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# Impact of Gastrocnemius Tightness on Increased Risk of Plantar Fasciitis Among Hairdressers

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## ABSTRACT

*Background: Plantar heel pain and plantar fasciitis are common causes of functional limitation, particularly in occupations requiring prolonged standing. Isolated gastrocnemius tightness may increase plantar fascia strain through restricted ankle dorsiflexion, but occupation-specific evidence in hairdressers is limited. Objective: To determine the association between isolated gastrocnemius tightness, pain intensity, and foot health status among hairdressers exposed to prolonged standing. Methods: A cross-sectional observational study was conducted among 155 male and female hairdressers in Lahore using purposive sampling. Isolated gastrocnemius tightness was assessed using the Silfverskiöld test, pain intensity using the Numeric Pain Rating Scale, and foot health status using the Foot Health Status Questionnaire. Associations were evaluated using Pearson's chi-square test and linear-by-linear association in SPSS version 23, with significance set at $p < 0.05$. Results: Significant associations were observed between gastrocnemius tightness and foot health status (Pearson $\chi^2 = 120.564$, $p = 0.002$; linear-by-linear $\chi^2 = 18.562$, $p < 0.001$), gastrocnemius tightness and pain intensity (Pearson $\chi^2 = 9.563$, $p = 0.008$; linear-by-linear $\chi^2 = 7.730$, $p = 0.005$), and pain intensity and foot health status (Pearson $\chi^2 = 201.532$, $p = 0.004$; linear-by-linear $\chi^2 = 7.845$, $p = 0.005$). Conclusion: Isolated gastrocnemius tightness is significantly associated with higher pain intensity and poorer foot health status among hairdressers, supporting early screening and preventive interventions targeting calf muscle flexibility in prolonged-standing workers.*

***Keywords***

*Plantar fasciitis; plantar heel pain; gastrocnemius tightness; Silfverskiöld test; foot health; pain; hairdressers.*

## INTRODUCTION

Plantar fasciitis is among the most frequently reported causes of plantar heel pain in adults and remains a common clinical presentation in primary care, sports medicine, and rehabilitation practice (1,2). Although historically conceptualized as an inflammatory disorder, contemporary evidence supports a load-related continuum in which repetitive tensile stress at the plantar fascia enthesis produces microtrauma, pain, and functional limitation, with chronic cases exhibiting degenerative changes rather than persistent inflammation (3,4). The classical clinical presentation includes sharp, localized heel pain that is often most pronounced during the first steps after periods of rest and may recur or worsen with prolonged standing and repetitive weight-bearing activity, contributing to reduced work capacity and impaired health-related quality of life (2,5). In occupational contexts that require extended standing, the cumulative mechanical exposure may exceed tissue tolerance, increasing vulnerability to plantar fascia overload and symptom persistence (2,6).

Multiple intrinsic and extrinsic factors have been implicated in plantar fasciitis and plantar heel pain, including higher body mass, repetitive loading intensity, altered foot biomechanics, and footwear-related factors; however, restricted ankle dorsiflexion is consistently reported as a particularly relevant and modifiable contributor (2,3). A prominent biomechanical determinant of restricted dorsiflexion is isolated gastrocnemius tightness, defined functionally by reduced ankle dorsiflexion when the knee is extended with relative improvement when the knee is flexed, reflecting limitation attributable primarily to the gastrocnemius rather than the soleus muscle (7,8). This restriction may provoke compensatory pronation, altered timing of heel rise, and increased tensile strain on the plantar fascia during stance and gait, thereby plausibly contributing to plantar heel pain and impaired foot function (7,8). Observational evidence indicates that gastrocnemius tightness is prevalent in individuals with foot and ankle pathology and may represent a clinically meaningful risk-related biomechanical feature (9,10). The Silfverskiöld test is widely used to differentiate gastrocnemius-related limitation from soleus-related restriction, and methodological studies support its clinical utility and reliability when standardized procedures are followed (7,8).

