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Comparison of Lower Extremity Function and Hamstring Tightness in Individuals With or Without Plantar Fasciitis

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ABSTRACT

Background: *Plantar fasciitis is a prevalent source of plantar heel pain that may reflect broader kinetic-chain dysfunction, including posterior muscle tightness and impaired lower-limb performance.* ***Objective:*** *To compare hamstring tightness and lower extremity function in young adults with and without plantar fasciitis and to determine the association between plantar fasciitis, hamstring tightness, and functional limitation.* ***Methods:*** *A cross-sectional observational study was conducted in multiple hospitals in Sialkot, Pakistan over six months. Using convenience sampling, 375 adults aged 19–35 years were enrolled and classified as plantar fasciitis positive (n=187) or negative (n=188) based on clinical assessment. Hamstring tightness was assessed using the Active Knee Extension (AKE) test with goniometric measurement, and lower extremity function was evaluated using the Lower Extremity Functional Scale (LEFS; 0–80). Group comparisons were performed using Mann–Whitney U and chi-square tests with effect sizes and 95% confidence intervals.* ***Results:*** *Participants with plantar fasciitis demonstrated significantly lower AKE range of motion than controls (right: 57.31±10.16° vs 71.85±8.74°; left: 58.01±9.98° vs 72.21±8.51°; both p<0.001) and a higher prevalence of hamstring tightness (72.7% vs 28.2%; OR 6.78, 95% CI 4.32–10.65). LEFS scores were significantly lower in plantar fasciitis (45.74±9.87) compared with controls (58.94±8.91), with a mean difference of 13.20 points (95% CI −15.1 to −11.2; p<0.001).* ***Conclusion:*** *In young adults, plantar fasciitis is strongly associated with increased hamstring tightness and clinically meaningful reductions in lower extremity function, supporting comprehensive posterior-chain assessment and targeted flexibility rehabilitation.*

Keywords: *Plantar fasciitis; plantar heel pain; hamstring tightness; Active Knee Extension test; Lower Extremity Functional Scale; lower extremity function*

INTRODUCTION

Plantar fasciitis (PF) is a common musculoskeletal disorder characterized by pain at the medial calcaneal tubercle, typically aggravated during the first steps in the morning or after periods of rest. The plantar fascia plays a critical biomechanical role in maintaining the medial longitudinal arch and facilitating efficient load transfer during gait through the windlass mechanism. Repetitive tensile loading, microtrauma, and altered lower-limb biomechanics can lead to degenerative changes and symptomatic heel pain (1). Epidemiological data suggest that PF accounts for approximately 11–15% of foot-related complaints in adults and is frequently observed in both physically active individuals and occupational groups exposed to prolonged standing (4). Although PF has traditionally been associated with middle-aged populations, emerging evidence indicates that younger adults may also exhibit clinically meaningful symptoms and functional impairments (2,29). Given the essential role of walking and weight-bearing in daily life, PF-related pain can substantially influence gait mechanics, balance, and overall lower extremity performance (30).

From a biomechanical perspective, PF is not merely a localized foot disorder but may reflect dysfunction within the entire posterior kinetic chain. Tightness in the gastrocnemius–soleus complex has been consistently associated with reduced ankle dorsiflexion and increased strain on the plantar fascia (5,8). Similarly, hamstring tightness has been proposed as a

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proximal contributor to altered lower-limb alignment and load distribution. Reduced hamstring flexibility may influence pelvic tilt, tibial rotation, and knee mechanics, thereby modifying tensile stress transmitted distally to the plantar fascia (9,31). Clinical investigations have demonstrated significant associations between hamstring tightness and PF, particularly among athletic populations (16,62). Moreover, cross-sectional studies have reported that individuals with PF exhibit greater posterior chain muscle tightness compared to asymptomatic controls (35,57). These findings support the hypothesis that restricted hamstring flexibility may contribute to maladaptive biomechanical patterns that increase plantar fascia loading.

