

Clinical, Socio-Demographic and Occupational Profile and Associated Factors of Plantar Heel Pain: A Hospital-Based Cross-Sectional Study

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Abstract

Background: Plantar heel pain is one of the most common musculoskeletal complaints encountered in orthopedic practice and is frequently attributed to plantar fasciopathy. It can significantly interfere with walking, occupational activities and quality of life. Several demographic, occupational and metabolic factors, including increasing age, prolonged standing, increased body mass index (BMI), inappropriate footwear and structural abnormalities, have been implicated in its development. Ultrasonography provides a useful non-invasive method for assessing plantar fascia thickness and associated abnormalities.

Aim: To study the clinical, socio-demographic and occupational profile of patients with plantar heel pain and

to evaluate selected factors associated with plantar heel pain.

Materials and Methods: A hospital-based cross-sectional study was conducted among 66 participants aged 18–60 years attending the Orthopedic Outpatient Department of a tertiary care hospital. Participants were enrolled using consecutive sampling. Sociodemographic and occupational information, clinical symptoms, anthropometric measurements, footwear, thyroid status and radiological findings were recorded using a predesigned proforma. Plantar fascia thickness was assessed by ultrasonography, and thyroid function tests were performed. Associations were assessed using the Chi-square/Fisher's exact test, and multivariate logistic regression was used to identify independent predictors.

Results: Among 66 participants, 24 (36.4%) had plantar heel pain. The highest proportion belonged to the 31–40-year age group (30.3%). Males constituted 57.6% of the study population. Plantar heel pain was significantly associated with age ($p=0.03$), standing for >6 hours/day ($p=0.01$), occupational standing ($p=0.03$), footwear ($p=0.04$), thyroid disorder ($p=0.02$), BMI ($p=0.01$), calcaneal spur ($p=0.01$) and plantar fascia thickness >4 mm ($p<0.001$). Early morning pain was present in 83.3% of participants with plantar heel pain. On multivariate analysis, calcaneal spur, prolonged standing, BMI category and thyroid disorder remained significant predictors.

Conclusion: Plantar heel pain was common in the study population and was associated with several occupational, anthropometric, metabolic and structural factors. Prolonged occupational standing, increased BMI, thyroid disorder, calcaneal spur and increased plantar fascia thickness were important associated factors. Recognition of these factors may facilitate earlier diagnosis, preventive counselling and appropriate management.

Keywords: Plantar Heel Pain, Plantar Fasciitis, Plantar Fascia, Ultrasonography, BMI, Prolonged Standing, Footwear, Thyroid Disorder, Calcaneal Spur.

Introduction

Plantar heel pain is a common musculoskeletal disorder and an important cause of disability in adults. It is frequently encountered in orthopedic and primary-care practice and may interfere with walking, standing, occupational activities and routine daily functioning. Plantar fasciitis, more appropriately termed plantar fasciopathy in many contemporary publications, is considered one of the principal causes of plantar heel pain. The condition usually results from repetitive mechanical loading of the plantar fascia at its calcaneal

attachment rather than from an isolated acute inflammatory process.¹⁻³

The plantar fascia is a strong fibrous connective-tissue structure extending from the calcaneal tuberosity toward the toes. It plays an important role in maintaining the longitudinal arch of the foot and in transferring forces during weight bearing and gait. Repeated tensile loading can produce microscopic tissue injury and degenerative changes at its calcaneal insertion. Patients typically present with pain around the medial plantar aspect of the heel, particularly during the first few steps after waking or after a period of rest.¹⁻⁴ The clinical diagnosis of plantar heel pain is primarily based on a detailed history and physical examination. Classical findings include tenderness over the medial calcaneal tuberosity, pain during the first few steps in the morning and discomfort following prolonged sitting or standing. Passive dorsiflexion of the toes may reproduce symptoms by stretching the plantar fascia. Imaging is generally not essential for straightforward cases but becomes useful when symptoms are atypical, persistent or when alternative causes of heel pain need to be excluded.^{1,2,5} The burden of plantar heel pain is substantial, particularly among middle-aged and older adults. Population-based research has demonstrated that plantar heel pain is associated with impaired physical function and reduced health-related quality of life.⁶ The condition is also influenced by multiple interacting risk factors rather than by a single cause. Age, body weight, occupational loading, physical activity, foot biomechanics and footwear may all contribute to the development or persistence of symptoms.^{2,6-8}