Evidence linking gastrocnemius tightness with plantar fasciitis and symptom burden has expanded in recent years. Association studies report that isolated gastrocnemius tightness frequently coexists with plantar fasciitis, suggesting that gastrocnemius contracture may represent an important biomechanical correlate in affected individuals (11). Moreover, heel pain severity has been shown to correlate with gastrocnemius tightness, implying a graded relationship between restriction in dorsiflexion and symptom intensity (12). Interventions targeting gastrocnemius–soleus flexibility, including structured stretching protocols, have demonstrated improvement in plantar fasciitis symptoms, further supporting a plausible mechanistic link between calf tightness, plantar fascia strain, and pain outcomes (13). Beyond pain intensity alone, plantar fasciitis is also associated with broader decrements in foot-related health and function that can be quantified using validated patient-reported outcome measures such as the Foot Health Status Questionnaire (FHSQ), which captures pain and function domains relevant to foot disability and footwear limitations (14).

Hairdressers represent an occupational group with sustained standing exposure, constrained postures, and repetitive lower-limb loading that may predispose them to gastrocnemius tightness and plantar fascia overload. Despite the biomechanical plausibility and growing evidence connecting gastrocnemius tightness to plantar fasciitis in clinical populations, occupation-specific data among hairdressers—particularly within local settings where ergonomics, workload patterns, and footwear practices may differ—remain limited. Addressing this gap is important because identifying a

modifiable biomechanical correlate in this workforce may support targeted screening and prevention strategies, including flexibility training, ergonomic modifications, and early physiotherapy interventions.

Therefore, this study aimed to determine the association between isolated gastrocnemius tightness, pain intensity, and foot health status among male and female hairdressers exposed to prolonged standing in Lahore, using the Silfverskiöld test, the Numeric Pain Rating Scale (NPRS), and the Foot Health Status Questionnaire. The primary research question was: among hairdressers exposed to prolonged standing, is isolated gastrocnemius tightness associated with higher pain intensity and poorer foot health status?

## MATERIALS AND METHODS

A cross-sectional observational study was conducted in Lahore, Pakistan, to examine the association between isolated gastrocnemius tightness and plantar heel pain–related symptom severity and foot health status among hairdressers exposed to prolonged occupational standing. Participants were recruited from workplace settings using non-probability purposive sampling, targeting hairdressers whose routine work required sustained standing and repetitive weight-bearing activity. The required sample size was calculated as 155 using a World Health Organization sample size calculator. Prior to enrolment, participants received a standardized explanation of study objectives and procedures, confidentiality was assured, and written informed consent was obtained. Ethical approval was obtained from the relevant institutional ethics committee.

Male and female hairdressers aged 18–40 years were eligible if they had up to three years of professional experience and reported occupational standing for more than eight hours per day for at least five working days per week. Individuals reporting systemic medical conditions that may influence soft tissue and pain outcomes (e.g., diabetes mellitus), a history of lower-limb deformity, or prior lower-limb surgery were excluded to reduce clinical heterogeneity and potential confounding from comorbidity-related impairment. Hairdressers working fewer than eight hours per day were also excluded due to reduced exposure to the occupational loading pattern under investigation.

Data were collected using a standardized proforma capturing demographic characteristics and occupational exposures, including age, sex, education level, years of experience, and average daily working hours. The primary exposure variable was isolated gastrocnemius tightness, assessed using the Silfverskiöld test performed in a standardized supine position. Ankle dorsiflexion was assessed with the knee extended and then reassessed with the knee flexed; a meaningful increase in dorsiflexion with knee flexion relative to knee extension was interpreted as isolated gastrocnemius tightness, consistent with the biomechanical rationale and reliability evidence supporting the test (7,8). Plantar heel pain severity was quantified using the Numeric Pain Rating Scale (NPRS), a validated and widely used measure for quantifying pain intensity on a 0–10 scale, where 0 represents no pain and 10 represents the worst imaginable pain (15). Foot health status was assessed using the Foot Health Status Questionnaire (FHSQ), a validated patient-reported outcome measure that captures multidimensional foot-related pain and functional impact relevant to plantar heel pain (14). Instrument administration followed standardized procedures, and all assessments were performed using a consistent protocol to reduce measurement error.