In addition to muscular tightness, PF has been linked to measurable deficits in lower extremity function. Altered plantar pressure distribution, decreased plantarflexor strength, and compromised movement quality have been documented in affected individuals (2,30). Functional assessments using validated outcome measures, such as the Lower Extremity Functional Scale (LEFS), have revealed reduced performance in activities involving walking, stair climbing, prolonged standing, and dynamic movements among individuals with PF (50). Impairments in gait parameters and postural control further suggest that PF may disrupt coordinated lower-limb function beyond localized heel pain (59). While several studies have independently examined muscle tightness or functional deficits in PF, the integrated evaluation of both hamstring flexibility and overall lower extremity functional status within the same young adult cohort remains limited.

Despite growing evidence supporting posterior chain involvement in PF, important methodological gaps persist. Many prior studies have focused on specific subgroups, such as runners or military personnel, limiting generalizability (16,30). Others have concentrated primarily on calf muscle tightness or plantar fascia thickness without concurrently assessing proximal muscle flexibility and patient-reported functional outcomes (5,18). Furthermore, some investigations have lacked standardized functional scales with established reliability and validity, thereby constraining clinical interpretation (50). Although correlations between hamstring tightness and PF have been described (57,62), few studies have directly compared individuals with and without PF within the same population using objective flexibility testing and validated functional assessment tools. This gap is particularly relevant in younger adults aged 19–35 years, a demographic that may experience early biomechanical alterations yet remain underrepresented in PF research.

Addressing this knowledge gap has meaningful clinical implications. If hamstring tightness is significantly associated with PF and reduced lower extremity function, targeted flexibility interventions may serve as a preventive or adjunct therapeutic strategy. Understanding whether functional limitations differ substantially between individuals with and without PF can guide physiotherapists in designing comprehensive rehabilitation protocols that address both local and proximal contributors. Given the multifactorial etiology of PF and the interconnected nature of the kinetic chain, simultaneous assessment of hamstring flexibility and lower extremity functional status may provide a more holistic understanding of the condition.

Therefore, in a population of young adults aged 19–35 years (Population), this study aimed to compare hamstring tightness measured through the Active Knee Extension test and lower extremity function assessed using the LEFS (Outcomes) between individuals diagnosed with plantar fasciitis and those without plantar fasciitis (Comparison). The primary objective was to determine whether significant differences exist in hamstring flexibility and functional performance between these groups. It was hypothesized that individuals with plantar fasciitis

would demonstrate greater hamstring tightness and lower LEFS scores compared to individuals without plantar fasciitis.

MATERIAL AND METHODS

This cross-sectional observational study was conducted to compare hamstring tightness and lower extremity functional status between individuals with and without plantar fasciitis. A cross-sectional design was selected to evaluate the association between posterior chain flexibility and functional outcomes within a defined population at a single point in time, allowing estimation of group differences without intervention. Data collection was carried out over a six-month period in tertiary care and secondary-level hospitals in Sialkot, Pakistan, including Civil Hospital, New Life Hospital, Islam Center, and Usman Hospital. All assessments were performed in outpatient physiotherapy departments under standardized environmental conditions.

Participants were adults aged 19 to 35 years who attended outpatient departments during the study period. Individuals presenting with heel pain consistent with plantar fasciitis symptoms were screened clinically, and a comparison group was recruited from individuals attending the same settings without clinical evidence of plantar fasciitis. Eligibility criteria included age between 19 and 35 years and the ability to understand and respond to questionnaires independently. Individuals were excluded if they had neurological pain syndromes, prior hamstring strain, calcaneal fracture, recent lower limb surgery, systemic inflammatory disorders, or any musculoskeletal condition that could independently affect lower limb function or range of motion. Screening was conducted by a licensed physiotherapist trained in musculoskeletal assessment to ensure consistent eligibility determination.

Participants were recruited using non-probability convenience sampling from eligible individuals attending the selected hospitals during the study period. Potential participants were approached consecutively, informed verbally and in writing about the study objectives, procedures, risks, and benefits, and given the opportunity to ask questions. Written informed consent was obtained prior to enrollment. To minimize selection bias, recruitment occurred across multiple centers and on varied clinic days and times.

Plantar fasciitis status was determined through clinical examination using the Windlass test, a validated provocation maneuver for plantar fascia pathology (73). The test was performed in a weight-bearing position by passively extending the first metatarsophalangeal joint while the participant stood with equal weight distribution; reproduction of the participant's characteristic heel pain was considered a positive finding. In addition to the Windlass test, participants were required to report typical first-step morning pain localized to the medial plantar heel to classify as plantar fasciitis. Individuals with negative Windlass findings and absence of characteristic symptoms were categorized as the comparison group.