Body weight is an important modifiable factor. Increased BMI increases the mechanical load transmitted through the plantar surface of the foot. A systematic review and

meta-analysis demonstrated a consistent association between higher BMI and plantar fasciopathy, with BMI >27 kg/m² associated with substantially increased odds of plantar fasciopathy, particularly among non-athletic populations.⁷ Similarly, a systematic review in physically active individuals identified increased BMI and body mass among important risk factors.⁸ Occupational exposure is another potentially important determinant. Individuals whose work requires prolonged standing or walking may experience repeated loading of the plantar fascia over many hours. Evidence concerning occupational weight bearing has historically been heterogeneous, but systematic review data suggest an association between plantar fasciitis and prolonged weight-bearing activities, including standing and walking on hard surfaces.⁹ Therefore, occupational history should form an important part of the evaluation of patients presenting with plantar heel pain¹⁰.

Ultrasonography is increasingly used as a non-invasive adjunct in the assessment of plantar fascia pathology. Increased plantar fascia thickness, reduced echogenicity and perifascial changes have been described in symptomatic patients. A plantar fascia thickness greater than approximately 4 mm has traditionally been considered suggestive of plantar fasciitis, although measurement technique and foot position can influence the observed value.¹¹⁻¹³ Recent studies have also demonstrated the usefulness of ultrasound and shear-wave elastography in differentiating plantar fasciitis from other causes of heel pain.¹²⁻¹⁴ The present study therefore included thyroid function assessment to explore whether thyroid abnormalities were associated with plantar heel pain. Calcaneal spurs are another frequently observed radiological finding in patients with heel pain. Although a calcaneal spur should not automatically be considered

the cause of plantar heel pain, its presence may reflect chronic mechanical loading or plantar fascia enthesopathy. Imaging therefore has value in selected patients, particularly when structural abnormalities are suspected.^{5,13}

Despite the high frequency of plantar heel pain, the relative contribution of occupational, anthropometric, footwear, endocrine and structural factors may vary between populations. A hospital-based assessment of these factors can help identify potentially modifiable risks and improve clinical evaluation. The present study was therefore undertaken to evaluate the clinical and socio-demographic profile of individuals attending an orthopedic outpatient department and to determine selected factors associated with plantar heel pain.

Materials and Methods

Study design

A hospital-based cross-sectional study was conducted among adults attending the Orthopedic Outpatient Department of a tertiary-care hospital. The study duration was two years.

Study population

Participants of either sex aged 18–60 years attending the orthopedic OPD and fulfilling the predefined eligibility criteria were included.

Inclusion criteria

1. Age 18–60 years.
2. Participants having fixed duty hours.
3. Willingness to participate and provide written informed consent.

Exclusion criteria

1. Irregular or infrequent working hours.
2. Age outside the specified range.
3. Individuals unwilling to participate.

Sample size

The sample size was calculated using the formula:

$$n = Z^2pq/d^2$$

A previous prevalence of 9.6% was used, with a 90% confidence level and an allowable error of 6%. The calculated minimum sample size was 64.8 and the final sample size was taken as 66 participants.

Sampling technique

Consecutive sampling was used. Participants fulfilling the eligibility criteria were enrolled sequentially until the required sample size was achieved.

Data collection

A predesigned and pretested semi-structured proforma was used. Sociodemographic information included age, sex, education, occupation, socioeconomic status and marital status. Occupational variables included type of occupation, duration of employment, working hours, standing hours, duration of standing without rest, footwear and workplace surface.

Clinical assessment

History included site and duration of pain, onset and progression, early morning pain, pain following prolonged standing, walking-related symptoms, aggravating and relieving factors, trauma, previous similar complaints and relevant systemic diseases.

Anthropometric assessment

Height and weight were recorded and BMI was calculated as:

$$\text{BMI} = \text{Weight (kg)} / \text{Height}^2 (\text{m}^2)$$

Participants were categorized according to BMI category.

Local examination

Examination included inspection, palpation over the inferomedial calcaneal tuberosity, plantar fascia assessment, pain on toe dorsiflexion, gait, ankle range of motion and associated musculoskeletal abnormalities.

Ultrasonography and radiology

Ultrasonography was used to assess plantar fascia thickness. Radiological assessment was also performed to identify calcaneal spur and other bony abnormalities. In the study dataset, plantar fascia thickness >4 mm was strongly associated with plantar heel pain.