To enhance internal validity and reduce information bias, data collection procedures followed a standardized sequence with uniform participant positioning, consistent verbal instructions, and structured recording. Data completeness was verified at the point of collection, and entries were cross-checked during data entry to minimize transcription errors. Potential confounding variables plausibly related to plantar fascia loading and symptom perception were recorded, including age, sex, experience, and working hours, and were considered during interpretation of findings.

Statistical analyses were performed using SPSS version 23. Continuous variables were summarized using mean and standard deviation, while categorical variables were summarized using frequencies and percentages. Associations between gastrocnemius tightness (Silfverskiöld test category), pain intensity (NPRS category), and foot health status (FHSQ category) were assessed using Pearson's chi-square test, with likelihood ratio statistics reported where appropriate. For ordered categorical variables, linear-by-linear association tests were used to evaluate graded patterns across categories. All statistical tests were two-sided, with significance set at $p < 0.05$. Records with missing values for variables required in a given analysis were handled using listwise exclusion for the corresponding contingency analysis to preserve interpretability of chi-square inference.

## RESULTS

A total of 155 hairdressers participated in the study. The sample comprised predominantly young adults with a mean age of 25.41 years (SD ± 5.35; range: 18–39), indicating that heel pain–related symptoms and gastrocnemius tightness–related impairment were present early in professional working life rather than being confined to older age groups. Occupational exposure was substantial; the mean daily working duration was 10.45 hours (SD ± 1.68; range: 8–13), and the largest proportion of participants reported working 11–12 hours per day (48.4% combined; 11 hours: 21.9%, 12 hours: 26.5%). Professional exposure was similarly concentrated within early years of employment, with an average experience of 2.10 years (SD ± 0.76), and the highest proportion reporting two years of experience (41.3%), suggesting sustained exposure to prolonged standing within a relatively short professional duration.

***Table 1. Descriptive Characteristics of Study Participants (N = 155)***

| Variable | Mean ± SD | Minimum | Maximum |
|---|---|---|---|
| Age (years) | 25.41 ± 5.35 | 18 | 39 |
| Experience (years)* | 2.10 ± 0.76 | 1 | 3 |
| Working hours/day | 10.45 ± 1.68 | 8 | 13 |

***Table 2. Gender Distribution of Participants (N = 155)***

| Gender | n | % |
|---|---|---|
| Male | 84 | 54.2 |
| Female | 71 | 45.8 |
| Total | 155 | 100 |

*Table 3. Educational Status of Participants (N = 155)*

| Education Level | n | % |
|---|---|---|
| Matriculation | 61 | 39.4 |
| Intermediate | 69 | 44.5 |
| Graduate | 20 | 12.9 |
| Postgraduate | 5 | 3.2 |
| Total | 155 | 100 |

*Table 4. Professional Experience of Participants (N = 155)*

| Experience | n | % |
|---|---|---|
| 1 year | 38 | 24.5 |
| 2 years | 64 | 41.3 |
| 3 years | 53 | 34.2 |
| Total | 155 | 100 |

*Table 5. Daily Working Hours (N = 155)*

| Working Hours | n | % |
|---|---|---|
| 8 hours | 31 | 20.0 |
| 9 hours | 24 | 15.5 |
| 10 hours | 12 | 7.7 |
| 11 hours | 34 | 21.9 |
| 12 hours | 41 | 26.5 |
| 13 hours | 13 | 8.4 |
| Total | 155 | 100 |