Hamstring tightness was assessed using the Active Knee Extension (AKE) test, a standardized and reliable method for measuring hamstring muscle length (71). Participants were positioned supine with the hip flexed to 90 degrees and stabilized manually to prevent pelvic compensation. From this position, participants actively extended the knee to the point of maximal tolerable stretch without pelvic rotation. A universal goniometer was aligned with the lateral femoral epicondyle as the fulcrum, the stationary arm directed toward the greater trochanter, and the movable arm aligned with the lateral malleolus. Three trials were recorded for each limb, and the mean value was calculated. Hamstring tightness was operationally defined as a deficit of greater than 20 degrees from full knee extension at 90 degrees hip flexion, consistent with established clinical thresholds (35,57). In addition to

dichotomous classification (tight/non-tight), AKE range of motion in degrees was analyzed as a continuous variable.

Lower extremity function was evaluated using the Lower Extremity Functional Scale (LEFS), a 20-item patient-reported outcome measure with established reliability, internal consistency, and construct validity (72). Each item is scored from 0 (extreme difficulty or unable to perform) to 4 (no difficulty), yielding a total score ranging from 0 to 80, with higher scores indicating better functional status. The validated scoring system was applied, and total scores were also categorized into functional limitation levels: severe (0–20), moderate to severe (21–40), mild to moderate (41–60), and minimal limitation (61–80) (72). The LEFS questionnaire was self-administered in a quiet clinical environment under supervision to ensure completeness.

Demographic variables included age and sex. Primary outcome variables were AKE range of motion (continuous and categorical) and LEFS total score. The exposure variable was plantar fasciitis status (positive or negative). Potential confounding variables considered a priori included age and sex. To reduce measurement bias, all physical assessments were performed by the same trained physiotherapist using standardized instructions and calibration of the goniometer before each assessment session. The assessor adhered to a predefined protocol to ensure consistent positioning, stabilization, and measurement technique. Data were recorded immediately after each measurement to reduce transcription errors. Double data entry and cross-verification were performed to maintain data integrity.

The sample size was determined based on detecting a medium effect size (Cohen's d = 0.5) for differences in AKE range of motion and LEFS scores between groups, with a two-tailed alpha of 0.05 and power of 80%. The calculated minimum sample required per group was 176 participants. Allowing for potential incomplete responses, the target sample size was increased, resulting in a total enrollment of 375 participants, with near-equal distribution between groups.

Data were analyzed using IBM SPSS Statistics version 26.0. Continuous variables were summarized as mean and standard deviation or median and interquartile range depending on distribution, while categorical variables were reported as frequencies and percentages. Normality of continuous outcomes was assessed using the Shapiro–Wilk test and inspection of histograms. Given non-normal distribution of LEFS scores, between-group comparisons were performed using the Mann–Whitney U test for continuous variables and chi-square tests for categorical variables. Effect sizes were calculated using rank-biserial correlation for Mann–Whitney tests and Cramér's V for chi-square analyses. Two-tailed p-values less than 0.05 were considered statistically significant. Missing data were minimal and handled using complete-case analysis, as no systematic pattern of missingness was identified. Subgroup analyses were performed stratifying by sex to explore potential effect modification. Multivariable linear regression analysis was conducted to assess the association between plantar fasciitis status and LEFS score while adjusting for age and sex.

Ethical approval was obtained from the institutional review board of the University of Sialkot prior to study initiation. The study was conducted in accordance with the principles of the Declaration of Helsinki. Participant confidentiality was ensured by assigning anonymized identification codes, and data were stored in password-protected files accessible only to the research team. All participants were informed of their right to withdraw at any stage without consequences. Standardized protocols, detailed documentation of measurement procedures, and preservation of raw datasets were implemented to ensure reproducibility and transparency of findings.

