

Investigating the Effects of Isolated Plantar Fascia Release Versus Lumbar Flexibility Exercises on Lumbar Spine Mobility in Young Adults - A Comparative Study

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DOI: <https://doi.org/10.52403/gijhsr.20260401>

ABSTRACT

Background: Lumbar mobility is essential for daily functional activities. Reduced lumbar mobility is commonly observed in young adults due to prolonged sitting, poor posture, and reduced physical activity. The human body functions as an integrated unit because of the anatomical and functional continuity of myofascial chains. Restrictions in lumbar movement may arise due to tightness in the posterior myofascial chain. Recent studies suggest that plantar fascia release may influence proximal structures through myofascial continuity. Traditional physiotherapy interventions mainly focus on lumbar flexibility exercises to improve spinal mobility. Both interventions were used to improve lumbar mobility, but comparative evidence is limited.

Objective: The study aims to compare the effects of isolated plantar fascia release and lumbar flexibility exercises on mobility of the lumbar spine in young adults.

Methodology: A total of 30 young adults aged 18-25 years were included in this

study. They were assigned to two groups: Group A received isolated plantar fascia release (PFR), whereas Group B received lumbar flexibility exercises over 5 weeks, 3 times a week. Lumbar mobility was assessed by using Modified Schober's Test (MST) and Fingertip-to-Floor Distance Test (FTFD) before and after the intervention period. Statistical analysis was performed using a T-test for within-group analysis and an independent T-test for between-group analysis. The data were statistically analysed using SPSS software.

Results: Both groups showed statistically significant improvements in MST and FTFD values ($p < 0.05$) following the intervention. However, Group B demonstrated significantly greater improvement in lumbar mobility compared to Group A.

Conclusion: Both interventions were effective in improving lumbar mobility; however, lumbar flexibility exercises were more effective than isolated plantar fascia release in young adults. These findings suggest that combining both interventions

may be explored in future studies to achieve enhanced therapeutic outcomes.

Keywords: Lumbar mobility, Plantar fascia release, lumbar flexibility exercises, Modified Schober's Test, Fingertip-to-Floor-Distance, Myofascial chain.

INTRODUCTION

Flexibility refers to the capability of a muscle to extend sufficiently to allow a joint to move through its full range of motion.^[1,2] It is an essential component of normal biomechanical functioning. Good flexibility is important for efficient movement, because when muscles can't stretch properly, it can place unusual pressure on the body and may lead to musculoskeletal injuries. In fact, poor flexibility is one of the factors that can interfere with natural alignment and function of the musculoskeletal system^[1].

Fascia is a widespread connective tissue system that wraps around every nerve, blood vessel, and muscle fibre in the body. Linking muscles, bones, and organs together, it creates large interconnected networks that help the whole body work as one system^[3]. The thin layers of fascia and connective tissue in the body line up to form continuous pathways called myofascial meridians. One of these pathways is the superficial back line [SBL], which extends from the plantar fascia, Achilles tendon, calf muscles, popliteus, hamstrings, sacrotuberus ligament, thoracolumbar fascia, erector spinae, and this tissue over the skull [epicranial fascia].^[1] These fascial structures are organised into fascial networks and arranged in well-organised sequences, creating a system of continuous interconnected pathways throughout the body.^[2]

Fascial tissues may become limited or stiff as a result of diminished physical activity, injuries, inflammation, or prolonged mechanical stress. Such restrictions decrease flexibility, reduce muscular endurance, impair movement control, and eventually cause pain throughout the body

^[4]. The plantar fascia is a strong and thick connective band that extends from the heel bone to the bones of the forefoot. It plays a crucial role in supporting the foot and transferring force efficiently during movement. Any alteration or dysfunction in this structure can lead to various clinical issues^[5]. According to a "schematic map" of the body's fascia connections, or "anatomy train", any tension at a specific region on the "anatomy train" may have detrimental effects that lead to a general decrease in flexibility. Research has shown that fascia and muscles function as a continuous, interconnected system^[4]. For the body to move properly, all parts of its movement chains need to work together smoothly. A disruption in one specific region can affect the functioning of the other parts within the chain^[6].

