

Estimating Prevalence of Gastrocnemius Contracture and Disability among Paramedical Staff with Plantar Fasciitis

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ABSTRACT

Plantar fasciitis is a painful condition affecting the heel and bottom of the foot. It happens when the plantar fascia, a thick band of tissue supporting the foot's arch, becomes swollen or irritated. When this muscle becomes tight or shortened, it puts extra pressure on the plantar fascia. This can make plantar fasciitis develop or get worse. In simple terms, if the gastrocnemius muscle is tight, it can make plantar fasciitis more likely or make existing pain worse. **Objective:** The purpose of this study was to determine prevalence of gastrocnemius contracture among paramedical staff with plantar fasciitis. **Methods:** The research design for this study is a cross-sectional study. A convenient sampling strategy was employed, with inclusion criteria consisting of both male and female participants aged between 25 to 45 years, having a minimum of two years of experience and at least three hours of duty. Exclusion criteria included participants with past surgical history or trauma. The sample size was determined to be 183 using the WHO Calculator. Data collection utilized the Plantar Fasciitis Pain Scale, Windlass test for plantar fasciitis, and Silfverskiold test for gastrocnemius. **Results:** Prolonged standing affected 71.6% of the population. Detailed statistics on plantar fasciitis depict pain severity and its impact. Mobility, function, and pain impact on various activities are discussed. Medication usage patterns and effectiveness are also explored. Significant associations (p-value 0.001) between the Silfverskiold and Windlass tests shows strong association between them. **Conclusion:** In conclusion, statistics provide valuable insights into the sample population, reinforcing established research findings on risk factors and symptom presentation in plantar fasciitis. Females showed slightly higher prevalence of gastrocnemius contracture as 46.4% and plantar fasciitis as 52%. Duty hours and experience levels closely match established standards and demonstrate diverse clinical profiles.

Keywords: Disability, Plantar fasciitis, Gastrocnemius muscle, Silfverskiold test, Windlass test

INTRODUCTION

Plantar fasciitis is one of the most common musculoskeletal conditions that cause heel pain.¹ It is characterized by inflammation and degeneration of the plantar fascia - a thick band of connective tissue running under the foot that supports the arch.² Plantar fasciitis commonly presents as pain localized under the heel that is worse with initial steps after periods of rest. Plantar fasciitis accounts for approximately 10% of all running injuries and is estimated to affect around 1 in 10 people at some point in their lives. While generally not a serious condition, plantar fasciitis can lead to impaired mobility and quality of life if left untreated.³

The plantar fascia is a complex anatomical structure that provides dynamic support to the foot. It

originates from the medial tubercle and lateral process of the calcaneus and fans out towards the bases of the toes. Plantar fascia acts as a static stabilizer maintaining the medial longitudinal arch during weight bearing activities like standing and walking.³ It also functions as a dynamic stabilizer facilitating windlass mechanism that winds the plantar fascia tight during push-off phase of gait to efficiently transfer force from the toes to the calcaneus.⁴

The heavy tensile loads experienced by the plantar fascia make it susceptible to injury from repetitive microtrauma. Degeneration of the intramuscular connective tissue due to inefficient dissipation of stress gradually leads to microtears.⁴ This triggers an inflammatory cascade releasing chemical mediators like bradykinin, substance P, and cytokines that sensitize pain neurons. Edema and thickening of

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the plantar fascia further compromise windlass function predisposing to additional strain injuries.⁵

The resulting heel pain typically manifests upon initial weight bearing after periods of rest attributed to recovery of hyperalgesia during rest phases. Risk factors that can predispose to plantar fasciitis include tight calf muscles, obesity, and repetitive sports activities like running, standing for prolonged periods, improper footwear, and biomechanical issues like flat feet or high arches. The condition most commonly affects middle-aged adults between the ages of 40-60 years.

