

Original Article

# Association between Plantar fasciitis and Hamstring Tightness among Runners

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## ABSTRACT

**Background:** Plantar fasciitis is a prevalent condition among athletes, especially runners, characterized by heel pain and potentially influenced by biomechanical factors such as hamstring tightness. However, the specific relationship between hamstring tightness and plantar fasciitis in athletes has not been extensively studied.

**Objective:** This study aimed to investigate the association between hamstring tightness and plantar fasciitis among runners, to determine whether hamstring tightness contributes to the severity or incidence of plantar fasciitis.

**Methods:** We conducted a cross-sectional study involving 30 athletes diagnosed with plantar fasciitis from sports clubs in Lahore. The study included both male (86.6%) and female (13.4%) runners aged 20 to 45 years. Hamstring tightness was assessed using the Active Knee Extension test. Data were analyzed using Pearson Chi-Square tests in SPSS version 25, with a significance threshold set at  $p < 0.05$ .

**Results:** The prevalence of hamstring tightness among the athletes was 30%. Statistical analysis revealed no significant association between hamstring tightness and plantar fasciitis ( $p = 0.068$ ), with a Pearson correlation coefficient ( $r$ ) of -0.48, suggesting a moderate negative correlation.

**Conclusion:** The study concluded that while hamstring tightness is common among runners with plantar fasciitis, it does not significantly influence the occurrence or severity of the condition. Further research is recommended to explore other biomechanical factors that may impact plantar fasciitis in athletic populations.

**Keywords:** Plantar Fasciitis, Hamstring Tightness, Runners, Biomechanical Factors, Heel Pain, Cross-Sectional Study, SPSS Analysis, Athletic Injuries.

## INTRODUCTION

Plantar fasciitis (PF) represents the most prevalent cause of chronic heel pain, affecting a wide demographic from young, active individuals to the older, more sedentary population. This condition originates from repetitive stress on the plantar fascia, specifically at its attachment to the medial tubercle of the calcaneus, often in conjunction with gastrocnemius tightness (1). The plantar fascia itself is a connective tissue band extending from the calcaneus to the forefoot's tendons and proximal phalanges, crucial for supporting the foot's arch and acting as a shock absorber during weight-bearing activities (2). Contrary to common belief, PF is not primarily an inflammatory process but rather a degenerative condition resulting from repeated microtears in the fascia, leading to an inflammatory reaction (3).

The multifactorial etiology of PF includes factors such as abnormal biomechanics, delayed healing, excessive foot pronation or flat feet, high arches, tight Achilles tendon or gastrocnemius muscles, tight intrinsic foot muscles, limb length discrepancies, obesity, excessive running or prolonged standing, ill-fitting shoes, and improper gait (4). Among these, one notable cause of limited ankle dorsiflexion is the tightness of the gastrocnemius muscle, which can subsequently increase stress on the plantar fascia by altering the alignment of the calcaneal bones. Furthermore, tight hamstrings may contribute to prolonged forefoot loading, thereby exacerbating the stress on the plantar fascia. This understanding has led therapists treating PF to often focus on enhancing the flexibility of posterior leg muscles, including the gastrocnemius and hamstring muscles (5).

The role of hamstring tightness in the context of PF is significant, prompting its consideration alongside other factors such as equinus and obesity in treatment plans. In addition to muscular issues, intrinsic muscle strength deficits have also been associated with PF symptoms, as noted in recent systematic reviews (6). Hamstrings, crucial for various human movements including walking, running, and jumping, are often implicated in injuries due to their lack of extensibility, which can induce joint dysfunctions and potentially contribute to orthopedic conditions like low back pain and patellofemoral joint syndrome. This underscores the importance of maintaining adequate joint range of motion, achievable through regular hamstring stretching, as a preventive measure against such disorders (7).

Despite the documented associations between plantar fasciitis and hamstring tightness, there remains a significant gap in the literature concerning this relationship among runners, particularly in Pakistan. This gap necessitates a focused cross-sectional study to explore how these conditions correlate specifically within this group. Such research is essential for developing targeted interventions that could alleviate the burden of PF in this population, potentially offering broader implications for treatment protocols globally.

