

Comparison of thoracolumbar fascia flexibility and its relationship with trunk proprioception and spinal posture in individuals with nonspecific low back pain and healthy peers

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Abstract

Aim: To investigate the relationship between thoracolumbar fascia flexibility, trunk proprioception, and spinal posture in individuals with non-specific low back pain.

Materials and Methods: A total of 80 participants were included in the study, comprising 40 individuals with nonspecific low back pain and 40 healthy controls. The Visual Analog Scale (VAS) was used to determine pain severity; the Oswestry Disability Index (ODI) to assess the impact of low back pain on daily life; and the International Physical Activity Questionnaire-Short Form (IPAQ) to determine physical activity levels. Thoracolumbar fascia flexibility was assessed with a goniometric platform; trunk proprioception with; and spinal posture with the Spinal Mouse device.

Results: There were significant differences in VAS and Oswestry Disability Index scores between the groups with and without nonspecific low back pain ($p<0.05$). IPAQ scores were similar between groups ($p=0.288$). Thoracolumbar fascia flexibility in the nonspecific low back pain group was lower than that in the healthy group ($p<0.05$). When results from the posture evaluation were compared, the thoracic angle during maximum flexion was significantly smaller in the group with non-specific low back pain ($p=0.014$). No significant results were found for the upright and maximum extension postures ($p>0.05$). No correlation was found between thoracolumbar fascia flexibility and trunk proprioception.

Conclusion: Thoracolumbar fascia flexibility and trunk proprioception were adversely affected in individuals with nonspecific low back pain. Although TLF flexibility and proprioception differed between groups, TLF flexibility was not associated with proprioceptive error. These findings highlight the potential clinical value of incorporating assessments of thoracolumbar fascia flexibility and trunk proprioception into the evaluation of individuals with nonspecific low back pain.

Keywords: flexibility, low back pain, posture, proprioception, thoracolumbar fascia

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INTRODUCTION

Low back pain is the second leading cause of disability worldwide; however, accurately identifying its underlying cause remains challenging (1). Consequently, cases in which no specific underlying pathology can be identified are commonly classified as nonspecific low back pain. Therefore cannot be attributed to conditions such as osteoporosis, infection, fracture, structural deformity, cauda equina syndrome, tumor, radicular syndrome, or inflammatory disorders, is defined as non-specific low back pain (2). Low back pain may lead to postural impairments, deficits in proprioceptive acuity, and reductions in flexibility. Dysfunction within the myofascial system and the thoracolumbar fascia is considered one of the primary contributing factors to non-specific low back pain (3). The thoracolumbar fascia is an active connective tissue structure that plays a crucial role in the transmission of forces between the trunk muscles and the vertebral column (4). This connective tissue, within the deep epimysium and aponeurotic tissues, is rich in nerve fibers responsive to pain and low-threshold mechanical stimuli. Under conditions of mechanical loading, microtrauma, and fatigue-related stress, inflammatory responses may develop within the connective tissue (5). Abnormal connective tissue structure may predispose individuals to the development of low back pain or may occur as a consequence of injury and/or alterations in movement patterns resulting from chronic pain (6).

In individuals with low back pain, alterations in muscle activation patterns occur, leading to impairments in proprioceptive feedback (7). These individuals have been shown to exhibit greater lumbopelvic repositioning errors during standing or sitting postures (8). Fascia is richly innervated and plays a role in proprioception through receptors embedded within its tissue. Impairments in fascial mobility have been associated with deficits in proprioceptive acuity (9). Furthermore, it has been suggested that acute interventions targeting the fascia may lead to improvements in proprioceptive function (10). The thoracolumbar fascia (TLF) contributes to trunk stabilization and plays a key role in load distribution (5). Prolonged maintenance of inappropriate postures alters the tensioning patterns of the fascia, leading to tissue deformation. Studies conducted in individuals with chronic non-specific

low back pain have demonstrated structural changes in the TLF, including reduced flexibility and increased thickness. These alterations may contribute to changes in postural habits, affecting posture through mechanisms such as localized inflammation or fibrosis. Poor posture can impair the mechanical properties of the TLF, suggesting a bidirectional interaction between posture and fascia.

