control (*n* = 15) X ± SS**	**Study (*n* = 15) X ± SS**	***p***
Age (years)	42.8 ± 10.6	49.6 ± 8.1	0.061
Weight (kg)	78.4 ± 14.1	82.9 ± 10.6	0.337
Height (cm)	170.5 ± 9.8	169.2 ± 10.4	0.722

Note: X ± SS: Mean ± standard deviation, $p < 0.05$ means statistical significance.

4 | Discussion

This study evaluated the effects of LD-TLF complex stretching exercises in combination with conventional physiotherapy—including Williams exercises, ultrasound therapy and hot pack application—on pain characteristics, on participants' ability to function in daily living, and disability in adults with CLBP. Although ultrasound and heat applications are not typically considered part of standard care, the World Health Organization (WHO) suggests that they may have an effect, particularly on pain, despite the low level of supporting evidence (WHO Guidelines Approved by the Guidelines Review Committee 2023). As ultrasound and heat applications remain commonly used in both clinical physiotherapy practice and scientific studies (Ebadi et al. 2020), we included them in both groups. Compared to the control group, the study group demonstrated better outcomes in pain characteristics, in participants' ability to function in daily living, and a reduction in disability.

Although previous studies have investigated the efficacy of various types of exercise, only moderate evidence supports that exercise treatment is more effective than no treatment, usual care, or placebo in managing CLBP (Hayden et al. 2021). While some studies have examined the effects of LD-TLF stretching on parameters such as tissue stiffness (Blain et al. 2019), there is still a lack of study on the effects of LD-TLF stretching exercises in combination with conventional physiotherapy on pain characteristics, participants' ability to function in daily life, and disability (Brandl et al. 2021; Hayden et al. 2021; van Amstel et al. 2022). Our findings contribute to addressing this gap by demonstrating that LD-TLF stretching in combination with conventional physiotherapy leads to improvements in pain characteristics, participants' functional ability in daily living, and reductions in disability compared to conventional physiotherapy alone.

Pain sensitivity has been identified as a key factor in the development and persistence of chronic pain. In this study, the Pain Sensitivity Questionnaire (PSQ) was used to assess participants' general pain perception. Consistent with prior study reporting increased PSQ scores in individuals with CLBP (O'Neill et al. 2014),

TABLE 2 | Within and between group comparisons.

Outcome measures	Study group ($n = 15$) Mean differences (95% CI)	Control group ($n = 15$) Mean differences (95% CI)	Time p (ηp^2)	Group × time p (ηp^2)
Algometer				
L3	−19.9 (−23.9 to −15.9)	1.7 (−3.0 to 7.4)	< 0.001 (0.52)	< 0.001 (0.61)
L1	−22.7 (−28.9 to −17.2)	4.5 (−0.8 to 9.9)	< 0.001 (0.47)	< 0.001 (0.67)
12.costa	−21.05 (−24.3 to −17.7)	0.02 (−3.8 to 3.8)	< 0.001 (0.74)	< 0.001 (0.74)
PSQ	2.6 (2.1–3.1)	0.1 (−0.2–0.4)	< 0.001 (0.73)	< 0.001 (0.67)
BPI				
Worst pain in 24 h	5.9 (5.1–6.6)	2.4 (1.9–2.8)	< 0.001 (0.93)	< 0.001 (0.73)
Least pain in 24 h	3.0 (2.3–3.7)	1.6 (1.1–2.1)	< 0.001 (0.83)	< 0.001 (0.3)
Average pain	4.0 (3.5–4.5)	2.1 (1.6–2.5)	< 0.001 (0.92)	< 0.001 (0.55)
Pain right now	4.4 (3.7–5.2)	2.2 (1.6–2.7)	< 0.001 (0.89)	< 0.001 (0.5)
General activity	5.0 (4.3–5.7)	2.9 (2.0–3.8)	< 0.001 (0.89)	< 0.001 (0.37)
Walking ability	5.8 (5.1–6.4)	2.9 (2.1–3.7)	< 0.001 (0.92)	< 0.001 (0.55)
Normal work	5.0 (4.4–5.7)	3.0 (2.3–3.6)	< 0.001 (0.93)	< 0.001 (0.46)
Relations with other people	4.6 (3.5–5.6)	2.4 (1.4–3.3)	< 0.001 (0.78)	< 0.05 (0.26)
Sleep	5.5 (4.4–5.7)	2.1 (1.3–2.9)	< 0.001 (0.84)	< 0.001 (0.52)
Enjoyment of life	6.0 (5.03–7.1)	2.8 (2.1–3.6)	< 0.001 (0.88)	< 0.001 (0.5)
ODQ	28.1 (24.-32.1)	5.2 (3.1–7.2)	< 0.001 (0.89)	< 0.001 (0.8)