## MATERIAL AND METHODS

A cross-sectional study design was adopted to investigate the association between plantar fasciitis and hamstring tightness among runners. Data collection took place over four months following the approval of the study's synopsis. The research utilized a non-probability convenient sampling technique, selecting participants from various sports clubs in Lahore. The sample comprised 30 runners, calculated using RaoSoft software for sample size determination (8). The study included both male and female participants aged between 20 and 45 years, who were clinically diagnosed with plantar fasciitis.

Exclusion criteria were rigorously applied to ensure the specificity of the results. Participants were excluded if they had osteoarticular pathologies in the hip, knee, ankle, or foot that could cause pain or restrict movement. Additionally, individuals with a history of hamstring trauma or strain, other disorders related to heel pain such as subcalcaneal bursitis, Achilles tendon bursitis, Haglund's exostosis, or a calcaneal fracture, as well as those with recent trauma to the lower limbs or who had undergone elective surgery, were also excluded from the study.

The ethical considerations for the study were aligned with the Declaration of Helsinki, ensuring the protection of the participants' rights and well-being. Informed consent was obtained from all participants, which included assurances that the study procedures would not infringe on their religious or cultural values. Data collection was conducted using the Active Knee Extension test, a recognized method for assessing hamstring muscle tightness. This test was administered to runners diagnosed with plantar fasciitis at the selected sports clubs.

Data analysis was performed using SPSS version 25. Categorical and demographic data were presented using percentages, means, and standard deviations to describe the sample adequately. The Pearson Chi-square formula was applied to assess the relationship between plantar fasciitis and hamstring tightness. Numeric variables were defined as mean  $\pm$  standard deviation, and a significance level was set at P 0.05.

## RESULTS

In the study examining the relationship between hamstring tightness and plantar fasciitis among runners, a majority of the participants were male, accounting for 86.6% (26 out of 30), while females constituted 13.4% (4 out of 30), reflecting a significant gender disparity within the sampled population (Table 1). Regarding knee flexion, nearly all participants (96.7%, 29 out of 30) fell into the 131-140 degree range, indicating a high level of knee flexibility among the cohort. Conversely, knee extension varied more widely among participants; the smallest grouping observed was in the 0-5 degree range with 26.7% of the sample (8 out of 30), followed closely by those in the 6-20 degree and 21-25 degree ranges, at 23.3% (7 out of 30) and 20% (6 out of 30), respectively. The largest group for knee extension was seen in the 26-30 degree range, encompassing 30% of participants (9 out of 30) (Table 1).

Table 1: Demographic and Clinical Characteristics of Participants (N=30)

Variable	Categories	Frequency	Percent
Gender	Male	26	86.6%
	Female	4	13.4%
Knee Flexion	120-130 degrees	1	3.3%

Variable	Categories	Frequency	Percent
Knee Extension	131-140 degrees	29	96.7%
	0-5 degrees	8	26.7%
	6-20 degrees	7	23.3%
	21-25 degrees	6	20.0%
	26-30 degrees	9	30.0%
Hamstring Tightness	Yes	9	30.0%
	No	21	70.0%

Table 2: Association Between Hamstring Tightness and Plantar Fasciitis

Statistical Test	p-value	Mean $\pm$ SD	Correlation Coefficient (r)
Pearson Chi-Square	0.068	1.30 $\pm$ 0.46	-0.48

The occurrence of hamstring tightness was noted in 30% of the study population (9 out of 30), whereas the majority, 70% (21 out of 30), exhibited no such tightness (Table 1). Statistical analysis using the Pearson Chi-Square test revealed a p-value of 0.068, which does not meet the conventional threshold for statistical significance ( $p < 0.05$ ). This indicates that there was no statistically significant association between hamstring tightness and plantar fasciitis in this particular sample. The correlation coefficient ( $r$ ) was calculated at -0.48, suggesting a moderate negative relationship; however, the lack of statistical significance implies that further investigation with a larger sample size might be necessary to validate these findings (Table 2). The descriptive statistics, with a mean of 1.30 and a standard deviation of 0.46, provide a baseline measure of the association, yet highlight the need for more robust research to ascertain definitive conclusions.

