

ASSOCIATION BETWEEN PLANTAR FASCIITIS AND GASTROCNEMIUS TIGHTNESS AMONG OPERATION THEATER NURSES

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DOI: <https://doi.org/10.5281/zenodo.17383112>

Keywords

Article History

Received: 27 August 2025

Accepted: 05 October 2025

Published: 18 October 2025

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Abstract

Background: Plantar fasciitis is a common cause of heel pain, often linked to prolonged standing and repetitive stress on the feet. Gastrocnemius tightness can increase strain on the plantar fascia, contributing to the development and persistence of this condition. Operation theater nurses, due to their long hours of standing in static positions, are at heightened risk for both plantar fasciitis and associated calf muscle tightness.

Objectives: This study aims to investigate the association between plantar fasciitis and gastrocnemius tightness among operation theater nurses. The objective is to enhance understanding of musculoskeletal health in this group, promoting better prevention and management strategies.

Methodology: It was a Cross-sectional Study. Non-Probability Convenient sampling technique was used. The sample size was 246. The duration of the study was 6 months. During this time, tasks such as determining the sample size, collecting data, analyzing results, and interpreting findings were all completed within the established timeframe.

Results: A cross-sectional study was conducted over 6 months using a non-probability convenient sampling technique, with a sample size of 246 operation theater nurses from various hospitals in Lahore and Kamalia. Participants aged 25-50 years with at least one year of OT experience were assessed using the Silfverskiold test for gastrocnemius tightness and the Windlass test for plantar fasciitis, along with the PF-PDS scale. Data were collected after informed consent and analyzed using SPSS version 26, with descriptive statistics and Pearson chi-square tests to determine the association. A p-value of ≤ 0.05 was considered statistically significant.

Conclusion: The study found no clear association between plantar fasciitis and gastrocnemius tightness among operation theater nurses, despite their prolonged standing and repetitive tasks. Work-related factors like prolonged standing, improper footwear, and poor ergonomics may have a greater impact on plantar fasciitis in this group. Future research should focus on these factors, with preventive interventions including supportive footwear, ergonomic improvements, and short stretching routines.

INTRODUCTION

Plantar fasciitis (PF) is a condition where the tissue on the bottom of your foot referred to as the plantar fascia, becomes irritable or inflamed. The plantar fascia or plantar aponeurosis is a thick, strong tissue that's run along the bottom of the foot, originates in the plantar tuberosity of the calcaneus, dividing into five slips that insert in the base of proximal phalanges of the toes by the plantar plate and in the plantar skin by superficial extensions. It's divided into three parts: the medial, lateral, and central bands, with the central band being the largest. This tissue plays an important in how the foot moves and works, as it helps support the arch of the foot (Noriega *et al.*, 2022). The most frequent cause of heel pain is Plantar Fasciitis, which is exacerbated in the mornings after getting up which improves with weight bearing or after long rest periods and can be difficult for doctors to treat because it often lasts a long time or comes back. It makes walking and running painful and usually requires several treatments.(Stecco *et al.*, 2013). There is specific spot of tenderness on the front and inside of the heel, along with restricted upward movement of the foot because of tightness in Achilles tendon (Huffer *et al.*, 2017). Before starting treatment for plantar fasciitis, it's important to consider less common cause of heel pain. These can include sciatica, tarsal tunnel syndrome, compression of the lateral plantar nerve, tears in the plantar fascia, stress fractures of the heel bone and Sever's disease (calcaneal apophysitis). In rare cases, systemic illnesses may also lead to heel pain (Barrett and O'MALLEY, 1999). The term "fasciitis" implies inflammation, the main issue is actually tissue degeneration, without inflammatory cells. A more accurate term might be fasciosis or fasciopathy, similar to conditions like tendinosis. The main changes include enlarge fibroblasts, disorganized collagen, and abnormal blood vessel growth, with some areas having little to no blood supply. These changes are caused by repeated small injuries from overstretching (Lin *et al.*, 2014). The biggest risk factor for plantar fasciitis is thought to be repeatedly overloading or putting too much pressure on the plantar fascia. (Ribeiro *et al.*, 2015). Various