Thyroid assessment

Serum T3, T4 and TSH were assessed as thyroid function parameters.

Statistical analysis

Data were entered into Microsoft Excel and analyzed using Jamovi version 2.5.2. Quantitative variables were summarized as mean $\pm$ SD and categorical variables as frequencies and percentages. Chi-square or Fisher's exact test was used for categorical associations. A p-value <0.05 was considered statistically significant. Multivariate logistic regression was performed to identify independent predictors.

Results

Table 1: Distribution of Study Participants According to Age(n=66)

Age group	Number	Percentage (%)
18–30 years	18	27.3
31–40 years	20	30.3
41–50 years	16	24.2
51–60 years	12	18.2
Total	66	100.0

Graph: 1

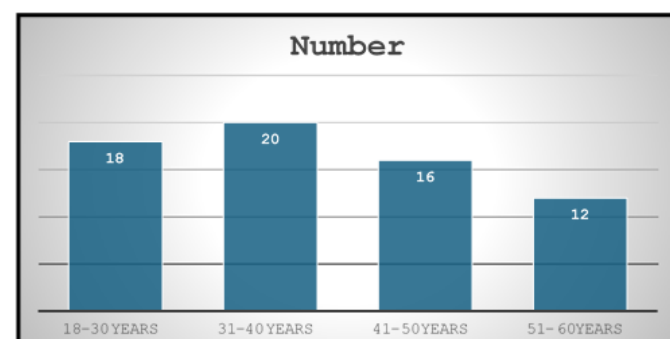


Table 1 shows the distribution of study participants according to age. Maximum participants belonged to the 31–40 years age group [20 participants, 30.3%], followed by 18–30 years [18 participants, 27.3%], 41–50 years [16 participants, 24.2%], and 51–60 years [12 participants, 18.2%].

Table 2: Distribution of Study Participants According to gender(n=66)

Gender	Number	Percentage (%)
Male	38	57.6
Female	28	42.4
Total	66	100.0

Table 3: Distribution of Study Participants According to Occupational Characteristics (n = 66)

Variable	Number	Percentage (%)
Occupation involving prolonged standing	42	63.6
Occupation without prolonged standing	24	36.4
Total	66	100.0

Table 4: Distribution of Study Participants According to Mean Hours of Standing

Standing hours	Number	Percentage (%)
Standing >6 hours/day	30	45.5
Standing ≤6 hours/day	36	54.5
Total	66	100.0

Table 5: Distribution of Study Participants According to Primary Footwear Used

Footwear	Number	Percentage (%)
Slippers	18	27.3
Sandals	16	24.2
Formal Shoes	14	21.2
Sports Shoes	10	15.2
Barefoot	8	12.1

Table 6: Distribution of Study Participants According to BMI Category (n = 66)

BMI Category	Number	Percentage (%)
Normal	24	36.4
Overweight	26	39.4
Obese	16	24.2
Total	66	100

Table 7: Distribution of Study Participants According to Thyroid Status (n = 66)

Thyroid Status	Number	Percentage (%)
Normal	50	75.8
Hypothyroidism	12	18.2
Hyperthyroidism	4	6.0
Total	66	100

Table 8: Prevalence of Study Participants According to Plantar Heel Pain (n = 66)

Plantar Heel Pain	Number	Percentage (%)
Present	24	36.4
Absent	42	63.6
Total	66	100

Table 9: Distribution of Study Participants According to Side of Heel Pain

Side Involved	Number	Percentage (%)
Right	10	41.7
Left	6	25.0
Bilateral	8	33.3
Total	24	100.0

Table 10: Distribution of Study Participants According to Early Morning Pain

Early Morning Pain	Number	Percentage (%)
Present	20	83.3
Absent	4	16.7
Total	24	100.0

Table11: Distribution of Study Participants According to Duration of Symptoms

Duration of Symptoms	Number	Percentage (%)
<1month	4	16.7
1-6 months	14	58.3
>6months	6	25.0

Table 12: Association between Plantar Fascia Thickness and Plantar Heel Pain on Ultrasonography finding

Planter fascia thickness	N	PlantarHeelPain				p value
		Present		Absent		
		N	%	N	%	
<4 mm	41	4	9.76	37	90.24	<0.001

Table 13: Association between age group and Plantar Heel Pain

Age group (years)	N	PlantarHeelPain				p value
		Present		Absent		
		N	%	N	%	
18-30	18	4	22.2	14	77.8	0.03*
31-40	20	6	30.0	14	70.0	
41-50	16	8	50.0	8	50.0	
51-60	12	6	50.0	6	50.0	
Total	66	24	36.4	42	63.6	

Table 13 shows the association between age group and plantar heel pain among study participants. The proportion of plantar heel pain increased with age, being higher in the 41-50 years and 51-60 years age groups. The association was statistically significant ($p = 0.03$), indicating that age group was significantly associated with plantar heel pain.

