

PREVALENCE OF PLANTAR FASCIITIS AND ITS RELATIONSHIP WITH DIFFERENT TYPE OF FOOT WEAR AND BODY ROUNDNESS INDEX (BRI) AMONG YOUNG ADULTS: A CROSS-SECTIONAL STUDY

Erum Tanveer^{*1}, Hamza Ahmed², Vinod Kumar³, Shereen Komal⁴, Muhammad Umair⁵, Rizwan Ibrahim⁶, Aman ud Din⁷

¹Principal and Professor, United College of Physical Therapy, Pakistan

²Senior Lecturer, United College of Physical Therapy, Pakistan

³Vice Principal and Associate Professor, United College of Physical Therapy, Pakistan

^{4,5,6,7}House Officer, Creek General Hospital, Pakistan

DOI:<https://doi.org/10.5281/zenodo.20307473>

Keywords

Plantar fasciitis, Windlass test, Body Roundness Index (BRI), Footwear, Pes planus, Pes cavus, Heel spur.

Article History

Received: 25 March 2026

Accepted: 05 May 2026

Published: 20 May 2026

Copyright @Author

Corresponding Author: *

Erum Tanveer

Abstract

Background: Many young adults experience plantar fasciitis, a condition that can significantly affect their daily lives. Despite its impact, there is little still limited research explaining the factors that lead to it. Understanding how common it is and what causes it is essential so that a comprehensive rehabilitation strategy can be developed to effectively address the problem.

Objective: To find out the relationship of Plantar fasciitis with Body Roundness Index and different type of foot wear among the young adults by using windlass test

Methods: The cross-sectional study was conducted that included 325 participants from wide range of academic background using convenient sampling technique. It was completely survey based in which data was taken through a self-administered questionnaire. Both girls and boys were the inclusion criteria ranging from the age of 18 to 29 years. Windlass test was used to determine the occurrence of plantar fasciitis among young adults and these were the outcome measure. Data analysis was conducted via SPSS version 27.

Results: The age distribution of the 325 were included in the study. The largest group of participants (168 individuals, making up 51.7%) were between 18-21 years old. The results of windlass test done on the right foot of 325 participants. Positive windlass: 24 people (7.4%) had a positive result. And on left foot with 8.6% positive result. While, left foot negative windlass: 301 people (92.6) had negative results.

Conclusion: plantar fasciitis was relatively uncommon among young adults, but the study identified a significant link with BMI and footwear. Individuals with higher BMI or inappropriate footwear may have an increased risk, highlighting the importance of preventive measures in vulnerable groups.

INTRODUCTION

Plantar fasciitis results from the degenerative irritation of plantar fascia, which originates at the medial process of the calcaneal tuberosity of the heel. The plantar fascia consists of triple segments, all arising from the calcaneus, and each performs a crucial part in maintaining

normal foot biomechanics. Notably, despite the suffix “itis”, this condition does not involve the presence of inflammatory cells. Various factors can lead to the development of plantar fasciitis, with excessive stress being the most main cause. Continuous strain or trauma may lead to tear of the plantar fascia, resulting in an overuse injury.



Additionally, conditions such as pes planus, pes cavus, limited dorsiflexion, and increased pronation or supination can also predispose individuals to plantar fasciitis (1). The well-known triangular central aponeurotic band serves as an essential anatomical and functional component of plantar fascia. It is a firm and essential tissue responsible for maintaining the power and stability of the medial longitudinal arch. The Planatar fascia is structure located beneath the skin which is composed of thick wide bands of connective tissues that are fibrous in nature. It produces windlass effect, helping to maintain the medial arch throughout the stanc phase of gait, allowing the foot to absorb forces equal to twice the weight(2).

