

EPIDEMIOLOGY OF PLANTAR FASCIITIS & ITS MODIFIABLE DETERMINANTS DURING REPRODUCTIVE AGE IN FEMALES

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Abstract-

Background: Heel pain is getting very common in females. About 80% of heel pain is due to Plantar fasciitis. It is the inflammation of a thick tissue underneath the foot that makes the foot arch. It affects both physically active and sedentary individuals. Plantar fasciitis can subside if risk factors are adjusted and treatment started as early as possible.

Objective: To find the prevalence of Plantar fasciitis and its association with different risk factors and physical activity in females.

Study Design: Analytical/Cross-sectional study using non-probability and convenient sampling.

Methodology: This study was conducted on 189 females of age between 15 to 49 in the Gujrat district. A self-structured questionnaire was developed to find the risk factors among the target population. Godin Leisure Time Questionnaire was used to assess the effect of physical activity on plantar fasciitis. Windlass test was used to diagnose plantar fasciitis. The Chi-square test was applied to find out the p-value for an association between variables.

Results: The prevalence of planter fascia was 38.62% among females. There was a significant relationship found between plantar fasciitis and BMI ($p < 0.001$), active lifestyle ($p = 0.03$) and shoe wearers without heel pads ($p = 0.003$). In the current study, 49% of sufferers were living an active lifestyle. Collectively 55.40% of women were wearing shoes without heel pads either fairly many times or always, 47% with more than normal BMI (24.9) had acquired plantar fasciitis.

Conclusion: Plantar fasciitis is quite common among females. Being overweight or obese, wearing shoes without heel pads, high level of physical activity on regular basis are the risk factors of plantar fasciitis.

Index Terms-

Plantar fasciitis, Heel pain, BMI, Foot pain, Risk Factors, podiatry

INTRODUCTION

About 11-15 percent of foot complaints are due to plantar fasciitis¹. Plantar fasciitis is a prevalent condition that affects one out of every ten people at some point in their lives.² Plantar fasciitis is quite widespread in the United States, with millions of people suffering from heel discomfort each year³. Also in Saudi Arabia, a study done by Suzan discovered that heel pain accounts for 41.5% of musculoskeletal disorders among nurses.⁴ Because of the important role of the plantar fascia during human gait, it is also a major public health issue and a disabling ailment.⁵ Because of the less & uneven effect of conservative therapy, determining risk factors are the best option to treat pathology. People with PF frequently experience a slow development of heel discomfort that is worst in the morning or after a period of inactivity.⁶

The plantar fascia comprises three segments that all originate from the calcaneus and play a crucial function in appropriate foot biomechanics. Motiffard explained that Plantar fascia is a triangular structure starting from the sole calcaneum and giving its attachment on forefoot on planter side with two ligaments, the collateral ligaments and deep transverse metatarsal ligaments. Deterioration of the planter fascia may lead to plantar fasciitis. Its key factors are the flexibility of plantar flexors, foot posture, obesity and heel spurs.⁷

One out of every ten people may feel heel pain at some point in their lives. PF is more frequent in middle-aged and obese females and young male athletes, has a greater frequency among the athletic community, although not all sufferers will require medical treatment. In the literature, PF has been

labelled as painful heel syndrome, runner's heel, calcaneal periostitis, persistent plantar heel pain and heel spur

syndrome³ Plantar fasciitis is the most prevalent cause of persistent heel pain in adults, affecting both active and sedentary people.⁸

The disease is multifaceted. It has been linked to aging, obesity, low physical activity, pes cavus and planus, long-distance runners, and individuals with long-standing. It is also characterized primarily by plantar fascia degradation caused by recurrent micro-tears that cause an inflammatory response locally with no systemic consequences.⁹ Plantar fasciitis is the most prevalent cause of persistent heel pain in adults, affecting both active and sedentary people.⁸ Another study stated that the Function of the plantar fascia is compromised by a number of predisposing factors, including excessive standing or prolonged weight bearing, rapid increase in activity levels, inadequate stretching, age, prolonged periods of walking or running, obesity, improper footwear, hard soles of footwear, as well as biomechanical disorders like pes planus, pes cavus and others. Such factors would cause pathologic pressure over the plantar fascia's calcaneal insertion, which might lead to micro tears in the fascia and eventually perifascial edema. They would also result in thicker heel pads, which would interfere with the foot's normal biomechanics and eventually reduce force absorption capacity. As a result, the plantar fascia would experience more stress, which would accelerate the degenerative processes.^{10, 11}