The flexibility of the TLF has been shown to decrease when sitting and in forward-flexed postures. Prolonged maintenance of these postures may reduce activation of the trunk and hip musculature, leading to deficits in postural control and increased lumbar pain (11). Consequently, examination of the thoracolumbar fascia represents an important step in elucidating the pathophysiology of low back pain. A review of the literature suggests that alterations in the thoracolumbar fascia (TLF) may play a role in the development of chronic low back pain. Adhesions within the fibrous structure of the TLF reduce its gliding capacity, resulting in increased stiffness and decreased flexibility (6). Anatomical studies in this field have demonstrated a high density of mechanoreceptors within the TLF, leading to the interpretation that fascia is not merely a passive connective tissue but also a structure capable of providing nociceptive and proprioceptive input (5).

A study assessing TLF stiffness using shear-wave elastography reported that increased stiffness was correlated with pain intensity and functional limitation; these findings suggest that mechanical alterations in the fascia may influence both motor control and proprioceptive function (12). Existing studies examining fascial flexibility in relation to proprioception and posture have generally involved small sample sizes and predominantly employed advanced measurement techniques such as ultrasound elastography. Research on non-imaging assessment methods that can be easily implemented in clinical practice remains limited. Furthermore, studies simultaneously investigating fascial flexibility together with both proprioception and posture are scarce, with most existing research focusing on a single parameter (13). This limitation impedes the ability to adequately explain the functional interactions among these variables.

In light of these considerations, we hypothesized that thoracolumbar fascial flexibility is reduced in individuals with non-specific low back pain and that this loss of flexibility adversely affects proprioceptive function and spinal posture. Therefore, this study aimed to compare thoracolumbar fascial flexibility, trunk proprioception, and spinal posture between individuals with non-specific low back pain and healthy controls and to determine the relationships between fascial flexibility and spinal posture, and between fascial flexibility and trunk proprioception. The findings of this study are expected to have clinical applicability and to contribute to the scientific literature.

MATERIALS AND METHODS

Study design and participants

This study was a randomized, controlled, comparative cross-sectional study involving 80 participants (Figure 1). Participants were assessed between October 2022 and April 2023. Ethical approval was obtained from the Bolu Abant İzzet Baysal University Clinical Researches Ethics Committee (approval date: 06 September 2022; decision number: 2022/226) and registered to clinicaltrials.gov (ID: NCT07039214 Date: 18/06/2025). Written informed consent was obtained from all participants who met the inclusion criteria prior to their enrollment in the study.

The inclusion criteria were: being between 35 and 65 years of age; having low back pain with an intensity greater than 3 on the Visual Analog Scale (VAS) that had persisted for at least 3 months; and having pain intensity below 3 on the VAS in all other body region (14). The exclusion criteria included a history of lumbar spine surgery; diagnosed osteoporosis, infection, fracture, structural deformity, cauda equina syndrome, tumor, radicular syndrome, or inflammatory disorder; being classified as highly physically active according to the International Physical Activity Questionnaire (IPAQ); generalized joint hypermobility (Beighton score ≥ 4) (15); the presence of a psychiatric disorder requiring treatment; pregnancy; or a diagnosed rheumatic disease.

Based on a similar study assessing fascial flexibility (16), a sample size calculation was performed

according to trunk proprioception, which was one of the primary hypotheses for the comparison between the two groups. Assuming a large effect size ($d = 0.68$), a power of 90%, and a significance level of 5%, the required total sample size was determined to be 70 participants (35 per group). sample size calculations were performed using G*Power 3.1.

Outcome measurements

Demographic data were collected from all participants.