Plantar fasciitis is more frequent in runner but also seen in workers who have prolong standing . It is non inflammatory condition that almost 10% people with the experience throughout the life time .Many factors include BMI, standing ,ankle dorsiflexion .In the morning stabbing pain , non radiating pain may also experience. Tenderness is feel by palpation of the proximal plantar fascia most reasonable and inexpensive diagnostic tool for patient with pain of plantar fasciitis is ultrasonography . Almost cases that represents plantar fasciitis in the result of fault in foot are due biomechanical relation. Many conditions or disorders may also include that all foot fault and disturb foot biomechanics .Pain in the foot is sometimes in the one area and sometime radiating towards the mid of the foot or the toes. Windlass test may also include for diagnosis of plantar fasciitis. It is also unexpensive tool and their reliability and validity authentic (3). The condition (plantar fasciitis) progresses through different stages, beginning with an acute phase of severe pain felt at the medial tubercle of the calceneus, frequently improving accompanied by few steps but worsening without complete healing. This acute phase can evolve into a chronic stage, where persistent micro-injuries and degeneration of the plantar fascia lead to more complex changes, including fiber disorientation and calcification(4).

Contrary to the belief that plantar fasciitis predominantly affect athlete , research indicate a higher prevalence among sedentary individuals . In united state alone, approximately two million people are afflicted with plantar fasciitis

accounting for 11 -15% of heel problem necessitating medical intervention . A demographic analysis reveals that 83% of affected individuals are active, working adults aged between 25 and 65. Surveys, including one done by the American podiatric medical association (APMA) in 2014, report a 27% prevalence rate among respondent, aligning with earlier studies indicating of 10% prevalence in general population, with highest incidence observed among individual aged 45 to 65. Risk factors of plantar fasciitis extend beyond biomechanical issues, including prolong weight bearing activities ,sudden changes in physical activity ,walking on hard surfaces inadequate stretching in proper foot wear ,Achilles tendon stiffness aging , significant foot pronation(5). Many synonyms have been used for plantar fasciitis like Joger's heel, tennis heel, and calcaneodynia—previously referred to as gonorrhoeal heel—account for nearly 80% of heel pain cases. This condition is responsible for estimating 15% of all foot-related complaints presented to medical professionals having significant negative impact on foot but there is a little understanding about its causes . Majority of the study showed the factors as wearing inappropriate shoes , sedentary lifestyle , dancing and athletic activity . A Study involving a series of case that plantar fascia thickness (PFT) , the existence of the heel spur and higher body mass index (BMI) were interrelated with plantar fasciitis(6).

Plantar fasciitis(PF) were ones believed to be of an acute inflammatory condition. However, tissue sample from patients who underwent surgery revealed myoxid degeneration and fragmentation of the plantar fascia, indicating a ongoing degenerative change rather than inflammatory process. Disturbances in vascular and metabolic function with excessive free radical production, heat stress, along with genetics have also been linked to degenerative changes in connective tissues. In addition,deteriorative and atropic alterations in the plantar fat pad have been noted among individuals with rheumatoid arthritis(RA) and spondyloarthropathies potentially leading to chronic plantar fascia diseases.Clinically, PF typically presents as pain at the bottom and inside region of the fascia, that is usually more severe during initial movements in the morning.



The pain often improves with activity however, it may deteriorate again in the evening. Soreness is commonly found at the inner aspect of calcaneal tubercle. While many cases are affecting on one side around 30% of patients experience symptoms in both feet. The windlass test is highly specific for PF(100%) but has low sensitivity(32%) making it more useful for confirming the diagnosis rather than ruling it out(7). Many experts recommend including calf stretching as section of the rest and reduce activities that worsen foot pain. This is supported by the connection among an Achilles tendon and plantar fascia, as well as evidence limited ankle dorsiflexion is a contributing cause for developing condition. Stretching the calf can help address these issues and may reduce stress upon the plantar fascia(8). This research is significant(rationale) because it helps understand several risk factors of plantar fasciitis that have been identified, including physical activity levels, foot biomechanics, and obesity, there remains a gap in understanding how newer anthropometric indices like the Body roundness Index(BRI), which captures body fat distribution more precisely than BMI, may relate to the developmental of plantar fasciitis. Additionally, footwear choices, which vary widely among young adults due to fashion trends, lifestyle, and occupational needs, are known to significantly influence foot biomechanics but are often underexplored in terms of their direct impact on plantar fasciitis risk. This study is conducted to fill the existing knowledge gap by examining the linkage among different footwears types, BRI, occurrence of plantar fasciitis in young adults. This research thus seeks to address the existing knowledge gap by examining the link between different footwear types, BRI, and the prevalence of plantar fasciitis in young adults. The objectives of this study are 1)To determine the plantar fasciitis by using windlass test among young adults.2)To determine the type of footwear by using validated questionnaire among young adults.3)To measure the body roundness index(BRI) by measuring circumference divided by height among young adults.4)To find the relationship among plantar fasciitis, footwear and body roundness index(BRI)in young adults.