Even though technology has generally simplified our lives, it has also created some negative effects on people's physical and mental well-being. Young adults who spend a long time sitting or staring at screens, such as college students and university students, are particularly affected by this problem. Because they move less, they are more likely to experience health issues associated with low physical activity^[7].

Most of the time, lower-back movement is measured using simple, non-imaging methods. One of the common tests is the Fingertip-to-floor distance [FTFD] during a full forward bend. It's easy to perform and is known to be very responsive and reliable for checking spinal mobility^[8]. "Fingertip-to-Floor-Distance and Modified Schober's Test are widely used by clinicians to measure how flexible and mobile the spine is"^[9]. The extent to which the fingertip-to-floor distance reflects actual lumbar flexibility and movement^[8].



Figure 1: Fingertip-to-Floor Distance

Rolling, instrumental-assisted fascial release, connective tissue massage, myofascial trigger point therapy, and muscle energy techniques are some of the techniques for improving fascia flexibility. Myofascial release is one of the most popular manipulative techniques and is known to help decrease restrictions and adhesions between layers of fascial tissue. The self-myofascial release [MFR], which can be used independently under a therapist's supervision, shares the same theory as the MFR. There are two ways to increase fascia mobilization with self-MFR: the Golgi tendon organ [GTO] reflex arc model and other mechanoreceptors. When the muscles are stretched, the GTO gives feedback about muscle tension and helps to regulate muscle activity. GTOs are stimulated when MFR or self-MFR increases pressure in the fascia, which lowers the motor unit firing rate and, as a result, lowers the muscle tone. Muscle tone reduces as pressure increases because the mechanical receptors activate the nervous system [1].

Myofascial release technique [MFRT] is a broad term used for different hands-on physiotherapy methods where gentle pressure is applied to soft tissues such as muscles and fascia. This technique involves using light, sustained stretching on these

tissues, and each area is treated for less than two minutes at a time. The main goal of MFRT is to help the fascia regain its normal softness and flexibility, especially when it has become tight or less elastic due to changes in its mechanical properties [2]. Myofascial interventions include a wide range of manual approaches such as osteopathic soft-tissue mobilisation, structural integration methods, various forms of therapeutic massage including connective tissue massage, instrument-assisted fascial mobilisation, trigger point deactivation, strain-counterstrain techniques, and muscle energy techniques [MFT] [3, 10].

The short-term influence of self-myofascial release [MFR] on flexibility has been widely examined, mainly because these techniques are commonly used both before and after exercise sessions. Current literature places strong emphasis on how SMR affects the posterior muscular chain. The posterior chain includes improvements in overall flexibility, increased extensibility of specific muscle groups such as the hamstrings, and enhanced range of motion at the ankle and spinal segments. Some studies suggest that the benefits may last up to approximately 10 minutes, while other findings indicate they may remain for as long as 30 minutes. However, the prolonged effects of self-MFR on posterior chain flexibility have not yet been clearly established [11].

On the other hand, lumbar flexibility exercises mainly consist of static stretches for the important muscles involved in lower-back movement, such as the abdominal muscles, quadriceps, hamstrings, tensor fascia latae, piriformis, and quadratus lumborum. These stretches help to improve lower-back mobility by reducing tightness in the tissues around the spine. This improvement is also related to the response of the nervous system during stretching. Slow and sustained stretching stimulates sensory receptors in the muscles and tendons, which helps them release tension and improve ease of movement [12].

In recent years, hands-on therapeutic techniques have gained significant importance in physiotherapy and rehabilitation practice. Physiotherapy interventions are typically designed as multi-component rehabilitation programs, often combining manual techniques with structured exercises, movement training, and patient education. One commonly used exercise method is the lumbar flexion routine, often referred to as “Williams’ flexion exercises”, which aims to improve spinal mobility and reduce mechanical stress on the lower back^[13].