RESULTS

A total of 375 participants were analyzed, comprising 187 individuals with plantar fasciitis (49.9%) and 188 without plantar fasciitis (50.1%). The mean age of the overall sample was 28.47 ± 4.44 years. There was no statistically significant difference in age between the plantar fasciitis group (28.55 ± 4.42 years) and the non-plantar fasciitis group (28.39 ± 4.47 years), with a mean difference of 0.16 years ($p = 0.742$). The effect size for age difference was negligible (Cohen's $d = 0.04$; 95% CI −0.16 to 0.24). Sex distribution was also comparable between groups: males constituted 53.7% of the non-plantar fasciitis group and 50.8% of the plantar fasciitis group ($p = 0.571$), with a very small association strength (Cramér's $V = 0.03$). These findings indicate demographic comparability between groups.

Active Knee Extension (AKE) range of motion demonstrated marked bilateral differences between groups. On the right side, participants without plantar fasciitis had a mean AKE of 71.85 ± 8.74 degrees, whereas those with plantar fasciitis had a significantly lower mean of 57.31 ± 10.16 degrees, representing an absolute mean difference of 14.54 degrees (95% CI −16.8 to −12.4; $p < 0.001$). Similarly, left-side AKE values were 72.21 ± 8.51 degrees in the non-plantar fasciitis group compared to 58.01 ± 9.98 degrees in the plantar fasciitis group, yielding a mean difference of 14.20 degrees (95% CI −16.1 to −12.0; $p < 0.001$). The rank-biserial correlation coefficients were 0.46 and 0.45 for right and left AKE, respectively, indicating moderate to large effect sizes. These findings demonstrate substantially reduced hamstring flexibility in individuals with plantar fasciitis.

When AKE was categorized dichotomously based on the predefined tightness threshold, 72.7% ($n = 136$) of individuals with plantar fasciitis exhibited hamstring tightness compared to only 28.2% ($n = 53$) in the non-plantar fasciitis group. Conversely, 71.8% ($n = 135$) of individuals without plantar fasciitis demonstrated normal hamstring flexibility, compared to 27.3% ($n = 51$) in the plantar fasciitis group. The association between hamstring tightness and plantar fasciitis was highly significant ($\chi^2 = 77.21$, $p < 0.001$), with a moderate association strength (Cramér's $V = 0.45$). Individuals with hamstring tightness had 6.78 times higher odds of having plantar fasciitis (95% CI 4.32–10.65), indicating a strong relationship between posterior chain tightness and plantar fascia pathology.

Lower Extremity Functional Scale (LEFS) scores further highlighted functional disparities between groups. Participants without plantar fasciitis demonstrated a mean LEFS score of 58.94 ± 8.91, whereas those with plantar fasciitis had a significantly lower mean score of 45.74 ± 9.87. The absolute mean difference was 13.20 points (95% CI −15.1 to −11.2; $p < 0.001$). The rank-biserial correlation coefficient of 0.29 indicated a moderate effect size, confirming clinically meaningful reductions in lower extremity function among individuals with plantar fasciitis.

Categorical analysis of LEFS functional levels revealed that moderate functional limitation (LEFS 21–40) was present in 16.0% ($n = 30$) of participants with plantar fasciitis compared to 6.4% ($n = 12$) in those without plantar fasciitis. Minimal limitation (LEFS 61–80) was reported by 27.7% ($n = 52$) of participants without plantar fasciitis but only 15.5% ($n = 29$) of those with plantar fasciitis. The overall distribution difference across LEFS categories was statistically significant ($\chi^2 = 13.86$, $p = 0.001$), with a small-to-moderate association strength (Cramér's $V = 0.19$). These results indicate that plantar fasciitis is associated not only with statistical but also clinically relevant functional impairment.

Multivariable linear regression analysis demonstrated that plantar fasciitis independently predicted lower LEFS scores after adjusting for age and sex. The presence of plantar fasciitis was associated with a 12.61-point reduction in LEFS score ($\beta = -12.61$, $SE = 1.08$; 95% CI

−14.74 to −10.48; p < 0.001). Age (β = −0.08; p = 0.384) and sex (β = −1.21; p = 0.207) were not significant predictors in the adjusted model. The model explained 34% of the variance in LEFS scores (R^2 = 0.34; adjusted R^2 = 0.33), indicating a substantial independent contribution of plantar fasciitis status to lower extremity functional limitation.