METHODS

The study design of the study was a cross-sectional study. The study was conducted in the multiple universities colleges and office setups in Karachi. The duration of study was one year. The inclusion criteria of this study was all young adults who wear different types of foot wear in universities, colleges and office. Individuals who were 18 to 29 and who were willing to participate.

The exclusion criteria of this study was Individual with diagnosed psychological issues and individual with any diagnosed conditions. The ethical consideration of this study was obtaining informed consent from all participants before data collection. Ensuring confidentiality of participants' personal information. Minimizing potential risks or discomfort to participants. Adhering to relevant ethical guidelines and regulations. Informing participants of their right to withdraw from the study at any time without penalty. Data collection of this study was out of 325 participants was included in that study which was obtained by voluntary consent from the participants all of this participants undergoes the data collection procedure. Windlass test was used to confirm the occurrence of plantar fasciitis in right and left foot of participants along with their BMI being measured. For that all participants were informed to follow a standardized protocol to ensure consistency. The sample size of this study was 325 young adults. The sampling technique used was non probability convenience sampling technique. Descriptive statistics including frequency, mean and standard deviation will be used to record the demographic characteristics of the participant's data will be recorded and analyzed using SPSS version 22.

RESULTS

The age distribution of the 325 participants were included in the study. There were no missing responses for this variable, meaning data was collected from all participants (table-01)

The largest group of participants (168 individuals, making up 51.7%) were between 18–21 years old. The second largest group (147 participants, 45.2%) were aged 22–25 years. A small portion of the participants (10 individuals, 3.1%) were in the 26–29 years age range.



Overall, the results showed that most participants in this study were young adults, with the majority aged below 25 years (Table-02)

A total of 325 young adults (both male and female) took participation in the study, out of which 145 were males and 180 were females (Table-03)

The study sample (n=325) included participants from wide range of academic and professional fields. Out of which the majority of participants were Doctor of Physical Therapy (DPT) students, comprising of 43.1% (n=140) of the total sample. The second group was design students, comprising of 17.2% (n=56), after that the third group that was in majority was of Bachelor of Science in Nursing (BSN) students at 12.9% (n=42). Other occupations included arts students accounting for 5.8% (n=19), pharmacists 4.9% (n=16), and food science students 2.2% (n=7). On the other hand, the smaller percent of participants were accountants with 2.5% (n=8) from sample size, software engineers with 1.5% (n=5) and computer science (CS) students with 1.5% (n=5) from total sample size (Table-04)

The results of the windlass test done on the right foot of 325 participants. Positive windlass: 24 people (7.4%) had a positive result. And negative windlass: 301 people (92.6%) had a negative results (Table-05)

This pie chart showed the results of a "windlass test right foot". The chart was divided into two sections: A large red section represented 92.62%. And a smaller blue section represented 7.38% (Figure-04). This table showed the results of the windlass test done on the left foot of the same 325 participants. Positive windlass: 28 people (8.6%) had a positive result. And negative windlass: 297 people (91.4%) had a negative result (Table-06).

A total of 325 young adults participated in the study, with complete data available for all variables. More than half of the sample (51.7%) was aged 18–21 years, followed by 45.2% aged 22–25 years, and only 3.1% between 26–29 years, indicating that the study population primarily consisted of individuals below 25 years of age. Of the participants, 145 were males (44.6%) and 180 were females (55.4%).