While previous studies independently support the effects of myofascial release on spinal biomechanics and the effectiveness of lumbar flexibility exercises on spinal mobility, no direct comparative studies have examined whether a distal intervention such as isolated plantar fascia release can produce changes in lumbar mobility similar to direct lumbar flexibility exercises. Given the interconnected nature of the human kinetic chain, understanding whether plantar fascia release influences lumbar ROM may provide new perspectives on integrated approaches to musculoskeletal rehabilitation.

NEED OF THE STUDY:

Mobility of the lumbar spine is essential for functional movements like bending, sitting, lifting, and sports performance. Lumbar stiffness is most common in many young adults due to a sedentary lifestyle, prolonged screen time, and reduced physical activity. The superficial back line [SBL] concept suggests that plantar fascia and lumbar structures are connected through fascial continuity. Plantar fascial release is a quick, low-cost technique and may provide alternative treatment options if proven effective.

This study adds evidence to:

- Manual therapy effectiveness
- Fascial connection theories
- Clinical decision-making for treating lumbar tightness

- Importance of lumbar flexibility exercises

HYPOTHESIS:

Null hypothesis (H0):

There will be no significant difference in lumbar spine mobility between isolated plantar fascia release and a lumbar flexibility exercise program in young adults.

Alternative hypothesis (H1):

There will be a significant difference in lumbar spine mobility between isolated plantar fascia release and a lumbar flexibility exercise program in young adults.

- Lumbar flexibility exercises will produce greater improvement in lumbar mobility than fascia release.
- Plantar fascia release will produce equal or greater improvement in lumbar mobility than lumbar flexibility exercises.

OBJECTIVES:

- To measure the change in lumbar spine mobility pre- and post-intervention in both groups
- To determine the short-term effects of plantar fascia release on lumbar spine flexibility
- To evaluate the effectiveness of a regional lumbar flexibility exercise program on lumbar mobility
- To compare the differences between the two interventions in terms of lumbar ROM and functional outcomes.

MATERIALS & METHODS

- **Study design:** Two-arm randomised comparative pre-test and post-test intervention study.
- **Study setting:** The study was conducted among the undergraduate college students of NRI College of Physiotherapy, NRI Academy of Sciences, Chinakakani, Andhra Pradesh, India
- **Sample size:** The sample size was predetermined as 30 participants based on the feasibility of the study,

considering the study duration and participant availability. Eligible participants who fulfilled the inclusion and exclusion criteria were recruited using a convenience sampling method and were equally allocated into two groups using a lottery method (15 participants in each group).

- **Sample population:** Consisting of young adults aged 18-25 years who met the inclusion criteria for reduced lumbar mobility
- **Sampling method:** Convenience sampling method based on the inclusion and exclusion criteria of the study.
- **Group allocation:** After recruitment, 30 participants were randomly allocated into two intervention groups using the lottery method. Thirty chits were prepared, of which 15 chits were labelled as Group A and 15 chits were labelled as Group B. Each participant selected one chit randomly, and based on the selected chit, participants were allocated to the respective intervention group.
- **Data collection:** Data were collected after obtaining informed consent from all participants. Baseline assessment of lumbar mobility was performed prior to the intervention using the Modified Schober test [MST] and fingertip-to - floor distance [FTFD]. Participants were then randomly allocated into two intervention groups using the lottery method: Group A [isolated plantar fascia release] and Group B [lumbar flexibility exercises]. Both interventions were administered for a period of 5 weeks, with sessions conducted 3 days per

week. Post-intervention lumbar mobility measurements were recorded using the same outcome measures under identical testing conditions. All data were recorded in a structured data collection proforma and maintained confidentially for analysis.

- **Study period:** The study was conducted from November 2025 to March 2026. The overall study, including participant recruitment, baseline assessment, intervention, post-intervention assessment, and data collection, was completed over a period of approximately 5 months.
- **Treatment duration:** Both intervention groups received treatment for 5 weeks, with 3 sessions per week.