One potential complication of plantar fasciitis is the development of a gastrocnemius contracture. The gastrocnemius muscle forms part of the calf and functions to plantarflex the ankle.⁶ A contracture refers to shortening and tightening of the muscle restricting its flexibility. It has been proposed that the calf and other plantarflexor muscles may shorten over time in response to heel pain from plantar fasciitis as a compensation mechanism.⁷

Despite assumptions of an association, little research has determined accurate prevalence rates of gastrocnemius contracture in plantar fasciitis.⁷ Variable study methodologies and samples have produced wide-ranging contracture incidence estimates of 15-80% (Tamminen *et al.* 2020).⁸ This large variation could be due to differences in sample characteristics, assessment protocols and diagnostic criteria between studies. Standardizing assessments is important to obtain a precise estimate.

Paramedical professionals like physiotherapists, occupational therapists, athletic trainers and podiatrists regularly assess and manage foot and lower limb conditions. They are often the first point of contact for patients with musculoskeletal complaints. Therefore, they provide an opportunity to examine the prevalence of contractures among patients diagnosed with plantar fasciitis more rigorously. Standardized assessment protocols can be implemented to obtain reliable measures. Limited ankle dorsiflexion range of motion correlates to both plantar fasciitis and contractures, yet their relationship when co-existing requires further elucidation.⁸

Overall, this research aims to advance current understanding of the suspected association between plantar fasciitis and gastrocnemius contractures using a rigorous methodology. Generating an accurate estimate of contracture prevalence and

elucidating etiological pathways will strengthen clinical management for improved patient well-being and productivity in the long run.

MATERIAL AND METHODS

This was a cross-sectional study. It was approved by ethical committee of UMT no: RE-003-2024. The objective of the study was to estimate the prevalence of gastrocnemius contracture and disability among paramedical staff with plantar fasciitis. For this purpose, a sample of 183 participants were recruited after calculating it from WHO calculator. Convenience sampling technique was used. Inclusion criteria consisted of both male and female gender with Age group of 25 to 45 years & participants with Minimum 3 duty hours. Participants having medical condition (Flat foot, Tarsal tunnel syndrome and haglund's syndrome) or recent surgery were excluded.

The Planter Fasciitis Pain Scale is an important tool used by medical practitioners to objectively evaluate the severity of heel pain experienced by patients suffering from plantar fasciitis. The scale also has high internal consistency, with the items measuring a single underlying construct of heel pain intensity. Overall, the Planter Fasciitis Pain Scale is a valid and reliable instrument for clinicians to routinely assess and monitor patients' heel pain associated with plantar fasciitis.⁸

This tool was used to find out the prevalence of plantar fasciitis. During the test, the patient lies down and the examiner firmly grasps the toes and pulls them towards the shin, dorsiflexing the foot. This mimics the function of the plantar fascia, simulating the windlass mechanism where it tightens the arch of the foot. In patients with plantar fasciitis, this motion will reliably reproduce or exacerbate the sharp, stabbing heel pain that is characteristic of the condition. A positive result on the windlass test, demonstrated by pain at the calcaneal insertion of the plantar fascia, supports a diagnosis of plantar fasciitis. The test utilizes the plantar fascia's anatomical structure and microscopic tearing associated with the condition to clinically confirm the diagnosis.⁹

A positive Silfverskiold test is useful for diagnosing gastrocnemius contracture. To perform the test, the patient lies flat while the examiner dorsiflexes the patient's ankle and foot (Molund *et al.*, 2018). Simultaneously, the knee is flexed so the sole of the foot moves toward the patient's buttocks.

Tightness or resistance felt in the calf muscle as the knee is flexed indicates a positive test, suggesting gastrocnemius shortening or contracture. This tissue tension is thought to limit ankle dorsiflexion beyond the neutral position. The test relies on isolated assessment of the gastrocnemius through joint positioning, allowing clinicians to mechanically identify contractures through physical impedance felt during examination. It provides valuable objective information when evaluating for mobility issues in the gastrocnemius muscle.¹⁰

RESULTS

According to demographic representation of participants in the study; mean of age was 35.3 ± 5.3 . 42.6% were male while 57.4% female in the study. Mostly participants were working up to 8 hours per day. Mostly participants have 7 years of experience. Table 1 showed the prevalence of gastrocnemius contracture in the paramedical staff with planter fasciitis, demonstrated by the Windlass and Silfverskiold tests, was revealed as 52.5% and 46.4% respectively. p-value of < 0.005 showed significant association of plantar fasciitis with gastrocnemius contractures.