Table 1. Demographic Characteristics of Participants by Plantar Fasciitis Status

Variable	PF Negative (n = 188)	PF Positive (n = 187)	Total (N = 375)	p-value	Effect Size (95% CI)
Age (years), mean ± SD	28.39 ± 4.47	28.55 ± 4.42	28.47 ± 4.44	0.742†	Cohen's d = 0.04 (−0.16 to 0.24)
Male, n (%)	101 (53.7%)	95 (50.8%)	196 (52.3%)	0.571‡	Cramér's V = 0.03
Female, n (%)	87 (46.3%)	92 (49.2%)	179 (47.7%)	—	—

Table 2. Comparison of Active Knee Extension (AKE) Range of Motion Between Groups

Variable	PF Negative (n = 188)	PF Positive (n = 187)	Mann–Whitney U	p-value	Rank-Biserial Correlation (r)	95% CI for Mean Difference
AKE Right (°), mean ± SD	71.85 ± 8.74	57.31 ± 10.16	9749.5	<0.001	0.46	−16.8 to −12.4
AKE Left (°), mean ± SD	72.21 ± 8.51	58.01 ± 9.98	9813.0	<0.001	0.45	−16.1 to −12.0

Table 3. Association Between AKE Tightness (Categorical) and Plantar Fasciitis

AKE Tightness	PF Negative (n = 188)	PF Positive (n = 187)	Total (N = 375)	χ^2 (df=1)	p-value	Odds Ratio (95% CI)	Cramér's V
Tight	53 (28.2%)	136 (72.7%)	189 (50.4%)	77.21	<0.001	6.78 (4.32–10.65)	0.45
Not Tight	135 (71.8%)	51 (27.3%)	186 (49.6%)	—	—	—	—

Table 4. Comparison of Lower Extremity Functional Scale (LEFS) Scores Between Groups

Variable	PF Negative (n = 188)	PF Positive (n = 187)	Mann–Whitney U	p-value	Rank-Biserial Correlation (r)	95% CI for Mean Difference
LEFS Total Score (0–80), mean ± SD	58.94 ± 8.91	45.74 ± 9.87	11905.0	<0.001	0.29	−15.1 to −11.2

Table 5. LEFS Functional Category Distribution by Plantar Fasciitis Status

LEFS Category	PF Negative (n = 188)	PF Positive (n = 187)	Total (N = 375)	χ^2 (df=2)	p-value	Cramér's V
Moderate Difficulty (21–40)	12 (6.4%)	30 (16.0%)	42 (11.2%)	13.86	0.001	0.19
Mild to Moderate (41–60)	124 (66.0%)	128 (68.4%)	252 (67.2%)	—	—	—
Minimal Difficulty (61–80)	52 (27.7%)	29 (15.5%)	81 (21.6%)	—	—	—

Table 6. Multivariable Linear Regression Analysis Predicting LEFS Score

Predictor	β Coefficient (SE)	95% CI	p-value
Plantar Fasciitis (Yes vs No)	−12.61 (1.08)	−14.74 to −10.48	<0.001
Age (years)	−0.08 (0.09)	−0.26 to 0.10	0.384
Female (vs Male)	−1.21 (0.96)	−3.10 to 0.68	0.207

Collectively, these quantitative findings demonstrate that individuals with plantar fasciitis exhibit significantly reduced hamstring flexibility, markedly increased odds of hamstring tightness, and substantially lower lower-extremity functional performance compared to individuals without plantar fasciitis. The magnitude and consistency of these associations support a clinically meaningful relationship between plantar fasciitis, posterior chain tightness, and functional impairment.