*Table 6. Association Between Silfverskiöld Test and Foot Health Status Questionnaire (N = 155)*

| Statistic | Value | df | p-value |
|---|---|---|---|
| Pearson Chi-square | 120.564 | 72 | 0.002 |
| Likelihood Ratio | 135.789 | 72 | 0.001 |
| Linear-by-linear association | 18.562 | 1 | <0.001 |
| Valid cases | 155 | — | — |

*Table 7. Association Between Silfverskiöld Test and Numeric Pain Rating Scale (N = 155)*

| Statistic | Value | df | p-value |
|---|---|---|---|
| Pearson Chi-square | 9.563 | 2 | 0.008 |
| Likelihood Ratio | 9.638 | 2 | 0.008 |
| Linear-by-linear association | 7.730 | 1 | 0.005 |
| Valid cases | 155 | — | — |

*Table 8. Association Between Numeric Pain Rating Scale and Foot Health Status Questionnaire (N = 155)*

| Statistic | Value | df | p-value |
|---|---|---|---|
| Pearson Chi-square | 201.532 | 144 | 0.004 |
| Likelihood Ratio | 205.345 | 144 | 0.003 |
| Linear-by-linear association | 7.845 | 1 | 0.005 |
| Valid cases | 155 | — | — |

Sex distribution was relatively balanced, with 84 male participants (54.2%) and 71 female participants (45.8%), supporting the applicability of findings across both sexes. Educational attainment reflected the typical occupational profile of the sample, with the majority completing intermediate (44.5%) or matriculation (39.4%) education, while a smaller proportion reported graduate (12.9%) and postgraduate education (3.2%).

Inferential analysis demonstrated a statistically significant association between isolated gastrocnemius tightness (Silfverskiöld test category) and foot health status (FHSQ category). The relationship was significant on Pearson chi-square testing ($\chi^2 = 120.564$, df = 72, $p = 0.002$), with a supportive likelihood ratio statistic (135.789, df = 72, $p = 0.001$), indicating that the distribution of foot health status differed significantly across gastrocnemius tightness categories. Importantly, a significant linear-by-linear association was observed ($\chi^2 = 18.562$, df = 1, $p < 0.001$), supporting a graded pattern in which increasing gastrocnemius tightness corresponded with progressively poorer foot health status.

A statistically significant association was also identified between gastrocnemius tightness and pain intensity measured by NPRS. Pearson chi-square testing demonstrated significance ($\chi^2 = 9.563$, df = 2, $p = 0.008$), corroborated by likelihood ratio results (9.638, df = 2, $p = 0.008$). The significant linear-by-linear association ($\chi^2 = 7.730$, df = 1, $p = 0.005$) further indicated an ordered relationship, suggesting that pain severity increased in parallel with gastrocnemius tightness.

The strongest association was observed between pain intensity (NPRS category) and foot health status (FHSQ category), with Pearson chi-square testing demonstrating significance ($\chi^2 = 201.532$, df = 144, $p = 0.004$) and likelihood ratio analysis confirming the relationship (205.345, df = 144,

p = 0.003). A significant linear-by-linear association ($\chi^2$ = 7.845, df = 1, p = 0.005) indicated that increasing pain intensity was consistently associated with progressively poorer foot health status. Collectively, these findings demonstrate a coherent pattern of interlinked associations in which gastrocnemius tightness aligns with higher pain intensity and poorer foot health among hairdressers exposed to prolonged occupational standing.

## DISCUSSION

The present study identified statistically significant associations between isolated gastrocnemius tightness, pain intensity, and poorer foot health status among hairdressers exposed to prolonged standing. These findings support the biomechanical rationale that limited ankle dorsiflexion attributable to gastrocnemius restriction may contribute to plantar heel pain–related symptom burden and functional impairment in weight-bearing occupations. Plantar fasciitis and plantar heel pain are widely recognized as common causes of disabling foot pain, particularly when mechanical loading is repetitive or sustained, and the occupational context of hairdressing—characterized by long working hours and continuous standing—represents a plausible environment for cumulative overuse and symptom progression (1–6). Within this framework, the observed graded relationships (linear-by-linear association) strengthen the interpretability of findings by suggesting that worsening gastrocnemius tightness is accompanied by progressively greater pain severity and poorer foot health outcomes rather than representing a purely categorical relationship.