ELIGIBILITY CRITERIA:

Inclusion criteria:

- Young adults aged 18-25
- Both genders
- Subjects with reduced lumbar mobility
 - Fingertip-to-Floor Distance [> 10 cm]
 - Modified Schober's Test
 -

Exclusion criteria:

- Recent back injuries
- History of back pain
- Plantar fasciitis

Materials used:

- Inch tape
- KESESU massage ball
- Pen
- Paper
- Data collection sheet



Figure 2: Materials used for the study

INTERVENTIONS:

Group A: Isolated plantar fascia release

- Plantar fascia self-myofascial release
- Manual stretching of the plantar fascia



Figure 3: Plantar fascia self-myofascial release



Figure 4: Manual stretching of the plantar fascia

Group B: Lumbar flexibility exercises

- Cat-camel mobility
- Bridge-pelvic tilts
- Prone press-up (cobra)
- Bird-dog with lumbar wave
- Downward dog to cobra

- Seated spinal twist



Figure 5 (a): Cat pose



Figure 5(b): Camel pose



Figure 6: Bridge – pelvic tilt position



Figure 7: Prone press-up pose



Figure 8: Bird dog with lumbar wave pose



Figure 9(a): Quadruped position



Figure 9(b): Downward dog pose



Figure 9(c): Cobra pose



Figure 10: Seated spinal twist position

OUTCOME MEASURE

To evaluate the impact of the intervention, two primary outcomes were used pre- and post-intervention: Fingertip-to-Floor Distance and Modified Schober's test to assess the lumbar spine mobility.

The Fingertip-to-Floor Distance and Modified Schober's test were used to assess the lumbar spine flexibility. The Fingertip-to-Floor Distance has demonstrated good to excellent test-retest validity, with reported reliability, including intra-and inter-observer intraclass correlation coefficient [ICC] of 0.99, indicating very high consistency of repeated measurements [14]. The modified Schober's test was used to assess lumbar spine mobility, particularly lumbar flexion. It demonstrates good to excellent intra-rater reliability, with reported intraclass correlation coefficients. The test also showed good concurrent validity when compared with radiographic and inclinometer-based measurements of lumbar range of motion [15].

Statistical Analysis

All collected data were entered into Microsoft Excel, and the data were analysed using SPSS version 26.0. All demographic variables were analysed using descriptive

statistics. Within-group analysis for the outcome measure was performed by a paired t-test. Between-group analysis for the outcome measures was carried out by an independent T-test. All statistical values were set at $p < 0.05$.

RESULT

Table 1: Age distribution of the study participants

Age	Mean	Standard deviation
18-25 years	21.4	1.45

In the present study, a total of 30 participants aged between 18 and 25 years were included, with a mean age of 21.4 (1.45 SD).

Table 2: Gender frequency distribution of the study participants

Frequency of Gender	Counts	% of total
Female	22	73.3 %
male	8	26.7%

A total of 30 young adults participated in this study, of whom 22 were females (73.3%), and 8 were males (26.7%).

Outcome measures

Within-group analysis (TABLE 3)

Table 3: Within-group analysis using a paired T-test showed statistically significant improvements in MST and FTFD in both groups [$p < 0.005$]

Group	Outcome measurements	Pre-test		Post-test		p-value
		Mean	Standard deviation	Mean	Standard deviation	
Plantar fascia release group	MST measurements	19.0	0.549	20.0	0.613	< 0.001
	FTFD measurements	22.3	6.42	12.3	5.37	
Lumbar flexibility exercises group	MST measurements	19.0	0.375	22.5	1.52	< 0.001
	FTFD measurements	23.5	4.38	7.98	4.27	

- The pre-plantar fascia release of MST showed a mean value of 19.0 with a standard deviation of 0.549, and the post-intervention mean value was 20.0 with a standard deviation of 0.613, which showed a significant value of < 0.001
- The pre-lumbar flexibility exercises of MST showed a mean value of 19.0 with a standard deviation of 0.375, and the

post-intervention mean value was 22.5 with a standard deviation of 1.52, which showed a significant value of < 0.001