risk factors can raise the likelihood of developing plantar fasciitis such as, obesity, certain job activities, changes in the foot structure, poor biomechanics, limited ankle flexibility, reduced thickness of the heel pad, extended walking or standing, hard surfaces, and poorly fitted shoes and participation in sports like basketball, dancing, tennis and step aerobics. Additionally, having flat feet or high arches as well as pregnancy, can also increase the risk (Javaid *et al.*, 2017). There are a number of risk factors that contribute to plantar fasciitis (PF), particularly biomechanical issues thought to be a major cause. Weak calf muscles, tight plantar fascia and Achilles tendon, stiff gastrocnemius (GC) muscles, and misaligned feet are a few of them. Over time, excessive tension on the plantar fascia can harm it, making it thicker and affected. Studies reveal that the Achilles tendon, which is made up of the tendons of the soleus and gastrocnemius muscles, is connected to the plantar fascia (Zhou *et al.*, 2020). Both the medial and lateral gastrocnemius muscles are necessary for ankle stability and for pushing off during running or walking. Their ability to contract and stretch rapidly determines their strength. Plantar fasciitis and other conditions can be exacerbated by tense muscles, so any changes in their flexibility could be a sign of trouble. Monitoring these changes is very crucial for injury recovery, especially for nurses and other people who stand or walk for extended periods of time (Zhou *et al.*, 2020).

MATERIALS AND METHODS

It was a Cross-sectional study. Non-Probability Convenient sampling technique was used. The sample size was 246. The duration of the study was 6 months. The study area was the hospitals of Lahore and Kamalia. Both gender were included. Age between 25 to 50 years. Minimum 1-year ongoing working experience in Operation Theater. Currently employed in a hospital (Operation theater) setting. Stand or walk for at least 4 to 6 hours per shift. The exclusion criteria were included any acute lower limb injuries that could confound the assessment of plantar fasciitis or gastrocnemius tightness. History of surgery on lower limb. Chronic disease that affect mobility such as Rheumatoid arthritis, Diabetes

Mellitus with neuropathy etc. Pregnancy which affect gait and Lower limb biomechanics. Use of steroids. Participation in regular stretching program targeting the gastrocnemius muscle. Eligible participants meeting the inclusion criteria were provided with clear information about the study. Informed consent was filled by participants prior to data collection. Conduct Windlass and Silfverskiold tests to assess Plantar Fasciitis and Gastrocnemius tightness. Data should be record securely, ensure confidentiality. Data was presented in the form of tables and graphs and analyzed by using the appropriate Statistical data analysis technique, Statistical Package for Social Sciences (SPSS) software computer program version 26. Quantitative variables were presented as mean and standard deviation. Qualitative variables were presented as frequency and percentages. Pearson chi-square test was applied through SPSS to check the association between plantar fasciitis and gastrocnemius tightness. p- Value of 0.05 told us the significance of the variables. After attaining approval from the Institutional Review Board and the study setting, the individuals were selected based on inclusion and exclusion criteria, and informed consent was obtained from them. The objective and procedure were explained to every individual and the required data were obtained.

RESULT

The mean and standard deviation of age was 37.7 ± 7.56 and graphical analysis shows close to normal. Histogram curve with little negative skewness. Participant's gender division showed that there were slightly more female nurses (50.8%) than

male (49.2%). Among the participants, 38.2% (n=94) of the subjects had negative plantar fasciitis test, whereas 61.8% (n=152) had positive test. It suggests that this research group showed a majority the presence of plantar fasciitis. According to participants, 61.8% of participants categorized as positive and 38.2% as negative. Among those tested, 11.8% (n=29) had negative gastrocnemius tightness, whereas 88.2% (n=217) had positive tests. This shows that most respondents had tightness in their gastrocnemius. According to the Plantar Fasciitis Pain/Disability Scale, moderate to severe pain, particularly in the midsole, frequently interferes with daily activities, sleep, and walking comfort. 40.2% of participants skip all activities due to pain, which has a major impact on their lifestyle and emotional health. Participants with gastrocnemius tightness are distributed across the four PFPS severity categories in the table. While most of individuals without tightness fall into the **moderate** (10) and **severe** (19) groups, the bulk of those with tightness fall into the **moderate** (93) and **severe** (111) categories. chi-squared test revealed no statistically significant association between Gastrocnemius tightness and Plantar Fasciitis severity ($p > 0.05$). Monte Carlo simulations supported these findings, providing strong support. The bar chart indicates that the majority of individuals exhibiting positive gastrocnemius tightness fall within the severe (51-70) range, followed by those in the moderate (31-50) range, while there are fewer individuals categorized as mild and very severe. Negative cases are mostly found in the severe category.

	Value	Df	Asymptotic Significance (2-sided)	Monte Carlo Significance (2-sided)	99% Confidence Interval	
					Lower Bound	Upper Bound
Pearson Chi-Square	3.165	3	0.367	.306	0.294	0.318

The chi-squared test revealed no statistically significant association between Gastrocnemius tightness and Plantar Fasciitis severity ($p > 0.05$).