There are many different types of orthotic shoes available, ranging from over-the-counter manufactured shoe inserts like heel pads of silicon, or rubber heel cups to custom-built orthotics. The goal of orthotic therapy is to alleviate tension on the plantar fascia by raising the heel, supporting the medial arch, and providing comfort. It is a valuable technique for people who are overweight.¹² Chronic plantar fasciitis is treated with anti-inflammatory therapies¹³

This research aimed to check the prevalence of plantar fasciitis among females and to find the major disease-leading risk factors. So, people could avoid them. Its secondary goal was to find the association of plantar fasciitis with physical activity to help mankind in solving problems related to heel pain which are faced from time to time and to make life more comfortable and entertaining. Many diseases can be prevented by addressing the risk factors leading to them.

Methodology

This cross-sectional study was carried out on females of reproductive age (14 to 49) years who were selected by non-probability convenient sampling from

female general population of Gujrat between August to October 2022. Sample size (n=189) was calculated using the below-mentioned formula;

$$n = (Z_{1-\alpha/2})^2 \cdot P \cdot (1-P) / d^2$$

In the formula, $Z_{1-\alpha/2} = 1.96$ at 95% confidence interval, $d = 0.05$ marginal error or effect size and anticipated proportion ($p = 0.87$) was applied. Females with a recent foot fracture, heel spur, diagnosed foot deformity or any kind of arthritis were excluded from the study.

The Windlass test was performed to diagnose plantar fasciitis. It is a widely used and clinically accepted test to diagnose the plantar fasciitis. The test was performed with the ankle in a neutral position (90 degrees) and by extending the first or all Metatarsophalangeal joints (MTJ). If the patient's plantar heel discomfort aggravates, then the test was declared positive.¹⁴ Visual Analogue Scale (VAS) was used to assess the intensity of heel pain.

Godin Leisure-Time Physical Activity Questionnaire was used to determine the level of a sedentary and active lifestyle in target population to identify the risk factors. The overall weekly leisure activity score was calculated using the following formula.

The Score for weekly leisure-time activity = $(9 \times \text{Strenuous}) + (5 \times \text{Moderate}) + (3 \times \text{Mild})$ ¹⁵

Patients were considered physically active if the Godin score was ≥ 24 while those with a score ranging between 14 to 23 were classified as moderately active. Patients with a score less than 14 were considered physically inactive or sedentary.

A self-structured questionnaire was undertaken by the target population to collect the socio-demographic data (e.g., age, occupation & marital status) and identify the modifiable Risk factors (e.g. BMI, long-standing, kind of footwear and level of physical activity). BMI was calculated by using height and weight. Long-standing was considered if the person was standing for 6-8 hours a day on regular basis.

Prior to the investigation, a pilot study with 40 patients was conducted to make sure the questionnaire used to determine risk factors was reliable and standardized.

Ethical consideration:

The rules and regulations set by the ethical committee of the university of Lahore were followed while conducting the research. Written consent was taken from all the participants who were willing. Data was kept confidential. The subjects were informed that there are no disadvantages or risks in the procedure of the study and they are free to withdraw.

Statistical analysis:

Data were entered with Statistical Package for Social Sciences (SPSS) version 24, IBM Corp. Released in 2016. For descriptive analysis, mean and standard deviation were calculated for quantitative variables whereas frequency and percentages were used for qualitative variables. For the inferential statistics to find significance an appropriate statistical test was applied. All results were calculated at 95% confidence interval and p-value ≤ 0.05 was considered as a significant value.