Pain intensity was assessed using a 10-cm horizontal Visual Analog Scale (VAS). The VAS is a scale with established validity and reliability for assessing pain in individuals with musculoskeletal disorders (14). The scale consists of a 10-cm line anchored by 0, indicating “no pain,” and 10, indicating “unbearable pain.” Participants were instructed to indicate the intensity of their perceived pain by placing a dot, drawing a line, or making a mark on the scale. The distance from the starting point (0) to the point marked by the participant was recorded as the participant’s pain intensity. VAS scores of 0–3.4 cm, 3.5–7.4 cm, and ≥ 7.5 cm were classified as mild, moderate, and severe pain, respectively.

The Oswestry Disability Index (ODI) was used to assess the impact of low back pain on daily activities. The Turkish validity and reliability of the questionnaire were established by Yakut et al. in 2004 (17). The questionnaire consists of 10 items assessing different aspects of functional status. Each item is scored from 0 to 5, with higher scores indicating greater disability.

The International Physical Activity Questionnaire (IPAQ) is a standardized questionnaire developed by researchers from several countries with support from the World Health Organization (WHO) to assess physical activity levels. Its Turkish validity and reliability were established by Sağlam et al (18). The original questionnaire consists of 27 items, whereas the short form comprises 7 items. Participants are asked to estimate the frequency and duration of their physical activities during the previous week. The duration of each activity is multiplied by its corresponding metabolic equivalent of task (MET) value, and the overall score is calculated by summing the MET values across all activity categories.