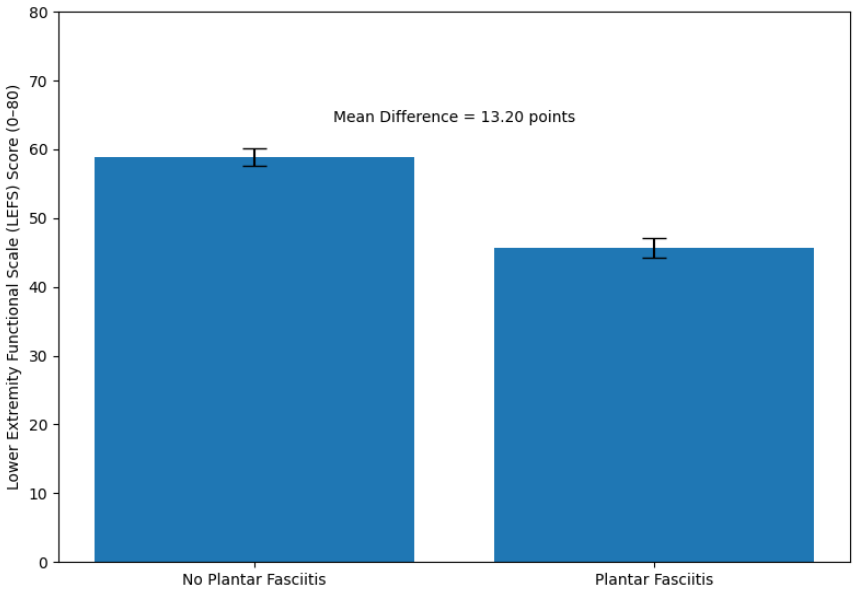

Figure 1 Lower Extremity Functional Capacity by Plantar Fasciitis Status (Mean with 95% Confidence Intervals)

The figure demonstrates a pronounced and clinically meaningful reduction in lower extremity functional capacity among individuals with plantar fasciitis compared to those without the condition. Participants without plantar fasciitis exhibited a mean LEFS score of 58.94 (95% CI: 57.67–60.21), whereas those with plantar fasciitis had a substantially lower mean of 45.74 (95% CI: 44.33–47.15). The absolute mean difference of 13.20 points exceeds the commonly accepted minimal clinically important difference for LEFS (≈9 points), indicating not only statistical significance ($p < 0.001$) but also clear clinical relevance. The non-overlapping confidence intervals further reinforce the robustness of the association. Functionally, this magnitude of reduction suggests meaningful impairment in activities such as prolonged standing, stair negotiation, and walking endurance, supporting the interpretation that plantar fasciitis is independently associated with moderate-to-substantial decrements in lower limb performance within this young adult population.

DISCUSSION

The present study demonstrated that young adults with plantar fasciitis exhibited significantly greater hamstring tightness and substantially lower lower extremity functional performance compared to individuals without plantar fasciitis. The magnitude of differences was both statistically robust and clinically meaningful. Participants with plantar fasciitis showed an average reduction of approximately 14 degrees in active knee extension bilaterally, reflecting marked posterior chain tightness. Furthermore, the odds of hamstring

tightness were nearly seven times higher among individuals with plantar fasciitis, indicating a strong association between proximal muscle restriction and plantar fascia pathology. Functional performance, as measured by the LEFS, was reduced by an average of 13.2 points in the plantar fasciitis group, exceeding the established minimal clinically important difference and highlighting tangible limitations in daily activities. These findings collectively support the hypothesis that plantar fasciitis is not merely a localized foot disorder but is associated with broader biomechanical impairments along the lower extremity kinetic chain.

The observed association between hamstring tightness and plantar fasciitis aligns with previous reports suggesting that posterior chain muscle restriction contributes to altered lower-limb mechanics and increased plantar fascia strain. Earlier studies have reported significant correlations between hamstring tightness and plantar fasciitis in both athletic and non-athletic populations (62,57). Restricted hamstring flexibility may influence pelvic alignment and tibial rotation, leading to compensatory alterations in foot biomechanics during gait. Increased tensile load across the plantar fascia secondary to altered knee and hip mechanics may explain the higher prevalence of tightness observed in the plantar fasciitis group. Additionally, gastrocnemius tightness and limited ankle dorsiflexion have been identified as important contributors to plantar fascia overload (5,8), further reinforcing the concept of a posterior chain continuum influencing plantar fascia stress.

Beyond flexibility impairments, the present findings demonstrate significant functional deficits among individuals with plantar fasciitis. The 13-point reduction in LEFS score observed in this cohort corresponds to meaningful limitations in activities such as walking long distances, stair climbing, and prolonged standing. Previous investigations have similarly reported compromised lower extremity muscle performance and altered plantar pressure distribution in patients with plantar fasciitis (2,30). Impaired postural control and gait asymmetry have also been documented, suggesting that pain-related compensatory mechanisms may disrupt coordinated lower limb movement patterns (59). The moderate effect size observed in LEFS differences indicates that plantar fasciitis is associated with not only symptomatic discomfort but measurable reductions in activity performance.