Results

A sample of 189 reproductive females was selected from Gujrat. Mean age of the participants was 28.88±9.3 years. Mean weekly leisure time activity score of participants was observed 37.24± 24.86. Mean BMI was 23± 5.53 Kg/m². (Table 1)

Table 1: Mean and standard deviation of all the variables

Variables	Mean	S.D
Age of participant (Years)	28.88	9.39
Height of participant (m)	1.64	0.08
Weight of participant (Kg)	62.13	14.33
BMI value of Participants (Kg/m ²)	23.16	5.53
Weekly Leisure time- activity score of Participant	37.24	24.87

Plantar fasciitis is a self-limiting condition .It can be subsided by itself but the unbearable pain limits the daily activities and the patients seek medical treatment immediately. In the current study, most of the sufferers were housewives by occupation.Prolong standing was also an effective factor leading to the

plantar fasciitis . The prevalence of plantar fasciitis was 73(38.62%) according to windlass test that is shown in Figure 1.

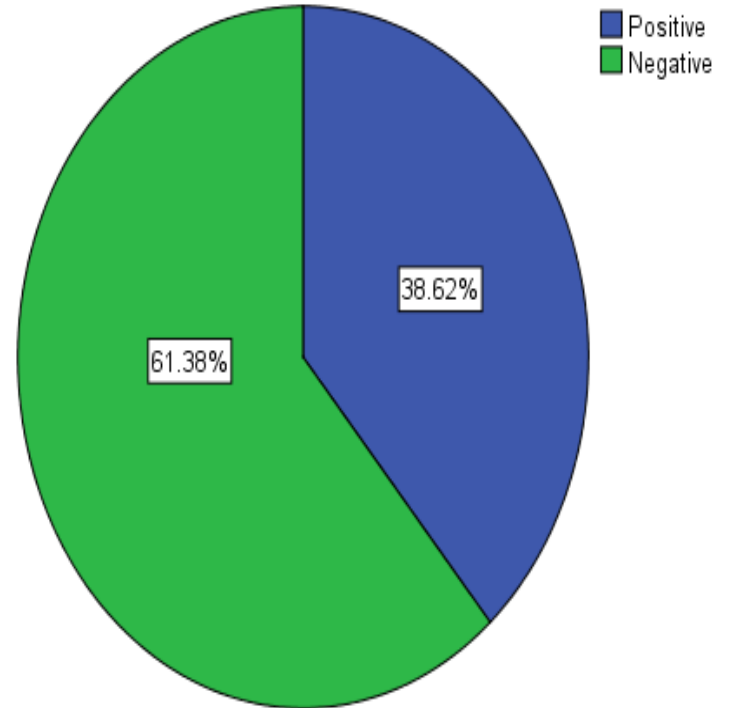


Figure.1: Prevalence of plantar fasciitis among females

After analysis of the risk factors in relation to plantar fasciitis, we found a significant relation of a few factors with plantar fasciitis which includes individuals with active lifestyle, shoe wearers without heel pads and higher BMI. Numerically (49%) of the sufferers were living an active lifestyle, (28%) and (27.40%) were wearing shoes without heel pads either fairly many times or always respectively. (43.80%) were having normal weight and (28.80%) were overweight, (7.8%) were obese. Collectively, women (47%) with more than normal BMI (24.9) were more prone to plantar fasciitis. Wearing heels(p=0.39), shoes with thin soles(p=0.25) and tight shoes (p=0.52) did not have a significant relationship with plantar fasciitis. There was a significant relationship between plantar fasciitis and BMI(p<0.001), active lifestyle (p=0.03)and wearing shoes without heel pads (p=0.003) (table 2). Results declare that BMI,active lifestyleand wearing shoes without heelpad can cause plantar fasciitis.

Table 2. Comparison of Risk factors among females with & without Plantar fasciitis