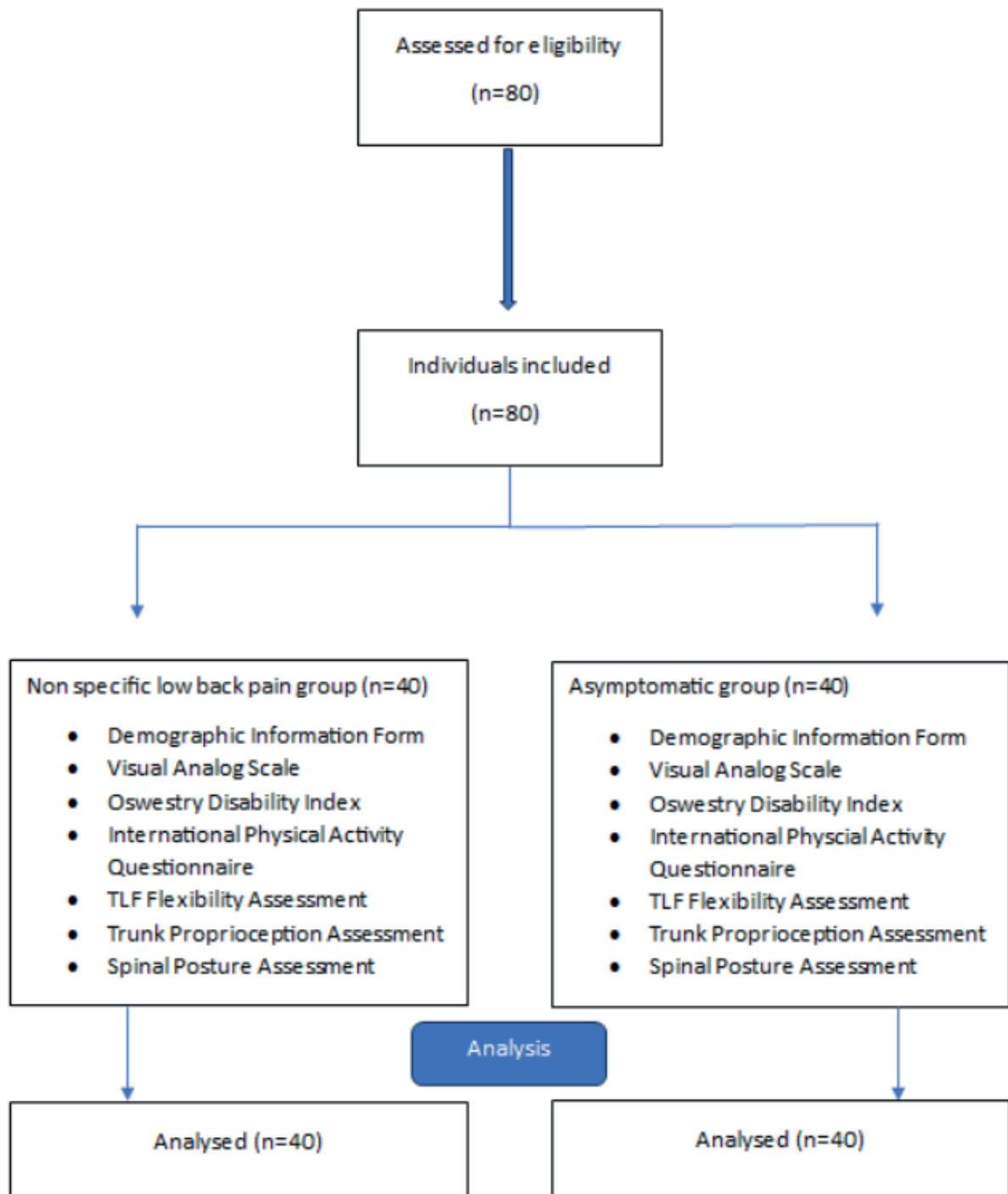


Figure 1. Flowchart of study.

The primary outcome was thoracolumbar fascia (TLF) flexibility. Thoracolumbar fascia (TLF) flexibility was assessed using a goniometric platform developed by Sarioğlu and Özünlü Pekyavaş (19), which has demonstrated good internal consistency, with reported Cronbach's α coefficients of 0.80 for right rotation and 0.96 for left rotation. The goniometric platform was placed on a table positioned in front of the participants. Participants were seated on a chair without back support, with the lumbar spine in a neutral position and the hips and knees flexed to 90°. To ensure that rotation occurred primarily through the thoracic region, the researcher stabilized the pelvis by holding the posterior superior iliac spines. Participants were instructed to perform trunk rotation first to the right and then to the left. Verbal cues were provided to monitor and guide the rotation. At the end range of rotation, participants were asked to mark the platform positioned in front of them while maintaining 90° of shoulder flexion, with the hands clasped in front of the trunk, holding a wooden pencil between the hands. Each measurement was repeated three times on both sides, and the mean of the three trials was used for analysis.

Trunk proprioception was assessed using a mobile application, Clinometer (20). Participants stood in an upright position with their arms fixed alongside their bodies, heels positioned 3 cm apart, and their gaze directed toward a fixed point at eye level. The smartphone was placed vertically just above the iliac crest, along the mid-axillary line at the midpoint of the iliac spine, and secured with a belt. The clinometer was calibrated to 0°, with 0° defined as the starting position. The target movement range was set between 0° and 30°. Participants were first passively guided by the physiotherapist to the target angle. They were instructed to maintain this position for 10 seconds to memorize it, after which they actively returned to the starting position. Subsequently, with their eyes closed, participants were asked to actively reproduce the target angle three times. The mean absolute deviation of the three trials was recorded as the proprioception value (20).

Spinal posture was assessed using the Spinal Mouse device (Idiag, Voletswil, Switzerland; SM) (21). Prior to the measurements, the researcher demonstrated all test positions to the participants. Participants were

instructed to maintain each position for 1–2 seconds during the measurements. They were asked to remove clothing to allow full exposure of the spinous processes and to stand upright. The spinous processes from C7 to S3 were palpated and marked. The Spinal Mouse was then guided along the marked points, from the superior to the inferior. Participants were instructed to assume three positions sequentially: upright standing, maximal trunk flexion, and maximal trunk extension. For the upright position, participants stood comfortably with their feet shoulder-width apart, heads in a neutral position, and arms relaxed at their sides. For maximal flexion, participants were instructed to bend forward as far as possible without flexing the knees. To achieve maximal extension, participants were asked to cross their arms in front of their trunk and extend the trunk as far as possible without knee flexion.