Abbreviations: ηp^2, Partial Eta Squared; BPI, Brief pain inventory; ODQ, Oswestry Low Back Pain Disability Questionnaire; p, Repeated measures ANOVA; PSQ, Pain sensitivity questionnaire.

both groups in our study showed a decrease in PSQ scores following treatment. However, the study group demonstrated significantly lower PSQ scores than the control group after the intervention. This finding in our study strengthens the evidence that LD-TLF complex stretching in combination with conventional physiotherapy contributes to improved pain tolerance in individuals with CLBP (Ajimsha et al. 2015; Dal Farra et al. 2021).

The TLF-related dysfunctions have been proposed as a potential source of LBP due to the possible high density of nociceptors in the region (Sinhorim et al. 2021). Prior studies have reported that the density of nociceptive receptors in the TLF is approximately three times higher than that in the spinal muscles (Barry et al. 2015). This finding may explain why patients in our study exhibited increased sensitivity to pressure pain around the lumbar spine, where the TLF plays a significant sensory and structural role. Other studies also support the finding that individuals with CLBP have lower pressure pain threshold values compared to healthy controls, including in regions distant from the primary pain site (Imamura et al. 2013; Kondrup et al. 2022). In this study, pressure pain thresholds were measured at the L1 and L3 vertebral levels and the 12th rib. Our findings revealed that baseline PPT values were similar between both groups prior to the intervention. However, consistent with previous studies, participants in the study group demonstrated a significant increase in PPT at the L1 and L3 vertebral levels and the 12th costa at the 4-week follow-up assessment, whereas the control group showed no significant change. These results suggest that LD-TLF complex stretching in combination with conventional physiotherapy plays a crucial role in increasing pressure pain threshold in individuals with CLBP. Given that pain is a key symptom in patients with CLBP, incorporating LD-TLF complex stretching into treatment protocols may offer therapeutic benefits.

Studies show a clear relationship between the severity of LBP and the elasticity of the TLF. Myofascial release techniques that reduce stiffness have been found to directly decrease pain in patients with CLBP (Hayden et al. 2021; Tamartash et al. 2022). On the other hand, exercise is considered more effective in managing pain in individuals with CLBP compared to no treatment, standard care, or placebo (Fernández-Rodríguez et al. 2022). In agreement with these findings, both the study and control groups in our study demonstrated significant improvements in BPI scores, indicating decreased pain levels. The findings of our study suggest that conventional physiotherapy decreases BPI scores, and that combining it with LD-TLF stretching exercises may provide greater benefits.

Previous studies have suggested that interventions targeting the TLF, such as stretching exercises, can promote relaxation of this tissue, leading to improvements in pain-related parameters (Stecco et al. 2011). Furthermore, reductions in pain intensity have been

TABLE 3 | Comparison of outcome measures pre- and post-treatment.

