

Impact of routine footwear on foot health: A study on plantar fasciitis

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ABSTRACT

Background: Plantar fasciitis is the most common cause of heel pain requiring medical attention. The clear understanding of the long-term impact routine footwear has on plantar fasciitis is essential as any slight changes in shoe selection could possibly prevent the wearer from substantial discomfort and disability. Thus this study was planned to investigate impact of routine footwear on foot health by highlighting different features of the shoes worn daily by the people having plantar fasciitis. **Methods:** A cross-sectional study was conducted in the orthopaedics' outpatient department of a tertiary-care hospital in Pakistan. Data was collected using non-probability convenient sampling from 101 people diagnosed with plantar fasciitis. Their routine footwear was categorized as appropriate or inappropriate on basis of heel height, sole thickness, and insole type (hard/cushioned/arched). Data were collected using a self-designed questionnaire and analysed by applying descriptive statistics and non-parametric tests. **Results:** The majority (83.2%) of the people wear inappropriate shoes, whereas only 16.8% wear the recommended shoes, i.e., with heel height between 0.5-4 cm, thick soles, and arched or cushioned insoles. About 82.2% of plantar fasciitis patients reported wearing shoes of minimal heel height and 55.5% wore shoes with hard, non-cushioned insole without built-in arch support. Participants who wear inappropriate shoes experience more severe heel pain (P 0.013) which limits their daily activities. **Conclusions:** Footwear plays an important role in causing plantar fasciitis as the majority of the diagnosed cases wear inappropriate shoes with minimal heel height, thin sole, and hard insole without any built-in arch support.

Keywords: Chronic limitation of activity, daily routine, foot disorders, footwear, heel pain, myths, orthoses, physical activity, plantar fasciitis, prevention and control, shoes

Introduction

Heel pain is one of the most common foot complain presenting in the primary care and general orthopaedic clinics. and plantar fasciitis accounts for about 80% of such cases.^[1,2] Plantar fasciitis is defined as a subacute or chronic pain in the bottom of the

heel, precisely at the site of attachment of the medial band of the plantar fascia to the medial calcaneal tubercle.^[3] The pain is more severe with the first few steps in the morning and when getting up from a sitting position after periods of rest. It is exacerbated by standing or walking for long periods and it is most often relieved by resting.^[2-4]

Each year, plantar fasciitis accounts for approximately two million visits to physicians in the United States of America,^[5] causing national economic burden of around \$284 million.^[6] The exact prevalence of plantar fasciitis is uncertain. There is a discrepancy between the number of patients diagnosed with plantar fasciitis

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and those seeking treatment.^[6] In one survey conducted by the American Podiatric Medical Association (APMA) in 2014, it was stated that out of the 1000 people, 27% had plantar fasciitis.^[7] The majority of current studies still regard a study conducted in 2003 as the benchmark. This 2003 study concluded that approximately ten percent of the general population had plantar fasciitis.^[8] Plantar fasciitis has a peak occurrence between 45 to 65 years of age. Risk factors include obesity/sedentary lifestyle, flat/high arched feet, ill-fitted shoes, prolonged running, and occupations requiring standing for a long period.^[9] Plantar fasciitis has a significant effect on the quality of life as it limits exercise, running, and other work/daily activities.^[10] It also cause significant economic burden on the patient due to its long recovery time and multiple visits to physicians.^[6]

Many people with heel pain face some footwear related problem.^[11] A study conducted on people presenting with heel pain in primary care hospitals of the Kingdom of Saudi Arabia showed a significant association between plantar fasciitis and ill-fitted shoes.^[2] National Health Sciences also listed shoes with poor cushioning or arch support as the cause of plantar fasciitis.^[12] The significance of footwear in developing plantar fasciitis is also stressed by Bharti Rajput and Rami J. Abboud in their study. They concluded that footwear contributes toward the development of heel pain in plantar fasciitis and stressed making footwear assessment a part of the clinical examination of people with plantar fasciitis.^[13]

The role of footwear in causing plantar fasciitis is less known. A firm understanding of the long-term impact of routine footwear on plantar fasciitis is essential so that a slight change in selecting shoes could prevent substantial discomfort and disability experienced. It is also important for optimizing footwear design to ensure the comfort and health of the person wearing them. Thus, this study was planned to unmask the effect of routine footwear in causing plantar fasciitis by studying the footwear worn daily by the patients.

Materials and Methods

A cross-sectional study was conducted in orthopedics' outpatient department of a tertiary care hospital in Rawalpindi, Pakistan from December 2019 to February 2020. The study was conducted after obtaining ethical approval from the institutional research forum of Rawalpindi Medical University. Data were collected from 101 people diagnosed with plantar fasciitis. Previously a pilot study was conducted on 30 subjects to ensure validity and standardization of the self-designed questionnaire. Amongst them, only 2 (6.67%) were diagnosed with plantar fasciitis using the inclusion and exclusion criteria. Therefore, the required sample size was calculated to be 101 with a confidence level of 95% and a confidence interval of 5%.