Table 14: Association between gender and Plantar Heel Pain

Gender	N	PlantarHeelPain				p value
		Present		Absent		
		N	%	N	%	
Male	38	16	42.1	22	57.9	0.18
Female	28	8	28.6	20	71.4	
Total	66	24	36.4	42	63.6	

Table 14 shows the association between gender and plantar heel pain. Plantar heel pain was present among 16 males and 8 females; however, the association was not

statistically significant ($p=0.18$). This indicates that gender was not significantly associated with plantar heel pain in the present study.

Table15: Association between mean hours of standing and Plantar Heel Pain

Standing hours	N	PlantarHeelPain				p value
		Present		Absent		
		N	%	N	%	
<6 hours/day	36	8	22.2	28	77.8	0.01*
>6hours/day	30	16	53.3	14	46.7	
Total	66	24	36.4	42	63.6	

Table 15 shows the association between mean hours of standing and plantar heel pain. Plantar heel pain was more common among participants standing for more than 6 hours per day (16/30,53.3%) compared with those standing for 6 hours or less per day (8/36, 22.2%). The association was statistically significant ($p = 0.01$), suggesting that prolonged standing was significantly associated with plantar heel pain.

Table 16: Association between occupational standing and Plantar Heel Pain

Occupational standing	N	PlantarHeelPain				p value
		Present		Absent		
		N	%	N	%	
Present	42	18	42.9	24	57.1	0.03*
Absent	24	6	25.0	18	75.0	
Total	66	24	36.4	42	63.6	

Table 16 shows the association between occupational standing and plantar heel pain. Plantar heel pain was observed in 18 out of 42 participants with occupational standing compared with 6 out of 24 participants without occupational standing. The association was statistically significant ($p = 0.03$), indicating that occupational standing was significantly associated with plantar heel pain.

Table 17: Association between foot wear and Plantar Heel Pain

Foot wear	N	PlantarHeelPain				p value
		Present		Absent		
		N	%	N	%	
Slippers/Sandals	34	16	47.1	18	52.9	0.04*
Formal/Sports shoes	24	6	25.0	18	75.0	
Barefoot	8	2	25.0	6	75.0	
Total	66	24	36.4	42	63.6	

Table 17 shows the association between footwear and plantar heel pain. The prevalence of plantar heel pain was highest among participants using slippers or sandals (16/34, 47.1%) compared with formal/sports shoes and barefoot categories. The association was statistically significant ($p = 0.04$), suggesting that type of footwear was significantly associated with plantar heel pain.

Table 18: Association between thyroid disorder and Plantar Heel Pain

Thyroid disorder	N	PlantarHeelPain				p value
		Present		Absent		
		N	%	N	%	
Present	16	10	62.5	6	37.5	0.02*
Absent	50	14	28.0	36	72.0	
Total	66	24	36.4	42	63.6	

Table 18 shows the association between thyroid disorder and plantar heel pain. Plantar heel pain was present in 10 out of 16 participants with thyroid disorder compared with 14 out of 50 participants without thyroid disorder. The association was statistically significant ($p = 0.02$), indicating that thyroid disorder was significantly associated with plantar heel pain.

Table 19: Association between BMI category and Plantar Heel Pain

BMI category	N	Plantar Heel Pain				p value
		Present		Absent		
		N	%	N	%	
Normal	24	4	16.7	20	83.3	0.01*
Overweight	26	10	38.5	16	61.5	
Obese	16	10	62.5	6	37.5	
Total	66	24	36.4	42	63.6	

Table 19 shows the association between BMI category and plantar heel pain. Plantar heel pain was more common

among overweight and obese participants compared with participants having normal BMI. The association was statistically significant ($p=0.01$), indicating that increased BMI was significantly associated with plantar heel pain.