- The pre-plantar fascia release of FTFD showed a mean value of 22.3 with a standard deviation of 6.42, and the post-intervention mean value was 12.3 with a standard deviation of 5.37, which showed a significant value of < 0.001

- The pre-lumbar flexibility exercises of FTFD showed a mean value of 23.5 with a standard deviation of 4.38, and the post-intervention mean value was 7.98 with a standard deviation of 4.27, which showed a significant value of <0.001
 - Within-group analysis revealed statistically significant improvements in both MST & FTFD in each group following the intervention.
- Between-group analysis (TABLE 4)

Table 4: Between -group analysis showed a statistically significant difference in post-test MST and FTFD values

Outcome measure	Plantar fascia release group		Lumbar flexibility exercises group		p-value
	Mean	Standard deviation	Mean	Standard deviation	
Modified Schober's test	20.0	0.613	22.5	1.52	<0.001
Fingertip-to-Floor -Distance	12.3	5.37	7.98	4.27	<0.021

- MST resulted as a mean value of 20.0 with a standard deviation of 0.613 in the plantar fascia release group, and in the lumbar flexibility exercises group, the mean value was 22.5 with a standard deviation of 1.52, which showed a p-value of <0.001
- FTFD resulted as a mean value of 12.3 with a standard deviation of 5.37 in the plantar fascia release group, and in the lumbar flexibility exercises group the mean value was 7.98 with a standard deviation of 4.27 that showed a p-value of <0.021
- Between-group analysis demonstrated that the lumbar flexibility exercise group achieved greater improvements in both MST and FTFD compared to the plantar fascia release group

DISCUSSION

Reduced lumbar spine mobility is commonly observed among many young adults. These conditions are primarily associated with prolonged sitting habits, improper posture, reduced physical activity, and excessive use of electronic devices. These factors contribute to the stiffness of the lumbar spine and posterior chain muscles, which can limit functional movements such as forward bending and trunk flexibility.

The demographic profile of the participants, consisting of young adults with a higher ratio of females, may have influenced the positive outcomes of the study. Young adults generally have better tissue

adaptability and recovery capability, while females are generally more flexible than males, which may improve responsiveness to flexibility-based interventions.

The present study aimed to compare the effects of isolated plantar fascia release and lumbar flexibility exercises on lumbar flexibility in young adults. The study sample consisted of a total of 30 ($n=30$) young adults aged between 18 and 25 years, with 22 females (73.3%) and males (26.7%). The predominance of female participants (73.3%) may limit the generalizability of the findings to the broader young adult population. Future studies should include a more balanced distribution of male and female participants to improve the external validity of the results. The participants were allocated into two groups and received either isolated plantar fascia release or lumbar flexibility exercises. These interventions were chosen to evaluate the comparative effects of a distal myofascial approach with a direct lumbar-focused exercise program on lumbar mobility.

The findings of this study demonstrated that both interventions were effective in enhancing lumbar mobility, as evidenced by improvements in Modified Schober's Test [MST] values and reductions in fingertip-to-floor distance [FTFD]. However, the group that received lumbar flexibility exercises exhibited greater improvements compared to the plantar fascia release group. These results suggest that exercises that target the lumbar region directly might be more

effective in improving lumbar range of motion than distal myofascial release.

Several previous studies support the effectiveness of flexibility exercise on lumbar ROM. Several studies evaluating lumbar, posterior chain, or related fascial structures have shown that flexibility techniques can produce meaningful increases in flexibility and movement. For example, self-myofascial release applied to the plantar surface was found to produce immediate improvements in hamstring and lumbar flexibility in healthy adults, suggesting a distal influence on spinal mobility through the posterior myofascial chain [3]. Additionally, a recent quasi-experimental study comparing single and multiple sessions of plantar fascia SMR produced the most significant gains in lumbar and hamstring flexibility and maintained these improvements at follow-up [4]. These findings align with the results observed in the plantar fascia release group of the present study, suggesting that repeated self-myofascial release may help improve flexibility along the posterior chain.