Inclusion and exclusion criteria used to reach a clinical diagnosis of plantar fasciitis and hence final inclusion in the research are illustrated in Figure 1. These criteria were derived from Pain Scale

for Plantar Fasciitis (PSPF)^[14] and previously published guidelines on plantar fasciitis.^[1,3,8] Only those participants who passed through these three filters were included in the study. Informed consent was taken from every participant and their anonymity was ensured.

No locally or internationally validated questionnaire existed to study the impact of footwear in causing plantar fasciitis. So data was collected using a self-designed questionnaire which was developed after extensive literature search. It included the demographic profile, height, and weight of the patient to calculate BMI, description of pain (including its duration, location, intensity, alleviating and relieving factors) diagnostic questions of plantar fasciitis [as mentioned earlier in Figure 1], previous treatment, and characteristics of their routine footwear (heel height, sole thickness and type of insole). Heel height was categorized as low/minimal (<0.5 cm), moderate (0.5 to 4 cm) or high (>4 cm) on basis of effect of heel height on health and comfort of foot.^[15] Different categories of insole on basis of material used includes hard, flexible/rubber, cushioned, and arched. Different myths regarding plantar fasciitis among the general population were also included. The intensity of pain was measured using the Visual Analogue Scale (VAS). Another scale was created to categorize shoes on basis of their description on the basis of evidences provided by different studies.^[11,12,15] Shoes with arched or cushioned insoles, heel height between 0.5 to 4 cm, and thick soles were categorized as appropriate. This category had a score of two or greater. Whereas minimal (<0.5 cm) or high heel (>4 cm), thin soles and insole made up of hard or flexible (rubber) material were categorized as inappropriate. This category had a score of less than two. The validity of the questionnaire was ensured after a detailed review by a certified orthopedic surgeon and then conducting a pilot study.

Data were analyzed using Statistical Package for Social Sciences (SPSS) version 25 by applying descriptive statistics and non-parametric tests such as Chi-square tests. A *P* value of less than 0.05 was considered statistically significant.

Results

Out of 101 patients, 81 were female and 20 were male. The mean age of the participants was 45.25 ± 9.33 years and the mean BMI was 27.6 kg/m^2 (ranging from 25.4 to 39.7 kg/m^2). Amongst them, 68.3% had bilateral heel pain whereas, 19.8% had pain in the left foot and 11.9% in the right foot only. On the pain scale, most people reported a heel pain of eight out of ten. 46.5% of people had pain in the feet for less than a year. The pain was relieved by resting in 78.2% of the patients ($n = 72$). About 94% of the participants' experience heel pain while taking the first few steps in the morning and 92.1% feel pain in their heels after getting up from a sitting position. Further details about heel pain caused by plantar fasciitis are mentioned in Table 1.

Patients reported spending an average of 3.2 ± 3.01 hours of standing consecutively on a hard surface. The majority (97%) of them had no history of a recent foot injury.