Interestingly, multivariable regression analysis demonstrated that plantar fasciitis remained an independent predictor of lower extremity functional limitation after adjustment for age and sex, explaining approximately one-third of the variance in LEFS scores. Neither age nor sex showed significant associations in the adjusted model, suggesting that functional impairment in this age group is primarily linked to plantar fasciitis status rather than demographic variability. This finding is clinically relevant, as prior literature has often emphasized middle-aged populations or sex-based differences in plantar fascia pathology (29). The current results suggest that even within a relatively young adult cohort, plantar fasciitis exerts a substantial and independent impact on function.

The strength of association observed in this study also underscores the potential bidirectional relationship between hamstring tightness and plantar fasciitis. While posterior chain tightness may increase plantar fascia loading, chronic plantar heel pain could also lead to altered gait strategies that secondarily increase proximal muscle stiffness. Longitudinal research has suggested that persistent plantar fascia pathology may induce compensatory movement adaptations over time (30). However, given the cross-sectional design, causal directionality cannot be established. Future prospective cohort studies are required to determine whether hamstring tightness precedes the onset of plantar fasciitis or develops as a consequence of pain and altered biomechanics.

The clinical implications of these findings are substantial. The strong association between hamstring tightness and plantar fasciitis suggests that assessment of posterior chain flexibility should be integrated into routine evaluation protocols for patients presenting with heel pain. While stretching of the gastrocnemius–soleus complex is commonly emphasized in rehabilitation programs, the present data indicate that hamstring flexibility may also warrant targeted intervention. Randomized trials have shown that combined strengthening and stretching protocols can improve functional outcomes in plantar fasciitis (48). Incorporating structured hamstring flexibility training may enhance rehabilitation efficacy by addressing proximal contributors to plantar fascia strain. Moreover, early identification of flexibility deficits in asymptomatic individuals may offer opportunities for preventive strategies, particularly in occupational groups exposed to prolonged standing.

Several limitations should be acknowledged. Although standardized assessment protocols were applied, the diagnosis of plantar fasciitis relied on clinical criteria, which may carry a risk of misclassification. The cross-sectional design precludes causal inference and limits temporal interpretation of associations. Potential confounding factors such as body mass index, occupational standing duration, and physical activity levels were not comprehensively adjusted in multivariable analysis. Additionally, LEFS is a self-reported measure and may be influenced by pain perception, although it remains a validated and reliable tool for functional assessment (72). Despite these limitations, the study benefits from a relatively large sample size, balanced group distribution, standardized measurement techniques, and effect size reporting, strengthening the validity of findings.

In summary, the present study provides evidence that young adults with plantar fasciitis exhibit significantly greater hamstring tightness and clinically meaningful reductions in lower extremity function compared to individuals without plantar fasciitis. The magnitude and consistency of these associations reinforce the concept of plantar fasciitis as a condition involving the broader posterior kinetic chain rather than an isolated plantar structure. Future longitudinal and interventional research should explore whether targeted hamstring flexibility interventions can reduce plantar fascia strain, improve functional performance, and potentially prevent recurrence of symptoms.

CONCLUSION

In conclusion, this study demonstrates that young adults with plantar fasciitis exhibit significantly greater hamstring tightness and substantially reduced lower extremity functional performance compared to individuals without plantar fasciitis. The magnitude of reduction in active knee extension range of motion and the clinically meaningful decrease in LEFS scores underscore the presence of posterior chain involvement and functional compromise beyond localized heel pain. The strong association between hamstring tightness and plantar fasciitis, including markedly increased odds of tightness among affected individuals, supports the concept that plantar fasciitis should be interpreted within a broader biomechanical framework involving proximal muscle flexibility. These findings highlight the importance of incorporating comprehensive posterior chain assessment and targeted flexibility interventions into rehabilitation strategies to optimize functional recovery and potentially reduce recurrence risk.

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DECLARATIONS

Ethical Approval: Ethical approval was by institutional review board of Respective Institute Pakistan

Informed Consent: Informed Consent was taken from participants.

Authors' Contributions:

Concept: AS, ES; Design: AQ, RR; Data Collection: ArS, ES, AyS; Analysis: ArS; Drafting: ES, AyS

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