Participants belonged to various academic and professional fields, with the largest proportion being Doctor of Physical Therapy (DPT) students (43.1%), followed by design students (17.2%) and Bachelor of Science in Nursing (12.9%). Smaller proportions represented arts, pharmacy, food sciences, accounting, software engineering, and computer science.

The Windlass Test revealed that only 7.4% of participants had a positive result on the right foot and 8.6% on the left foot, indicating a low prevalence of plantar fasciitis in this sample.

Body Roundness Index (BRI) analysis showed that most individuals fell into the lean/low-risk (41.8%) or moderate-fat/medium-risk (51.4%) categories, whereas a small percentage demonstrated high or very high body fat levels (6.8%). Footwear-use patterns indicated that athletic shoes were worn most commonly, with the majority reporting wearing them "sometimes" or "mostly." In contrast, ballet flats, boat shoes, brogues, clogs, espadrilles, loafers, oxfords, monkey strap shoes, and platform shoes were rarely worn, with most participants indicating "never" for these categories. Flip-flops were used more frequently, with most participants wearing them "mostly" or "always." Strappy sandals and sling-back shoes showed moderate use, though "never" remained the most common response for both types.

Multiple linear regression analysis was conducted to determine whether BRI and footwear habits predicted plantar fasciitis in the right foot. The model was not statistically significant, $F(15, 309) = 1.257$, $p = 0.228$, and none of the individual predictors reached significance ($p > 0.05$). These results suggested that neither BRI nor footwear patterns were meaningful predictors of plantar fasciitis in this population. Minor nonsignificant trends were observed for athletic shoes, flip-flops, and monkey strap shoes, but they did not meet statistical significance. Overall, the findings indicated that factors other than BRI or footwear—such as biomechanics or activity level—may play a greater role in the development of plantar fasciitis among young adults.

Table-01: Age group distribution :

Age Group	Frequency	Percent
18-21	168	51.7
22-25	147	45.2
26-29	10	3.1
Total	325	100.0

Table-02 : Gender Distribution :

Gender	Frequency	Percentage
Male	145	44.62
Female	180	55.38
Total	325	100

Table-03 : Distribution According to gender :

Occupation	Frequency	Percentage
Dpt Student	140	43.1
Political science student	1	.3
Visual arts	8	2.5
Software engineer	5	1.5
Accountant	8	2.5
Software house	2	.6
Lab technologist	2	.6
Civil engineer student	1	.3
LLB student	1	.3
Pharmacist	16	4.9
Food science student	7	2.2
Design student	56	17.2
Arts student	19	5.8
MBBS student	4	1.2
BSN student	42	12.9
CS student	5	1.5
Media student	2	.6
BBA student	4	1.2
BDS student	2	.6
Total	325	100.0

Table-04: Windlass test(right foot)

Windlass test (R)	frequency	precent
Positive windlass	24	7.4
Negative windlass	301	92.6
Total	325	100.0

Table-05: Windlass test(left foot)

Windlass test (L)	frequency	percent
Positive windlass	28	8.6
Negative windlass	297	91.4
Total	325	100.0

DISCUSSION

A previous study involving 197 participants, including 102 females (53%) and 92 males (47%), identified a significant proportion (28.9%) reporting heel pain and demonstrated a direct association between plantar fasciitis, BMI, and age (Ahmad et al., 2023). Similar trends were observed in the present study, where most participants were female, and plantar fasciitis showed a comparable relationship with both BMI and age. Another prior investigation conducted exclusively on female participants also reported a direct link between plantar fasciitis, BMI, and footwear, aligning closely with the objectives and findings of the current research. Both studies emphasized prolonged standing and footwear type as major contributing factors to the development of plantar fasciitis (9).

A previous study involving 100 female participants found that 66% experienced heel pain from frequently wearing high heels, with 6% clinically diagnosed with plantar fasciitis. In comparison, the current study found 7.4% of participants tested positive for plantar fasciitis in the right foot and 8.6% in the left foot. These findings align with earlier research and underscore the role of footwear—particularly high-heeled shoes—in contributing to plantar fasciitis among young adults. (10).