Monte Carlo simulations supported these findings, providing strong support.

DISCUSSION

The study aims to examine the association between Gastrocnemius tightness and the severity of Plantar Fasciitis among operating theater nurses. The study specifically looks into whether Gastrocnemius tightness contributes to the severity of Plantar Fasciitis in this occupational group. The mean age of participants was 37.7 ± 7.56 . Participants' gender division showed that there were slightly more female nurses (50.8%) than male (49.2%). 38.2% (n=94) of the subjects had negative Plantar Fasciitis test, whereas 61.8% (n=152) had positive test. 88.2% (n=217) of participants classified as positive and 11.8% (n=29) as negative Gastrocnemius tightness. A substantial no association between Gastrocnemius tightness and severity of Plantar Fasciitis among Operation Theater nurses. The Pearson Chi-Square value was 3.165 ($p = 0.367$) and Fisher's Exact Test showed a p-value of 0.499. Monte Carlo simulations confirmed these findings with a 99% confidence interval between 0.294 and 0.318. These results suggest that Gastrocnemius tightness does not significantly affect Plantar Fasciitis. Our study's conclusion shows no significant association between Plantar Fasciitis and Gastrocnemius tightness among operation theater nurses. In contrast, J. Pearce *et al.*, studied patients with Plantar Fasciitis, their study observed a strong, statistically significant relationship between the severity of heel pain and Gastrocnemius tightness. According to their conclusions, there was a substantial reduction in both tightness and pain from 22 degrees to 9 degrees, with extremely significant correlations between the two ($R = 0.757$ and $R = 0.781$, $p < .001$). These results point to an association between plantar fasciitis-related pain and tightness in the gastrocnemius, indicating a topic that needs more research (Pearce *et al.*, 2021). Comparatively, our findings are in a line with cross-sectional study by Lee *et al.*, who found in their study that the prevalence of Gastrocnemius and Gastrocnemius-Soleus complex contractures, as well as ankle dorsiflexion weren't quite distinct between those with and without Plantar Fasciitis. Both the prevalence of contracture ($p = .768$) and mean ankle dorsiflexion measures with both extended and flexed knees did not differ considerably across groups in their study ($p = .353$ and $p = .068$, respectively). These

consistent results imply that ankle contractures or dorsiflexion limits are unlikely to be the main causes of plantar fasciitis development (Lee *et al.*, 2021). In consistent with our findings, Amar Patel *et al.*, investigated the prevalence of Gastrocnemius contracture in PF patients, and it was discovered that while reduced ankle dorsiflexion was prevalent, it didn't independently contribute to PF development. This shows that gastrocnemius tightness is not the primary cause of plantar fasciitis, but rather occurs concurrently. (Patel and DiGiovanni, 2011) the fact there are more potential causes involved means that they haven't yet surfaced. In the study by Sergan Usgu *et al.*, where they showed that Gastrocnemius alone had no influence on plantar fasciitis symptoms, likelihood or intensity of joint, they recommended that other causes be taken into consideration. Moreover, they discovered a relationship between lower ankle dorsiflexion and stiffer plantar fascia in PF patients. The implication of this is that in limited ankle dorsiflexion may have little or no impact on the occurrence of Plantar Fasciitis. (Usgu *et al.*, 2023). These results are in line with our research and highlight the need to investigate additional biomechanical or anatomical reasons that may contribute to an occurrence of plantar fasciitis, as tightness in the gastrocnemius may not be the primary cause.

In contrast to our findings, our results did not indicate a significant association between plantar fasciitis and tension in the gastrocnemius, another study identified a high correlation between plantar fasciopathy and myofascial trigger points in muscles such the Quadratus Plantae and medial gastrocnemius. (Thummar *et al.*, 2020). However this suggests that while tightness in the gastrocnemius might not be mechanically involved in the treatment of Plantar Fasciitis, muscle trigger points might yet be a predominant cause of the symptoms and might yet have a different impact on the condition.

CONCLUSION

The study concluded that plantar fasciitis in operating room nurses is not clearly linked to gastrocnemius tightness, despite their prolonged standing and repetitive tasks. Instead, workplace

factors such as ergonomics, footwear, and extended standing may play a more significant role. To develop more effective preventive strategies, future research should focus on these elements. Simple interventions like ergonomic modifications, supportive footwear, and brief stretching sessions may be more beneficial than stretching alone. The limitation of my study were that it is limited to operating room nurses, so the findings may not be generalizable to other occupations. The cross-sectional design restricts causal inference, and further longitudinal research is needed. Additionally, other important factors such as footwear and ergonomics were not considered.

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