The association between gastrocnemius tightness and foot health status aligns with prior evidence highlighting gastrocnemius restriction as a clinically meaningful correlate in foot and ankle pathology and as a contributor to altered lower-limb biomechanics that can increase plantar fascia strain (7–10). The Silfverskiöld test, used in this study to differentiate gastrocnemius-specific limitation, has been supported as a clinically useful approach when standardized procedures are applied, and its reliability has been explored in both technique comparisons and device validation research (7,8). The significant association observed between Silfverskiöld outcomes and FHSQ status suggests that gastrocnemius tightness may not only relate to pain but also to broader disability dimensions captured by patient-reported foot health instruments. This is clinically important because plantar heel pain conditions often have functional consequences extending beyond symptom intensity alone, including limitations in daily mobility, footwear tolerance, and participation in work-related activities, which are central domains measured by the FHSQ (14).

A significant relationship between gastrocnemius tightness and pain intensity was also observed, with evidence of an ordered trend indicating higher pain severity with greater tightness. These findings are consistent with earlier observational work reporting an association between plantar fasciitis and isolated gastrocnemius tightness and with studies describing a positive relationship between gastrocnemius tightness and heel pain severity (11,12). From a mechanistic perspective, gastrocnemius restriction may elevate plantar fascia stress by promoting compensatory pronation and limiting normal ankle dorsiflexion during stance and gait, thereby increasing tensile loading at the plantar fascia enthesis (7,8). The clinical relevance of this relationship is further supported by interventional evidence showing symptom improvement following gastrocnemius–soleus stretching programs in plantar fasciitis populations, suggesting that calf flexibility may represent a modifiable target for management and prevention (13).

The strongest association in the present study was observed between pain intensity and foot health status, reinforcing that symptom severity is closely linked to functional impairment and perceived foot-related quality of life. This finding parallels prior work demonstrating substantial reductions in FHSQ-measured quality-of-life domains among patients with plantar fasciitis, with impacts observed across both male and female populations (14). In the occupational setting of hairdressing, where prolonged standing is often unavoidable and rest opportunities may be limited, this pain–function relationship has potential implications for productivity, work endurance, and longer-term musculoskeletal wellbeing. Consequently, integrating preventive and early-intervention strategies within occupational health frameworks may be justified, including calf stretching protocols, scheduled micro-breaks, ergonomic modifications such as anti-fatigue mats, and education regarding supportive footwear.

Several limitations should be considered. The cross-sectional design precludes causal inference, and the findings should be interpreted as associations rather than evidence of increased risk. Non-probability purposive sampling may limit generalizability beyond similar workplace contexts. In addition, although standardized measures were used, pain intensity and foot health status were assessed through self-reported instruments, which may introduce reporting bias; however, the NPRS and the FHSQ are widely validated measures in musculoskeletal and foot-related research contexts (14,15). Residual confounding is also possible because factors such as body mass index, footwear type, foot posture, activity level, and prior injury history, each of which may influence plantar heel pain and gastrocnemius flexibility—were not incorporated into adjusted multivariable models. Finally, future studies should consider longitudinal designs to clarify temporality and interventional studies to determine whether targeted gastrocnemius flexibility interventions can reduce pain severity or improve foot health outcomes in prolonged-standing occupational groups, consistent with the therapeutic rationale demonstrated in prior stretching research (13).

## CONCLUSION

This study demonstrates statistically significant associations between isolated gastrocnemius tightness, higher pain intensity, and poorer foot health status among hairdressers exposed to prolonged occupational standing in Lahore. The observed graded relationships indicate that increasing gastrocnemius tightness corresponds with progressively worse pain severity and foot health outcomes, underscoring calf muscle restriction as a clinically relevant and potentially modifiable biomechanical correlate in prolonged-standing workers. These findings support the integration of routine screening for limited ankle dorsiflexion and implementation of preventive occupational strategies, such as targeted stretching programs, ergonomic modifications, and early physiotherapy referral—to mitigate symptom burden and improve functional wellbeing in hairdressers and related standing-intensive professions.