However, despite the positive effects of plantar fascia release on lumbar flexibility, lumbar flexibility yielded greater improvements in the current investigation. This is consistent with the notion that direct mechanical stretching and movement of the spine produces more substantial neuromuscular and mechanical adaptation in local lumbar tissues than distal intervention alone. The literature also indicates that SMR effects depend on application duration and fascial segment targeted- for example, SMR performed on the different segments of the superficial back line can improve flexibility, but the magnitude and mechanism may differ according to region and duration of application. Importantly, the improvements observed with plantar SMR may be explained by functional myofascial continuity. Studies on the superficial back line suggest that pressure applied to the plantar fascia

and other segments can result in gains in flexibility along the posterior chain, demonstrating that fascial networks contribute to movement behaviour across distant regions [16].

All things considered, the findings in the present study suggest that both plantar fascia release and lumbar flexibility exercise groups showed significant effects on improving MST and reducing FTFD distance among the young adults, but targeted lumbar flexibility exercises are more impactful in the lumbar range of motion. However, flexibility exercises appear to produce greater improvements and may be considered a primary intervention, while plantar fascia release can be used as a supportive technique in clinical practice.

Limitations

- The sample size was relatively small (n=30), and no a priori sample size calculation was performed, which may limit the generalizability of the results
- The study included only young adults; therefore, the findings cannot generalise to older populations or individuals with low back pain
- The study did not include a no-intervention control group, limiting comparison with natural changes over time
- The study had no allocation concealment, which may have introduced potential selection bias
- Assessor blinding was not performed, which may have introduced measurement bias
- The gender distribution was unequal, with a higher proportion of female participants (73.3%), which may affect the generalizability of the results
- The duration was very short, and long-term effects were not assessed

Future Recommendations:

- Future research should include a large sample size for better generalisation
- Future studies should include a more balanced distribution of male and female

participants to improve the external validity of the results

- Duration of the study should be longer to assess sustainability of improvements
- Can be used in other population like low back pain and other spinal conditions
- May include additional outcome measures
- Future research may compare combined interventions, such as plantar fascia release along with lumbar flexibility exercises, to assess whether combined treatment produces superior outcomes

CONCLUSION

The present study concluded that both isolated plantar fascia release and lumbar flexibility exercises were effective in improving lumbar mobility in young adults, as evidenced by Modified Schober's Test values and reduction in Fingertip-to-Floor Distance. However, lumbar flexibility exercises are more effective in enhancing lumbar mobility, while plantar fascia release can be used as an adjunct intervention due to its influence through myofascial connections. Therefore, lumbar flexibility exercises may be recommended as the primary intervention for improving lumbar mobility in young adults.

Declaration by Authors

Ethical Approval: Written informed consent was obtained from all participants before they participated in the study. The research involved minimal-risk physiotherapy interventions and was conducted in accordance with accepted ethical principles and the Declaration of Helsinki. Participant confidentiality and privacy were maintained throughout the study, and no personally identifiable information was collected or disclosed. Participation was entirely voluntary, and participants were free to withdraw from the study at any time without any consequences.

Acknowledgement: We would like to thank all the participants for their cooperation and willingness to participate in this study. We extend our heartfelt thanks to family,

seniors and friends for their continuous support, guidance, and encouragement throughout the research. Their contributions are highly appreciated.

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

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How to cite this article: Viswanadhuni. Uma Naga Devi, Praniti, Rajesh Brundavanam. Investigating the effects of isolated plantar fascia release versus lumbar flexibility exercises on lumbar spine mobility in young adults – a comparative study. *Gal Int J Health Sci Res*. 2026; 11(4): 1-14. doi: <https://doi.org/10.52403/gijhsr.20260401>