Statistical analysis

Statistical analyses were performed using SPSS version 25.0 (IBM SPSS Statistics 25; IBM Corp., Armonk, NY, USA). Continuous variables that were found to be normally distributed according to the Kolmogorov–Smirnov test were compared between groups using the independent samples t-test. The chi-square test was applied to examine the associations between categorical variables and group membership. Correlation analyses were conducted using Pearson's correlation coefficient. Descriptive statistics for continuous variables were presented as mean ($\bar{X}$), standard deviation (SD), minimum and maximum values, while categorical variables were expressed as frequencies (n) and percentages (%). A p-value less than 0.05 was considered statistically significant.

RESULTS

A total of 80 individuals aged between 35 and 65 years were included in this study. The non-specific low back pain group consisted of 40 individuals (24 females, 16 males), while the healthy control group included 40 individuals (23 females, 17 males).

The normality of data distribution for all outcome measures in both groups was assessed using the Shapiro-Wilk test. The results indicated that all parameters were normally distributed ($p > 0.05$).

In this study, the primary outcome measure was the difference in thoracolumbar fascia (TLF) flexibility between groups. Effect sizes, calculated using Cohen's *d*, were 1.63 for right rotation and 1.57 for left rotation, indicating large effects.

The mean age of the participants was 52.45 ± 7.00 years in the non-specific low back pain group and 52.75 ± 7.62 years in the healthy group. Body mass index was 24.04 ± 0.96 kg/m² in the non-specific low back pain group and 27.65 ± 2.18 kg/m² in the asymptomatic group (Table 1).

In between-group comparisons, significant differences were observed in Visual Analog Scale (VAS) scores ($p < 0.001$), Oswestry Disability Index scores ($p < 0.001$), thoracolumbar fascia (TLF) flexibility measurements on the right and left (both $p < 0.001$), and proprioception values ($p = 0.010$). In contrast, no significant differences were found between groups in International Physical Activity Questionnaire (IPAQ) scores ($p = 0.288$) (Table 2).

Thoracolumbar fascia (TLF) flexibility on the right side was 47.60 ± 10.41 in the non-specific low back pain group and 64.30 ± 10.07 in the healthy group. For the left side, TLF flexibility was 48.28 ± 11.38 in individuals with non-specific low back pain and 65.38 ± 10.31 in healthy individuals. On both sides, TLF flexibility was significantly higher in the healthy group ($p < 0.001$; Table 2).

The mean deviation value obtained from the proprioception assessment was 13.01 ± 6.97 in the non-specific low back pain group and 9.49 ± 4.82 in the healthy group. A significant difference in proprioception values was observed between the groups ($p = 0.01$) (Table 2).

Postural assessment data indicated that thoracic curvature was significantly lower in the non-specific low back pain group than in the healthy group ($p = 0.014$). No significant differences were observed between the groups for the remaining spinal angle parameters ($p > 0.05$) (Table 3).

Table 1. Individuals' age, body mass index information.

	Non-Specific Low Back Pain (n=40)	Healthy (n=40)		
	X±SD	X±SD	t	p
Age (year)	52.45±7.00	52.75±7.62	-0.183	0.855
Body Mass Index (kg/m ²)	24.04±0.96	27.65±2.18	1.330	0.188

t: Independent t-Test, * $p < 0.05$, X±SD: mean±standart deviation

Table 2. Independent t-test results of mean differences between groups.

	Non-Specific Low Back Pain (n=40)	Healthy (n=40)			
	X±SD	X±SD	t	p	CI %95 (min-max)
VAS	7.08±1.78	0.06±0.26	24.56	<0.001	6.45-7.59
IPAQ	340.06±291.80	266.66±321.42	1.069	0.288	-63.25 – 210.05
Oswestry	46.40±13.17	0.55±1.69	21.830	<0.001	41.66 – 50.03
TLF Flexibility (Right)	47.60±10.41	64.30±10.07	-7.292	<0.001	-21.26 – -12.16
TLF Flexibility (Left)	48.28±11.38	65.38±10.31	-7.043	<0.001	-21.94 – -12.27
Proprioception	13.01±6.97	9.49±4.82	2.625	0.010	0.85 – 6.19

VAS: Visual Analog Scale, IPAQ: International Physical Activity Questionnaire, TLF: thoracolumbar fascia, t: Independent t-Test, X±SD: mean±standart deviation, * $p < 0.05$, CI %95: Confidence Interval of the Difference.