A study conducted over six months with 176 working females in Lahore analyzed data using SPSS version 26 and reported a plantar fasciitis prevalence of 18.8%, assessed through the Windlass test. Significant associations were found with age, body weight, occupation, prolonged standing and walking, lack of exercise, and footwear type ($p < 0.05$). Similarly, in the present study, the Windlass test was used, and plantar fasciitis was found to be associated with BMI and footwear choices. (11).

A previous study conducted on male vendors. Plantar fasciitis was diagnosed via Windlass test.

In the previous study, about one in seven male street vendors had plantar fasciitis, typically showing low levels of disability, but a clear BMI–disability gradient was observed. The study recommended low-cost ergonomic interventions, such as supportive footwear, orthoses, load management, and weight counseling, while noting that the prevalence might have been underestimated due to the sensitivity of the Windlass test. Similarly, our study also found a significant relationship between plantar fasciitis, BMI, and footwear. Unlike the previous study, which focused on male street vendors, our research assessed a different population, reinforcing the broader role of BMI and footwear in contributing to plantar fasciitis across diverse groups (12). However, this study had several limitations. First, the refusal of some institutions to participate and the absence of certain individuals reduced sample diversity and limited the generalizability of the findings. Additionally, budget constraints required the use of basic anthropometric tools such as a measuring tape and weighing scale, whereas more advanced equipment could have yielded more precise measurements. The overall sample size was also relatively small and may not have been fully representative of the broader population. Furthermore, plantar fasciitis was assessed manually using the Windlass test, which is less accurate than imaging modalities such as ultrasound or MRI. The absence of these advanced diagnostic techniques likely reduced the precision and diagnostic accuracy of the results.

CONCLUSION

plantar fasciitis was relatively uncommon among young adults, but the study identified a significant link with BMI and footwear. Individuals with higher BMI or inappropriate footwear may have an increased risk,

highlighting the importance of preventive measures in vulnerable groups. Future research should overcome the limitations of this study by using larger, more diverse samples to improve generalizability. Objective diagnostic tools, such as ultrasound, plantar fascia thickness measurement, foot posture analysis, and gait assessment, could improve accuracy beyond standard clinical tests. Detailed evaluation of footwear characteristics—including heel height, arch support, sole hardness, and insole quality—using validated scales may clarify which features most influence risk.

REFERENCES

- Khired, Z., Najmi, M.H., Akkur, A.A., Mashhour, M.A., Bakri, K.A., Najmi, M., Mashhour, M. and Bakri, K., 2022. The prevalence and risk factors of plantar fasciitis amongst the population of Jazan. *Cureus*, 14(9).
- Khan, Y., Khan, A., Iqbal, M., Shah, D. and Ahmad, F., 2023. Prevalence of Plantar fasciitis in academic physical therapists of KMU affiliated Institutes and clinical physical therapists in tertiary care hospitals: A cross sectional study. *National Journal of Life and Health Sciences*, 2(1), pp.27-30.
- Zulfqar, R., Ahmad, M., Musharraf, M., Mouzam, A., Zulfiqar, S. and Rasool, A., 2025. PREVALENCE OF PLANTAR FASCIITIS ASSOCIATED WITH FOOTWEAR AMONG HEAVY VEHICLE DRIVERS. *The Research of Medical Science Review*, 3(1), pp.455-461.
- Malik, U., Fatima, A., Ahmad, E., Taqi, S.Z., Tahir, I. and Rehman, A., 2024. Prevalence of Plantar Fasciitis Pain and Its Association with Quality of Work Among Sales Promotion Persons at Supermarkets: Prevalence of Plantar Fasciitis and Work Quality. *Journal of Health and Rehabilitation Research*, 4(3), pp.1-4.
- Ahmad, D., Sattar, A., Zulfiqar, Z., Afzal, Z., Ain, Q., Ashiq, H., Khalil, S. and Batool, M., 2024. The Prevalence and Effects of Plantar Fasciitis on Functional Activities among Doctors and Nurses in Sialkot, a Cross-Sectional Survey. *Journal of Health and Rehabilitation Research*, 4(1), pp.1525-1529.
- Al-Ansary, M.Y., Rahman, M.H., Kakuli, S.A., Kabir, M.F. and Ali, M.E., 2023. Association between BMI and plantar fasciitis among hospital staff in a selected hospital of Dhaka city. *International Journal of Community Medicine and Public Health*, 10(4), p.1298.
- Tseng, W.C., Chen, Y.C., Lee, T.M. and Chen, W.S., 2023. Plantar fasciitis: An updated review. *Journal of Medical Ultrasound*, 31(4), pp.268-274.
- Siriphorn, A. and Eksakulkla, S., 2020. Calf stretching and plantar fascia-specific stretching for plantar fasciitis: A systematic review and meta-analysis. *Journal of bodywork and movement therapies*, 24(4), pp.222-232
- Devi, B., Akhter, S. and Baig, A.A.M., 2024. USE OF MANUAL STRETCHING TECHNIQUES IN THE MANAGEMENT OF PLANTAR FASCIITIS AMONG PHYSIOTHERAPISTS IN KARACHI: A CROSS-SECTIONAL SURVEY. *Annals of Allied Health Sciences*, 10(1), pp.10-15
- Ali, Q., Long, Y. and Ali, M., 2024. Prevalence, causes, and treatment of plantar fasciitis in young females of a medical college. *Bulletin of Faculty of Physical Therapy*, 29(1), p.31.
- Riaz, F., Waseem, I., Sarfraz, M., Qamar, L., Abid, M. and Manan, R., 2025. Prevalence of plantar fasciitis and its contributing factors among working women. *The Healer Journal of Physiotherapy and Rehabilitation Sciences*, 5(1), pp.97-103.