	Study group ($n=15$)			Control group ($n=15$)		
Outcome measures	**Pre-treatment**	**Post-treatment**	***p***	**Pre-treatment**	**Post-treatment**	***p***
Algometer						
L3	17.8 ± 10.3	37.8 ± 10.5	**< 0.001***	25.9 ± 10.9	24.1 ± 7.3	0.517
L1	19.0 ± 9.3	41.8 ± 8.5	**< 0.001***	27.9 ± 12.2	23.3 ± 8.1	0.931
12.costa	14.3 ± 7.8	35.3 ± 8.8	**< 0.001***	13.7 ± 7.02	13.7 ± 6.7	0.991
PSQ	5.9 ± 1.1	3.3 ± 1.0	**< 0.001***	6.5 ± 1.8	6.3 ± 1.5	0.327
BPI						
Worst pain in 24 h	8.8 ± 1.0	2.8 ± 0.9	**< 0.001***	8.3 ± 0.9	5.9 ± 1.2	**< 0.001***
Least pain in 24 h	5.1 ± 1.9	2.0 ± 1.1	**< 0.001***	5.1 ± 1.2	3.4 ± 1.0	**< 0.001***
Average pain	7.1 ± 0.9	3.0 ± 0.8	**< 0.001***	6.6 ± 0.8	4.4 ± 1.1	**< 0.001***
Pain right now	7.4 ± 1.5	2.9 ± 0.7	**< 0.001***	7.1 ± 0.9	4.9 ± 1.1	**< 0.001***
General activity	8.2 ± 1.1	3.2 ± 0.6	**< 0.001***	7.9 ± 1.3	5.0 ± 1.5	**< 0.001***
Walking ability	7.9 ± 1.3	2.1 ± 1.0	**< 0.001***	7.9 ± 1.3	5.0 ± 1.5	**< 0.001***
Normal work	8.2 ± 1.3	3.1 ± 0.9	**< 0.001***	7.6 ± 1.4	4.6 ± 1.4	**< 0.001***
Relations with other people	6.6 ± 2.5	2.0 ± 1.0	**< 0.001***	6.0 ± 2.9	3.6 ± 1.6	**< 0.001***
Sleep	7.8 ± 1.9	2.2 ± 1.0	**< 0.001***	6.4 ± 1.9	4.3 ± 1.2	**< 0.001***
Enjoyment of life	8.7 ± 1.6	2.6 ± 1.1	**< 0.001***	7.8 ± 1.6	4.9 ± 1.6	**< 0.001***
ODQ	48.8 ± 7.9	20.6 ± 6.6	**< 0.001***	48.9 ± 8.2	43.7 ± 8.5	**< 0.001***

Note: Bold fonts with '*' indicate statistically significant paired sample *t*-test.
Abbreviations: BPI, Brief pain inventory; ODQ, Oswestry Low Back Pain Disability Questionnaire; p, Paired-sample *t*-test; PSQ, Pain sensitivity questionnaire.

linked to decreased disability in individuals with CLBP, reflecting better functionality in daily life activities (Fernández-Rodríguez et al. 2022). In line with these findings, both groups showed improvement in disability over time. However, the study group showed a significant decrease in disability scores compared to the control group following the intervention. This finding suggests that although both treatments are effective in reducing disability, the addition of LD-TLF complex stretching to conventional physiotherapy may be a more effective approach for decreasing disability. Nevertheless, the exact biomechanical mechanisms underlying these improvements remain unclear, and future studies are warranted to investigate these mechanisms.

4.1 | Limitations

One of the limitations of our study is the lack of direct assessments of TLF structural changes. Although the intervention was designed to indirectly influence the TLF through stretching of the LD-TLF complex, no imaging techniques were used to confirm this effect. Moreover, the TLF is known to be a strong composite tissue, which raises questions about the biological plausibility of significantly affecting its structure through stretching alone. Another important limitation of our study is the small sample size, which may restrict the generalizability of the findings. Future studies incorporating imaging techniques, comprehensive biomechanical assessments, and larger sample sizes are warranted to validate the hypothesised link between LD-TLF complex stretching in combination with conventional physiotherapy and TLF modulation.

5 | Conclusion

This study has shown that an approach involving stretching the latissimus dorsi–thoracolumbar fascia complex in combination with conventional physiotherapy is more effective than conventional physiotherapy alone for improving pain characteristics, pain severity in daily functioning, and decreasing disability in individuals with CLBP. In conclusion, while latissimus dorsi–thoracolumbar fascia complex stretching in combination with conventional physiotherapy shows compelling potential in improving pain intensity, pain thresholds, pain sensitivity symptoms, and functional outcomes in individuals with non-specific CLBP, further studies are essential to validate these findings across diverse patient populations and settings.

Author Contributions

Conceptualization: N.U., S.B.K. Methodology: N.U. Data collection: S.B.K., M.İ.K. Statistical analyses: S.B.K., M.İ.K. Writing – original draft preparation: N.U., S.N.A. Writing – review and editing: N.U., S.N.A.

Consent

Informed consent was obtained from all the patients who participated in the study.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data can be made available by the author upon request.

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