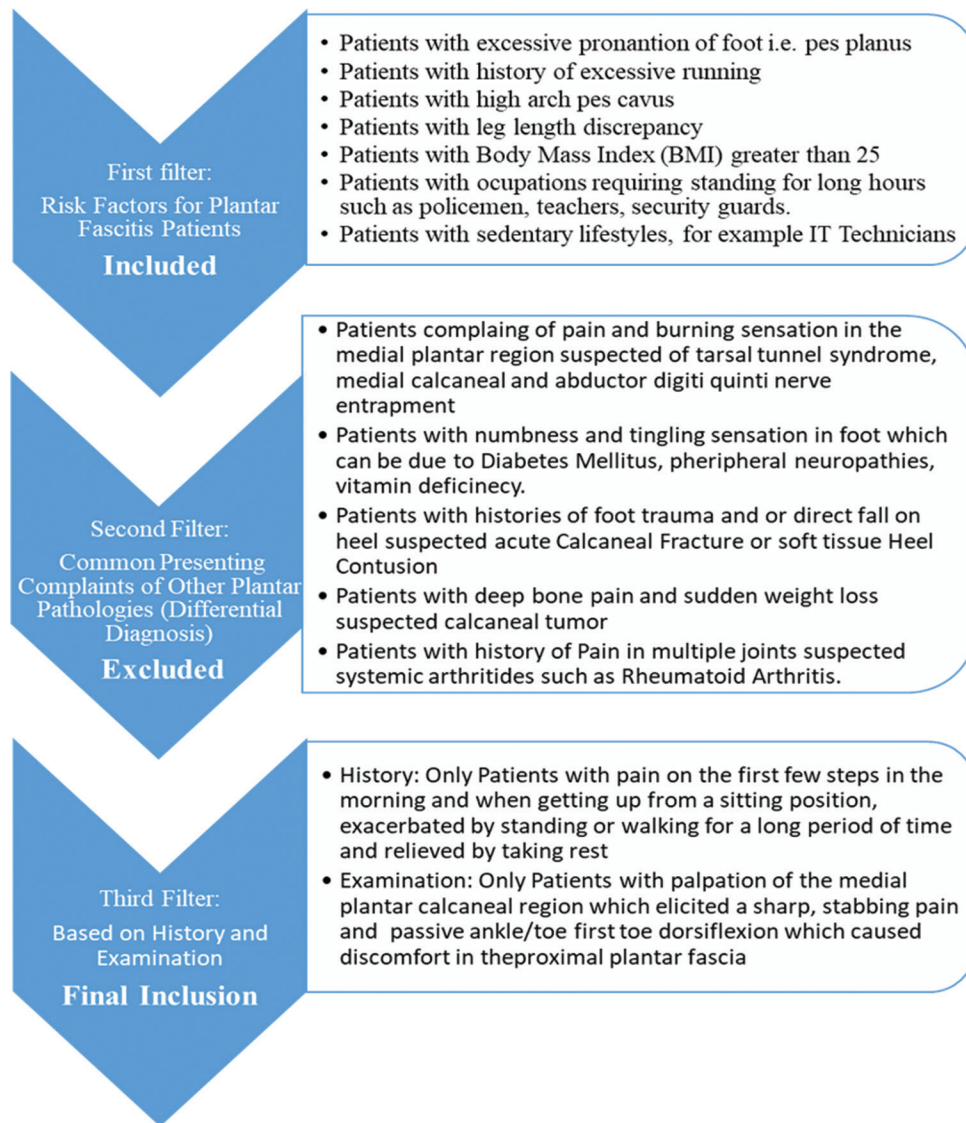


Figure 1: Flow diagram showing inclusion and exclusion criteria of participants

In order to highlight the role of footwear in causing plantar fasciitis details about the routine footwear were collected which is mentioned in Table 2.

There is a significant association between the intensity of pain with heel size as people who wear shoes with minimal heel height experience more severe pain. ($P < 0.001$). Similarly, shoes with thin soles cause more intense pain ($P 0.01$). Heel height also had an influence on the pain associated with long-standing hours ($P < 0.001$).

About 47.5% received no previous treatment for Plantar Fasciitis, 32.7% took painkillers, 7.9% injections, 7.9% physical therapy, and only 4% were using orthotic insoles/heel pads. Different beliefs of people regarding plantar fasciitis are discussed in Table 3. There is a significant association between the misconception about plantar fasciitis being an untreatable illness with the duration of disease ($P < 0.001$).

The role of footwear in causing plantar fasciitis cannot be ignored as 83.2% of the people wear inappropriate shoes, whereas only 16.8% wear the recommended shoes, i.e., with heel height between 0.5-4 cm, thick soles, and arched or cushioned insoles. Furthermore, there is a significant association between the use of inappropriate footwear with the intensity of heel pain ($P 0.01$), as those who wear the wrong shoes experience more severe pain.

Discussion

Plantar Fasciitis is the most common cause of pain in the infracalcaneal region. It interferes with daily activities and causes significant discomfort and disability for the patient. Routine footwear plays an important role in causing plantar fasciitis and unfortunately, about 83% of our participants wear inappropriate footwear having a minimal heel, thin soles, and hard insoles without any built-in arch support.

Table 1: Characteristics of heel pain

Variable	Frequency	Percentage
Time since onset of pain		
Less than a year	47	46.5
One to two years	24	23.8
Three to four years	15	14.9
Five years or longer	15	14.9
Time duration in which the pain improves (with ambulation):		
Instantaneously	08	7.9
<10 min	31	30.7
Between 10 to 30 min	39	38.6
More than 30 min	23	22.8
Pain aggravated by:		
Standing for a long period of time	97	96.0
Walk/exercise	65	64.4
Walking barefoot	12	11.9
Location of pain:		
Bottom of the heel	74	73.3
Radiating to mid sole	12	11.9
Ball of the foot	9	8.9
The rim of the heel	6	5.9

Table 2: Characteristics of routine footwear

Daily Footwear Characteristics	Frequency	Percentage	Association of the intensity of heel pain with footwear (P)
Heel size			<0.001
Minimal (<0.5 cm)	83	82.2	
Medium (0.5-4 cm)	16	15.8	
High (>4 cm)	02	02.0	
Sole thickness			0.01
Thin	83	82.2	
Thick	18	17.8	
Material of insole			0.16
Hard	55	54.5	
Flexible	21	20.8	
Cushioned	18	17.8	
Arched	07	06.9	