Risk Factors	Responses	Plantar fasciitis, n (%)			Chi square	P-value
		Positive	Negative	Total		
Occupation of Participant	Student	20(27.40)	48(41.40)	68(36)	5.86	0.12
	Housewife	36(49.3)	39(33.60)	75(39.70)		
	Job holder	17(23.3)	28(24.10)	45(23.80)		
	Other	0(0)	1(0.90)	1(0.50)		
Do you stand for about 8 hours in a day (prolonged standing)	Yes	39(53.40)	46(39.70)	85(45)	3.43	0.06
	No	34(46.60)	70(60.30)	104(55)		
Do you wear tight shoes?	Never	41(56.20)	59(50.90)	100(52.90)	1.96	0.58
	Occasionally	21(28.80)	41(35.50)	62(32.80)		
	Fairly many times	7(9.60)	13(11.20)	20(10.60)		
	Always	4(5.50)	3(2.60)	7(3.70)		
What is your health status?	Underweight(<18.5)	7(9.60)	17(14.70)	24(12.70)	18.82	<0.001*
	Normal(18.5-24.9)	32(43.80)	78(67.20)	110(58.20)		
	Overweight (25-29.9)	21(28.80)	16(13.80)	37(19.60)		
	Obesity (>30)	13(17.80)	5(4.30)	18(9.50)		
Do you wear shoes without arches?	Never	23(31.50)	40(34.50)	63(33.30)	5.89	0.12
	Occasionally	19(26)	36(31.00)	55(29.10)		
	Fairly many times	14(19.20)	28(24.10)	42(22.20)		
	Always	17(23.3)	12(10.30)	29(15.30)		
Do you wear heels?	Never	34(46.60)	40(34.50)	74(39.20)	3.01	0.39
	Occasionally	19(26)	40(34.50)	59(31.20)		
	Fairly many times	13(17.80)	25(21.60)	38(20.10)		
	Always	17(9.60)	11(9.50)	18(9.50)		
Do you wear shoes with thin soles?	Never	20(27.40)	31(26.70)	51(27)	4.09	0.25
	Occasionally	15(20.50)	33(28.40)	48(25.4)		
	Fairly many times	21(28.80)	37(31.90)	58(30.7)		
	Always	17(23.3)	15(12.90)	32(16.90)		
Do you wear shoes without heel pads?	Never	15(20.50)	47(40.50)	62(32.80)	8.83	0.03*
	Occasionally	17(23.3)	25(21.60)	42(22.20)		
	Fairly many times	20(27.40)	22(19)	42(22.20)		
	Always	21(28.80)	22(19)	43(22.80)		
Your level of physical activity during the day?	Active (>23)	35(47.90)	84(72.40)	119(63)	11.69	0.003*
	Moderately active (14-23)	29(39.70)	23(19.80)	52(27.50)		
	Insufficiently active/Sedentary(<14)	9(12.30)	9(7.80)	18(9.50)		

Discussion

Cross-sectional studies are important to find the magnitude of certain issues and to address the problems related to them. About 10% of the population is affected with Plantar fasciitis. Planter fascia plays an important role in normal gait and foot health. An inflamed fascia can interrupt your daily activities.

Although PF is the most frequent soft-tissue cause of heel discomfort, the exact origin is unknown. The disorder is thought to be complex, and many risk factors have been linked to its emergence. There is little proof for these elements, and it's unclear how important they are in relation to one another. Many causes have been proposed, including long standing, running, heel spur , overweight , improper footwear.

According to a recent study on nurses, female nurses are more likely to acquire plantar fasciitis than male nurses.¹⁰ Females are more likely to develop bilateral PF with discomfort impacting both heels and lowering quality of life. While further studies are required to verify these findings and investigate additional risk variables more typically reported in females,¹⁶. There are various studies showing that women are more affected by plantar fasciitis but still there are some variations. Our study focused only on females to get better and more precise results. It showed a high prevalence of plantar fasciitis among females and most of them were housewives with a mean age of 28.82.

The plantar fascia's biomechanical stress at its insertion of the calcaneal tuberosity is the most typical cause of plantar heel discomfort. The cause of mechanical stress, whether it's obesity, employment, improper shoe wear biomechanical flaws could be anyone but they all can lead to heel pain¹⁷. In our study collectively 53.4 % of women were suffering from mild to severe heel pain and 38.62% of the total women had acquired plantar fasciitis.

Table 3 : Shows the Heel pain severity in participants

HeelPain Severity calculated through Visual analogue scale	0(No pain)	88(46.6)
	1-3(Mild)	34(18)
	4-6(Moderate)	35(18.5)
	7-9(Severe)	21(11.1)
	10(Worst pain)	11(5.8)

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initiated in the planter heel by taking a few steps after a prolonged period of indolence and a positive windlass test indicates the plantar fasciitis¹⁸. Plantar fasciitis causes pain on weight-bearing in the medial plantar portion of the heel.¹⁹ Our study demonstrated that about 39% of women were suffering from plantar fasciitis by using the windlass test and vas scale showed a degree of mild to worst heel pain in all of them. Pain near the calcaneal tubercle after passive dorsiflexion of toes indicated a positive test.