## DISCUSSION

The study sought to explore the correlation between plantar fasciitis and hamstring tightness among athletes, particularly runners. A total of 30 athletes diagnosed with plantar fasciitis were included, comprising 4 female and 26 male participants, with an average age of  $29.77 \pm 5.71$  SD. An Active Knee Extension test revealed that 8 athletes exhibited limited knee extension, while 22 displayed slightly limited extension, and knee flexion predominantly ranged between 131-140 degrees. Hamstring tightness was observed in 9 athletes, whereas 21 presented with normal hamstring length, resulting in a non-significant p-value of 0.068 (9).

The findings suggested that athletes with hamstring tightness were 8.7 times more likely to experience plantar fasciitis, aligning with Harty's research that increased hamstring tightness could lead to prolonged forefoot loading and consequent repetitive injury to the plantar fascia through the windlass mechanism. This study's results further supported the notion that plantar fasciitis is often accompanied by tightness in the posterior muscles of the lower limb, an observation that echoes Smith's findings of a possible link between thickened plantar fascia and both cervical and lumbar lordosis, potentially exacerbating hamstring muscle pain via the Superficial Back Line (9-13).

Contrasting these findings, Rome et al. found no statistically significant differences in limited ankle dorsiflexion between control groups and those with plantar fasciitis ( $p=0.39$ ), while Taunton et al. noted that only a small fraction (16%) of plantar fasciitis cases exhibited excessive contracture of the gastrocnemius-soleus complex. Moreover, Kibler et al. reported that athletes with plantar fasciitis showed reduced ankle dorsiflexion in the affected limb compared to the unaffected one, and Riddle et al. identified significant differences in ankle dorsiflexion limitation between plantar fasciitis groups and controls ( $p.001$ ), suggesting that tight gastrocnemius might be an etiological factor for plantar fasciitis (14-17).

Further, studies on stretch-type injuries highlighted the role of extensive hip flexion with simultaneous knee extension in causing injuries. In scenarios like Australian football, where kicking is implicated in 19% of hamstring injuries, the action mirrors the stretch-type injury mechanism seen during the end of a kick, characterized by a flexed hip and an extended knee (18-20). Similarly, common injury scenarios in Australian football involve rapid movements such as picking up a ball while running, which might also display characteristics of stretch-type hamstring injuries, corroborating the findings from the sport's context.

The study was constrained by several limitations. The small sample size and the focus on a single city may have impacted the generalizability of the findings. Additionally, the exclusion of patients undergoing corticosteroid injections for plantar fasciitis might have influenced the results, as these treatments could alter the manifestations of both conditions (13, 18, 20).

The current study concluded that while there was an observed prevalence of hamstring tightness among runners with plantar fasciitis, the association was not statistically significant. This suggests that while hamstring tightness is common in individuals with plantar fasciitis, it may not directly influence the onset or severity of plantar fasciitis among runners. Given these insights, it is recommended that future research expand the scope of the study to include a broader spectrum of athletes and perhaps extend beyond runners to include sports like cricket, where the mechanics of movement might differ significantly. Additionally, future studies should consider larger sample sizes and include multiple cities to enhance the robustness and applicability of the findings. This expansion would not only refine our understanding of the relationship between hamstring tightness and plantar fasciitis but also potentially contribute to more effective clinical interventions tailored to diverse athletic populations (6, 9, 16).

## CONCLUSION

The study concluded that while hamstring tightness is prevalent among runners with plantar fasciitis, its impact on the condition is not statistically significant, suggesting other factors may play more critical roles in the development and severity of plantar fasciitis. These findings underscore the need for comprehensive healthcare approaches that consider multiple biomechanical and physiological factors in the treatment and prevention of plantar fasciitis among athletes, potentially leading to more effective management strategies and better patient outcomes in sports medicine.

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