Table 1. Results of windlass test and Silfverskiold test

Windlass test		Silfverskiold test		p-value
Frequency	Percentage	Frequency	Percentage	
Negative	87 47.5	Negative	98 53.6	<0.005
Positive	96 52.5	Positive	85 46.4	

DISCUSSION

The descriptive statistics provided useful insights into the characteristics of the sample population. The mean age of 35.3 years aligns well with previous research by Aiman *et al.* (2022) which found the peak incidence of plantar fasciitis to be between ages 30-50.⁴ Riddle and colleagues examined 150 patients diagnosed with plantar fasciitis and reported that 72% were between 30-50 years old. The tight age distribution in the current study centered on the median of 36 years validates the sample as representing the at-risk population well identified.

The slightly higher prevalence among females (57.4%) is consistent with studies by Granado *et al.* (2019) which identified gender as a risk factor. He and his colleagues retrospectively reviewed 40 patients with plantar fasciitis and found that 65% of cases were female.¹² The nearly equal split between males and females in the current study aligns with the previous studies that identified females as having a higher risk.

The mean duty hours of 7.84 closely matches the standard 8-hour shift described in Bhoir *et al.* (2021) examination of how prolonged standing relates to symptoms.⁷ Bhoir and colleagues reviewed 100 subjects and had them complete an 8-hour work shift that required prolonged standing and walking. They found that duration of weight-bearing activities positively correlated to increased plantar fascia thickness and symptom severity. This validates those prolonged standing durations, like the 7.84 hours found in the current study, can influence outcomes as demonstrated.

Prolonged standing was reported by 71.6% of the sample, consistent with Purvitagiri *et al.* (2017) identification of this occupational hazard as a primary risk factor.¹⁴ Purvitagiri and colleagues measured plantar fascia pressure in 73 individuals and found that pressure increased significantly over the course of an 8-hour workday requiring prolonged standing. They demonstrated how standing augmented pressure on the plantar fascia, lending support to its role in symptom development. This provides validation for the high proportion who reported prolonged standing as a potential risk factor in the present study.

Palee *et al.* (2024) studied the relation between plantar fasciitis, skin blood flow and flexor digitorum brevis thickness.¹⁵ Thirty-two individuals with unilateral plantar fasciitis were recruited in the study. Visual analogue scale was used to determine pain level and for SBF measurement laser dropper flowmeter. Significant correlation was observed among all variables. The current study detected substantial association between gastrocnemius contracture and plantar fasciitis.

In summary, the sample demographics aligned well with prior descriptive epidemiological investigations. Valid relationships emerged like between prolonged standing, symptom provocation during plantar fascia loading activities, and diagnostic tests performance consistent with previous reports. Areas where findings diverged

highlight opportunities for expanding current knowledge through investigations utilizing larger sample sizes or multi-modal assessment techniques.

The study assessing the risk factors associated with gastrocnemius contracture faced several limitations. One key limitation is the lack of generalizability, as the results are only applicable to a very specific population and profession, making it difficult to extend the findings to broader groups. Additionally, more research is needed to determine whether targeted interventions can effectively benefit these workers. Future studies should be conducted with larger sample sizes to ensure more robust results. Furthermore, other factors related to plantar fasciitis, such as footwear, the use of heel pads, and the presence of flexible flat feet, should be considered to provide a more comprehensive understanding of the condition.

CONCLUSION

This review article concluded that the prevalence of gastrocnemius contracture and planter fasciitis in paramedical staff is 52.5 % and 46.4% respectively by using windlass and silfverskiöld test. 48. 6% have surface and 51.4 % have deep pain. By using chi square we have found association between both tests. Out of 183 participants, 77 participants were having both test positive which shows a positive association. On the basis of Planter fasciitis pain scale, there were 53.6% participants have moderate disability and 32.8 % participants have severe disability. P-value was less than 0.05 which means that data is significant statistically.

DECLARATION

Conflicts of Interest: the author declared no conflict of interest.

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