The current study showed statistical significance with BMI. Gariana etal conducted a research about plantar fasciitis in the diabetic population and concluded that diabetic patients are particularly vulnerable to plantar fasciitis due to the existence of frequent hazards such as being overweight and a sedentary lifestyle.⁹. Our study also concluded that being overweight and obese is a major risk factor leading to plantar fasciitis.

A recent study showed that compared to men, women with plantar fasciitis had lower health-related quality of life scores for foot pain, foot function, footwear, and overall foot health²⁰Footwear is significant in the development of plantar fasciitis since the majority of diagnosed patients wear improper shoes with a low heel height, a flat and thin sole, and a firm insole without arch.²¹.According to another study age range 20-40, hard shoe wear, field employment, and extended standing (more than eight hours) were shown to have a substantial connection with plantar fasciitis²²Plantar fasciitis is more likely to develop in occupations that require prolonged standing or walking. Plantar fasciitis was also linked to middle age, extended exercise, and tight gastrocnemius muscles.²³Coinciding with all these studies the current study also showed high prevalence of plantar fasciitis in females with extensive standing and in improper shoe wearers (without heel pad) .Plantar fasciitis can be relieved if we exclude these factors from our lives.

In a study conducted in 2019, no statistically significant relation was found between body mass index and plantar fasciitis but patients' foot functional index indicated that foot pain and disability were high in overweight patients and interrupted their daily life activities. This study was limited by the low sample size and response rate²⁴ while our study discovered a significant value of being over body weight with

plantar fasciitis. Another recently done study claims increased plantar flexion ROM, BMI, and body mass as the key risk factors for PF in a physically active population. They exert an increasing tensile stress on force-absorbing material of the foot's plantar surface⁶. Another study stated that, as a result of the statistical analysis conducted on middle-aged Iraqi women who had acute sharp painful heels at the start of walking plus calcaneal spur in the lateral X-ray, it can be clearly stated that Plantar Fasciitis is evidence for obesity.²⁵ The current study reveals that Body weight of an individual plays a great role in his physical health. Excessive BMI leads to many degenerative issues and plantar fasciitis is one of them. An overweight and obese woman is relatively more prone to plantar fasciitis than a woman with normal health status. But still, it affects both. And people with active lifestyles are more prone for having plantar fasciitis than sedentary individuals.

We can address these factors by lowering BMI and wearing appropriate shoes with heel pads. Conservative treatment like stretching exercises, fascia retraining, shoe insoles, and shockwave therapy relieves pain completely or adequately in 90-95% of patients after one year.¹⁹ The findings of another study done by Nakhaee showed that foot orthoses based on dynamic plantar pressure can reduce plantar fascia thickness and problems associated with plantar fasciitis while increasing daily activity, quality of life, and sports participation.²⁶ so it is much more important to use good shoe soles and with proper heel bed.

Due to Long Standing, and being overweight people develop plantar fasciitis that causes heel pain.

This research is limited to a small population and done by using non-Probability convenient sampling. So, it is advised to conduct this research on a large scale and by using Probability sampling to find the more definite factors that can lead to plantar fasciitis so that they can be addressed to avoid future complications.

Conclusions

Plantar fasciitis is quite common among females. Being overweight or obese, high level of physical activity and improper shoe wear plays a great role in developing plantar fasciitis. Women with these risk factors are more prone to have plantar fasciitis than women without risk factors. Occupation, tight shoes, heels or shoes without arch did not have a significant relation with plantar fasciitis. Women should tend to wear medicated shoes with proper heel pads and avoid standing for a long time

while overweight and obese females should lower their weight. Primary preventions are important to be taken to avoid plantar fasciitis.

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Conflict of interest:

There was no conflict of interest.

Abbreviations:

BMI	Body mass index
MTP	metatarsophalangeal
ROM	Range of motion
PF	Plantar fasciitis
APTA	American physiotherapy association
VAS	Visual analogue scale
GSLTPAQ	Godin-Shephard Leisure-Time Physical Activity Questionnaire

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