## REFERENCE

1. Buchanan BK, Kushner D. Plantar fasciitis. 2017.
2. Muth CC. Plantar fasciitis. JAMA. 2017;318(4):400.
3. Motley T. Plantar fasciitis/fasciosis. Clin Podiatr Med Surg. 2021;38(2):193-200.
4. Latt LD, Jaffe DE, Tang Y, Taljanovic MS. Evaluation and treatment of chronic plantar fasciitis. Foot Ankle Orthop. 2020;5(1):2473011419896763.
5. Trojian T, Tucker AK. Plantar fasciitis. Am Fam Physician. 2019;99(12):744-750.
6. Luffy L, Grosel J, Thomas R, So E. Plantar fasciitis: a review of treatments. JAAPA. 2018;31(1):20-24.

DOI: https://doi.org/10.61919/mvwyjx98

7. Goss DA Jr, Long J, Carr A, Rockwell K, Cheney NA, Law TD Sr. Clinical implications of a one-hand versus two-hand technique in the Silfverskiöld test for gastrocnemius equinus. Cureus. 2020;12(1).
8. Molund M, Husebye EE, Nilsen F, Hellesnes J, Berdal G, Hvaal KH. Validation of a new device for measuring isolated gastrocnemius contracture and evaluation of the reliability of the Silfverskiöld test. Foot Ankle Int. 2018;39(8):960-965.
9. Chan O, Malhotra K, Buraimoh O, Cullen N, Welck M, Goldberg A, Singh D. Gastrocnemius tightness: a population based observational study. Foot Ankle Surg. 2019;25(4):517-522.
10. Malhotra K, Chan O, Cullen S, Welck M, Goldberg A, Cullen N, Singh D. Prevalence of isolated gastrocnemius tightness in patients with foot and ankle pathology: a population-based study. Bone Joint J. 2018;100(7):945-952.
11. Nakale NT, Strydom A, Saragas NP, Ferrao PNF. Association between plantar fasciitis and isolated gastrocnemius tightness. Foot Ankle Int. 2017;39(3):271-277. doi:10.1177/1071100717744175.
12. Pearce CJ, Seow D, Lau BP. Correlation between gastrocnemius tightness and heel pain severity in plantar fasciitis. Foot Ankle Int. 2020;42(1):76-82. doi:10.1177/1071100720955144.
13. Arif MA, Hafeez S. Effectiveness of gastrocnemius-soleus stretching program as a therapeutic treatment of plantar fasciitis. Cureus. 2022. doi:10.7759/cureus.22532.
14. Palomo-López P, Becerro-de-Bengoa-Vallejo R, Losa-Iglesias ME, Rodriguez-Sanz D, Calvo-Lobo C, Lopez-Lopez D. Impact of plantar fasciitis on the quality of life of male and female patients according to the Foot Health Status Questionnaire. J Pain Res. 2018;11:875-880.
15. Modarresi S, Lukacs MJ, Ghodrati M, Salim S, MacDermid JC, Walton DM. A systematic review and synthesis of psychometric properties of the numeric pain rating scale and the visual analog scale for use in people with neck pain. Clin J Pain. 2022;38(2):132-148.
16. Petraglia F, Ramazzina I, Costantino C. Plantar fasciitis in athletes: diagnostic and treatment strategies. A systematic review. Muscles Ligaments Tendons J. 2017;7(1):107.
17. Liyanarachi S, Hulleberg G, Foss OA. Is gastrocnemius tightness a normal finding in children? A cross-sectional study of 204 Norwegian schoolchildren. J Bone Joint Surg Am. 2021;103(20):1872-1879.