Table 3. Comparison of spinal postures of individuals.

		Non-Specific Low Back Pain (n=40)	Healthy (n=40)		
		X±SD	X±SD	p	t
UP	Sacrum-Hip	32.00 ± 39.70	23.65 ± 14.31	0.226	1.220
	Thoracic Angle	53.89 ± 10.25	58.63 ± 49.23	0.559	-0.588
	Lumbar Angle	-38.10 ± 9.29	36.05 ± 22.30	0.598	-0.529
MFP	Sacrum-Hip	75.15 ± 50.17	70.57 ± 14.66	0.591	0.540
	Thoracic Angle	48.64 ± 14.76	56.52 ± 12.57	0.014*	-2.520
	Lumbar Angle	12.61 ± 18.14	17.07 ± 10.97	0.197	-1.302
MEP	Sacrum-Hip	19.17 ± 12.10	37.52 ± 69.79	0.110	-1.617
	Thoracic Angle	28.87 ± 15.18	25.07 ± 15.89	0.288	1.071
	Lumbar Angle	-48.43 ± 19.43	-56.97 ± 30.43	0.145	1.471

Independent t-Test *p<0.05, X±SD: mean±standart deviation UP: Upright Posture; MFP: Maximum Flexion Posture; MEP: Maximum Extansion Posture.

Table 4. Correlation evaluations of thoracolumbar fascia flexibility according to proprioception in non-specific low back pain and healthy groups.

		Proprioception	
		r	t
Non-Specific Low Back Pain (n=40)	Thoracolumbar Fascia Flexibilty (Right)	0.014	0.931
	Thoracolumbar Fascia Flexibilty (Left)	0.008	0.961
Healthy (n=40)	Thoracolumbar Fascia Flexibilty (Right)	-0.070	0.666
	Thoracolumbar Fascia Flexibilty (Left)	-0.044	0.786

Pearson Correlation Test *p<0.05

A Pearson product-moment correlation was used to examine the relationship between thoracolumbar fascia flexibility and proprioception. No significant correlations were found between thoracolumbar fascia flexibility on the right or left and proprioception in either the non-specific low back pain group or the healthy group (Table 4).

DISCUSSION

This study investigated the relationship between thoracolumbar fascia flexibility, trunk proprioception, and spinal posture in individuals with non-specific low back pain. A total of 80 participants were included: 40 individuals with non-specific low back pain and 40 healthy controls with comparable demographic characteristics. The findings demonstrated that, compared with healthy individuals, those with non-specific low back pain had significantly lower

thoracolumbar fascia flexibility and a significantly greater mean deviation in trunk proprioception. Spinal posture parameters were largely comparable between the groups. Furthermore, when the relationships among thoracolumbar fascia flexibility, proprioception, and spinal posture were examined, no significant correlations were identified among these variables in either group.

Physical activity is considered an important component in the management of non-specific low back pain, as prolonged physical inactivity has been shown to increase lumbar pain (22). However, no clear consensus exists that individuals with chronic low back pain consistently exhibit lower levels of physical activity than healthy individuals. A published review reported no clear association between physical activity levels and disability, pain, or being asymptomatic in individuals with non-specific low back pain (22). When