Table 3: Myths regarding plantar fasciitis

Myths	Frequency	Percentage
This disease is hereditary.	10	09.9
It is untreatable.	25	24.8
It is caused by wearing inappropriate shoes	42	41.6
It is caused by walking barefoot.	15	14.9
Icepacks can reduce pain.	10	09.9

In this study 80.2% of the diagnosed cases of plantar fasciitis were females and 19.8% were males. The higher prevalence in females as compared to males was shown in different studies conducted in the past.^[1,16] Whereas, a study conducted in the Saudi population concluded that it is not gender-specific.^[2] This difference can be explained by behavioral differences in seeking primary health care in different genders as females are more concerned about their health than males.^[17] The mean age of participants in our study was 45.25 ± 9.33 years with a range between 25 to 65 years. This was in accordance with

other researches done on plantar fasciitis stating peak incidence between 40 to 60 years of age.^[9,18,19]

In our study, most people with plantar fasciitis reported having heel pain of intensity eight on the visual analog scale of pain which is interpreted as an intense pain affecting the physical activity of the respondent. A survey by American Podiatric Medical Association in 2014 on 1000 US adults stated that 51% of the respondents have their daily activities restricted because of foot pain.^[7] Another study also showed that plantar fasciitis patients visited their physicians because of heel pain restricting them from performing their daily activities.^[9] This is in congruence with our results as patients complained that the intensity of heel pain increased with prolonged standing in 96% and walking or exercising in 64%, disabling them to perform their routine work.

In our study, about 41.6% believed that wearing inappropriate shoes can cause plantar fasciitis. This is in congruence with a heel pain survey by the American Podiatric Medical Association which revealed that 45% of people considered wearing ill-fitted or uncomfortable shoes cause heel pain.^[6] A study conducted on people presenting with heel pain in primary hospitals of the Kingdom of Saudi Arabia also that showed 58.3% of people with plantar fasciitis wore inappropriate shoes.^[2]

About 82% of our participants reported to wear shoes with minimal heels and showed a significant association between more intense heel pain with low heel height. A study was planned in 2013 to determine the appropriate heel height for shoes concluded that both flat (<0.05 cm) and high (>4 cm) heeled shoes had adverse effects on the health and comfort of feet. Increasing the heel height to a certain height (<4 cm) reduces the pressure on the heel and plantar fascia and thus can improve the condition.^[15]

Different studies have shown that the use of orthotic insoles, custom foot orthoses, and heel pads have proved to be beneficial in improving plantar fasciitis symptoms.^[20,21] A randomized control trial conducted in 2008 on athletes showed that cushioned-shoes are effective in reducing plantar heel pressure.^[22] In contrast to this all, routine footwear of only 17.8% of participants has cushioned insoles, and only 6.9% wear shoes that support the foot arch. Only four percent were using orthotic insoles or heel pads to improve pain associated with plantar fasciitis. Thus, it can be concluded that people should be informed about the use of shoes with arched or cushioned insoles as it reduces strain on the plantar fascia and provides support to foot arches and thus, are effective in preventing plantar fasciitis.

Plantar fasciitis is an important public health disorder that is often overlooked. The current prevalence of this disease is uncertain but it seems to be more than what is stated in the literature. Health education programs should be conducted in order to educate people about the role of footwear and other risk factors in developing plantar fasciitis, which is considered a preventable condition.

In short, our study hypothesized that wearing shoes with minimal heel height, thin sole, and hard insole without arch support contributes toward development of plantar fasciitis but we implemented a cross-sectional study, which was the first step in the long journey to assessing the role of footwear in causing plantar fasciitis, thus it needs further reinforcement to reach the end objective of raising awareness in the general population about plantar fasciitis and considering inappropriate footwear as a risk factor for developing plantar fasciitis. Also, our study was conducted in the orthopedics' outpatient department of only one center, it is recommended to the future researchers of this topic to arrange a multicenter study including the patients presenting to the general practitioners.

Hence, it can be concluded that footwear plays an important role in causing plantar fasciitis as the majority of the diagnosed cases wear inappropriate shoes with minimal heel height, thin sole, and hard insole without any built-in arch support. Participants who wear inappropriate footwear experience more severe heel pain as compared to others. A firm understanding of the long-term impact of routine footwear on plantar fasciitis is essential as a slight change in selecting shoes could prevent substantial discomfort and disability experienced. It is also important for optimizing footwear design to ensure the comfort and health of the person wearing them.

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Conflicts of interest

There are no conflicts of interest.

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