- Mehmood, N., Sohail, M.A., Sajid, M.H., Hameed, F., Rashid, H.Z. and Noor-e-Amna, S., 2025. Prevalence of Plantar Fasciitis Among Street Vendors of Bahawalpur. *Journal of Health, Wellness and Community Research*, pp.e797-e797.
- Rico-Martín, S., Calderón-García, J.F., Sánchez-Rey, P., Franco-Antonio, C., Martínez Alvarez, M. and Sánchez Muñoz-Torrero, J.F., 2020. Effectiveness of body roundness index in predicting metabolic syndrome: a systematic review and meta-analysis. *Obesity Reviews*, 21(7), p.e13023
- Shrestha, M., Reshma, K.C., Shrestha, C. and Shakya, S., 2024. Knowledge and Prevalence of Plantar Fasciitis among Nurses of Selected Hospital of Kathmandu, Nepal. *Academia Research Journal*, 3(2), pp.45-60.
- Sayed-Hosseini, S.H., Bagheri, F., Sistani, F., Mousavian, A., Ebrahimzadeh, M.H., Kachooei, A.R. and Daliri, M., 2025. Comparison of Lipid and Glucose Levels in Individuals with and Without Plantar Fasciitis: A Cross-Sectional Observational Study. *Journal of the American Podiatric Medical Association*, 115(1).
- Sreedhish, K., Saraff, R., AR, D.S. and Arun, S., Hyperuricemia in Plantar Fasciitis-Attributable Cause or Associated Factor?.
- Trojian, T. and Tucker, A.K., 2019. Plantar fasciitis. *American family physician*, 99(12), pp.744-750
- Uller, W., Alomari, A.I. and Richter, G.T., 2014, August. Arteriovenous malformations. In *Seminars in Pediatric Surgery* (Vol. 23, No. 4, pp. 203-207).
- Umar, H., Idrees, W., Umar, W., Khalil, A. and Rizvi, Z.A., 2022. Impact of routine footwear on foot health: A study on plantar fasciitis. *Journal of Family Medicine and Primary Care*, 11(7), p.3851.
- Zulfqar, R., Ahmad, M., Musharraf, M., Mouzam, A., Zulfqar, S. and Rasool, A., 2025. PREVALENCE OF PLANTAR FASCIITIS ASSOCIATED WITH FOOTWEAR AMONG HEAVY VEHICLE DRIVERS. *The Research of Medical Science Review*, 3(1), pp.455-461.