observational studies investigating the relationship between physical activity and low back pain were synthesized, moderate-level evidence supporting an association between these two parameters was identified (23). Heneweer et al. reported moderate evidence indicating that physical inactivity increases the risk of developing chronic low back pain in both individuals with and without existing low back pain (23). In the present study, no significant difference was found between the groups in terms of physical activity levels, and both groups were classified as sedentary based on questionnaire results. Although low back pain may reduce physical activity levels, it is difficult to conclude that sedentary behavior alone directly causes low back pain in individuals who are already inactive. In line with the findings of Heneweer et al. (23), being physically active or inactive does not appear to represent a definitive risk factor for low back pain, and the results of the present study are consistent with this perspective. The participants in this study were adults. A published review has demonstrated that, within the same adult age group, differences in physical activity are more likely to be observed in the distribution and intensity of activity throughout the day rather than in total activity levels (24). Accordingly, the similar physical activity levels observed between the groups in the present study may be interpreted in this context.

Previous studies have reported that the elastic modulus of the thoracolumbar fascia (TLF) in individuals with low back pain is approximately 25–30% lower than that observed in healthy individuals, and that this reduction is proportional to pain intensity, with decreasing flexibility being associated with increased pain levels (13). In a study evaluating TLF thickness using ultrasound in individuals with chronic non-specific low back pain, the fascia was found to be thicker in both longitudinal and transverse directions, indicating a loss of normal adaptive capacity (25). In the present study, TLF flexibility was reduced in individuals with non-specific low back pain. This finding may be attributed to an inability to maintain optimal positioning of the TLF because of pain, which may result in increased fiber thickness. Additionally, pain-related avoidance of movement aimed at protecting the lumbar region may reduce the fluid content of the TLF, leading to increased tissue adhesions and decreased flexibility. A reduction in fluid content may also decrease the

amount of hyaluronic acid within the fascia, alter fascial traction, and further reduce flexibility. These findings are consistent with our results and support the existing literature.

The literature has consistently emphasized that proprioceptive function is reduced in individuals with non-specific low back pain compared with healthy individuals. The majority of studies have assessed proprioception using repositioning error measures and have reported greater mean deviations in individuals with low back pain (7,26). A published meta-analysis demonstrated a significant and large deficit in repositioning accuracy in the low back pain group (26). In their systematic review, Tong et al. (27) suggested that chronic low back pain directly affects afferent mechanoreceptors responsible for proprioceptive control, leading to structural alterations in proprioceptors, while thixotropic adaptations of muscle spindles impair their signaling capacity. In individuals with low back pain, prolonged maintenance of static postures may cause muscle spindle stiffening through cross-bridge formation, thereby disrupting signal generation and transmission. In the present study, the mean deviation of repositioning error was significantly higher in individuals with non-specific low back pain than in healthy individuals. This finding may be explained by pain-related presynaptic inhibition, which disrupts the modulation of proprioceptors and leads to prolonged delays in muscle spindle feedback (28). Such impairments may reduce the accuracy of proprioceptive information and promote erroneous signal transmission, ultimately weakening the sense of repositioning in these individuals. Taimela et al. reported, in a biomechanical modeling study, that fatigue of the lumbar musculature reduces lumbar proprioception (29). Given that study participants had experienced low back pain for at least three months, prolonged pain-related changes in the lumbar muscles may have contributed to impaired proprioceptive function and, consequently, to increased mean deviation values in these participants.

Postural alterations are commonly observed in sedentary individuals, with physiological spinal curvatures often deviating from normal angular values. However, pain arising from musculoskeletal problems in this region is not always interpreted as

a direct consequence of postural deformities (30). A previous study reported that sedentary individuals tend to use similar spinal movement patterns during activities of daily living (31). Consequently, there is no clear consensus in the literature regarding the relationship between posture and the development of low back pain. In studies suggesting an association, postural assessments have typically been performed in specific or constrained positions (32). The postural findings of the present study are consistent with this perspective. In the present study, angular values measured in both groups were within normal ranges in the upright standing and maximal flexion positions, whereas values obtained in the maximal extension position exceeded normal limits. This finding may be attributed to the sedentary nature of both groups. Sedentary individuals have been shown to exhibit increased posterior pelvic tilt, which is associated with greater lumbar extension angles (33). Accordingly, the similar lumbar angles observed in both groups may be explained by comparable sedentary behavior. Although prolonged poor posture may result in tissue damage, not all tissue damage necessarily leads to pain; therefore, the absence of significant differences in postural angles between groups may be expected. Postural variations may influence muscle contraction patterns, optimal muscle length, and muscle activation, thereby contributing to the development of low back pain. However, given the lack of significant differences in postural parameters between the groups, the pain observed in the non-specific low back pain group in the present study is more likely attributable to reduced thoracolumbar fascia flexibility than to postural alterations.

Capsular or ligamentous tension in individuals with low back pain directly affects spinal mobility (34). The results of the present study demonstrated that the thoracic angle measured at maximal flexion was significantly greater in the healthy group. This finding indicates reduced thoracic mobility in individuals with non-specific low back pain.

Histological examination of the thoracolumbar fascia (TLF) has demonstrated the presence of mechanoreceptors and proprioceptors within its structure. However, a published review reported that these receptors are not uniformly distributed

throughout the deep layers of the fascia, suggesting that the TLF may play a proprioceptive role primarily through polymodal receptors rather than discrete proprioceptive endings (35). Although the TLF contains proprioceptive receptors, Stecco et al., in their investigation of deep fascia, indicated that not all regions of the TLF are innervated; therefore, sensory receptors are not present at every point within the fascia (36). The method used to assess fascial flexibility evaluated the fascia's mechanical properties at the macroscopic level. Proprioception, in contrast, was assessed using responses from peripheral tissues. However, proprioception is not solely dependent on peripheral input but also involves central processing mechanisms, including muscle spindles and Golgi tendon organs (37). This distinction may have contributed to the lack of correlation observed between TLF flexibility and proprioception. Furthermore, the goniometric platform used to assess fascial flexibility has limitations in accurately capturing the fascia's viscoelastic properties. Previous studies have reported that ultrasonographic techniques provide more objective and detailed assessments of fascial characteristics (14,25). Therefore, the measurement method used in this study may have limited the ability to detect a potential association. In addition, proprioception was evaluated in this study using repositioning error, which requires active participation. Repositioning accuracy represents only one aspect of proprioception. Factors such as fear-avoidance behaviors, postural control deficits, and kinesiophobia are also known to influence proprioceptive function (38). Consequently, the absence of a correlation between TLF flexibility and proprioception in our findings may be attributed to the influence of these additional factors, which contribute to reduced proprioceptive performance.

Limitations

This study has several limitations that should be considered when interpreting the results. The method used to evaluate TLF flexibility assessed all fascial layers collectively, without distinguishing superficial from deep fascial layers. Furthermore, the study included only individuals with non-specific low back pain and healthy peers; other lumbar pathologies were not evaluated. Physical activity levels were assessed

using a self-reported questionnaire rather than an objective measurement method, which may have introduced reporting bias.

CONCLUSION

This study evaluated whether thoracolumbar fascia flexibility is affected in individuals with non-specific low back pain, and whether it is associated with proprioception and spinal posture. The results demonstrated that fascia flexibility was significantly lower in individuals with non-specific low back pain than in healthy individuals; however, no association was observed between fascia flexibility and proprioception. Postural parameters were similar between the two groups. Additionally, this study found that individuals with low back pain had greater proprioceptive impairments than healthy individuals. The findings suggest that fascia should be considered in the assessment of individuals with low back pain and that interventions aimed at improving fascial flexibility may be an important component of rehabilitation programs to reduce symptoms.

Ethical approval

This study has been approved by the Bolu Abant İzzet Baysal University Clinical Researches Ethics Committee (approval date 06/09/2022, number 2022/226). Written informed consent was obtained from the participants.

Author contribution

Concept: HNC, RK; Design: HNC, RK; Data Collection or Processing: HNC, RK; Analysis or Interpretation: HNC, RK; Literature Search: HNC, RK; Writing: HNC, RK. All authors reviewed the results and approved the final version of the article.

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Conflict of interest

The authors declare that there is no conflict of interest.

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