Table 20: Association between calcaneal spur and Plantar Heel Pain

Calcaneal spur	N	Plantar Heel Pain				p value
		Present		Absent		
		N	%	N	%	
Present	20	12	60.0	8	40.0	0.01*
Absent	46	12	26.1	34	73.9	
Total	66	24	36.4	42	63.6	

Table 20 shows the association between calcaneal spur and plantar heel pain. Plantar heel pain was present in 12 out of 20 participants with calcaneal spur compared with 12 out of 46 participants without calcaneal spur. The association was statistically significant ($p=0.01$), suggesting that calcaneal spur was significantly associated with plantar heel pain.

Table 21: Multivariate Logistic Regression Analysis of Variables Associated with Plantar Heel Pain

Variable	Adjusted Odds Ratio (AOR)	95% Confidence Interval (CI)	P-value
Standing hours	3.2	1.4-7.1	0.004*
BMI category	2.8	1.2-6.5	0.01*
Thyroid disorder	2.5	1.1-5.8	0.03*
Calcaneal spur	3.6	1.5-8.4	0.002*

Table 21 shows the results of multivariate logistic regression analysis to identify independent predictors of plantar heel pain. After adjustment, calcaneal spur showed the highest odds of plantar heel pain (AOR=3.6, 95% CI:1.5-8.4, $p=0.002$), followed by standing for more than 6 hours per day (AOR=3.2, 95% CI:1.4-7.1, $p = 0.004$), obesity (AOR=2.8, 95% CI:1.2-6.5, $p = 0.01$), and thyroid disorder (AOR = 2.5, 95% CI: 1.1-5.8, $p = 0.03$). Thus, calcaneal spur, prolonged standing, obesity, and thyroid disorder were significant independent predictors of plantar heel pain.

Table 22: Mean Distribution of Anthropometric and Occupational Variables

Variable	Mean±SD
Age(years)	39.6 ± 10.8
BMI(kg/m ²)	27.4 ± 3.6
Mean Standing Hours/day	6.9 ± 2.4
Duration of Employment (years)	11.2 ± 5.8

Table 22 shows the mean distribution of anthropometric and occupational variables among the study participants. The mean age of the participants was 39.6 ± 10.8 years, indicating that most participants belonged to the middle-age group. The mean BMI was 27.4 ± 3.6 kg/m², suggesting that, on average, the participants were in the overweight category. The mean standing hours per day was 6.9 ± 2.4 hours, showing prolonged standing during work. The mean duration of employment was 11.2 ± 5.8 years, indicating considerable occupational exposure over several years.

Discussion

The present hospital-based cross-sectional study evaluated 66 participants and found plantar heel pain in 24 (36.4%). The study demonstrated significant associations between plantar heel pain and several demographic, occupational, anthropometric, metabolic and structural factors. The findings are clinically relevant because plantar heel pain is a multifactorial condition in which mechanical loading, body weight, occupational exposure and local structural abnormalities may interact. The clinical pattern observed in the present study was consistent with the classical presentation of plantar heel pain. Early morning pain was present in 83.3% of participants with plantar heel pain. This finding is consistent with established literature describing pain during the first few steps after waking or following prolonged rest as one of the characteristic features of plantar fasciitis.^{1,2,5} The high frequency of morning pain

in the current study supports the importance of detailed symptom history in the clinical diagnosis. The age distribution showed that the largest proportion of participants belonged to the 31–40-year group, while the prevalence of plantar heel pain increased across the older age categories. The association between age group and plantar heel pain was statistically significant ($p=0.03$). This observation is biologically plausible because cumulative mechanical loading, alterations in connective-tissue properties and age-related changes in foot biomechanics may increase susceptibility to plantar fascial pathology. Population-based research has similarly demonstrated an important burden of plantar heel pain among middle-aged and older adults.⁶

Although males constituted a larger proportion of the study population, gender was not significantly associated with plantar heel pain ($p=0.18$). This suggests that the apparent male predominance may reflect the characteristics of the hospital population rather than an independent effect of sex. Previous literature has reported variable findings regarding sex, reinforcing the importance of considering other mechanical and metabolic factors rather than interpreting sex alone as a major determinant.⁹

One of the most important findings of the present study was the association between prolonged standing and plantar heel pain. Participants standing for >6 hours/day had plantar heel pain in 53.3%, compared with 22.2% among those standing for ≤6 hours/day ($p=0.01$). Furthermore, occupational standing was significantly associated with plantar heel pain ($p=0.03$). These findings are particularly relevant because occupational standing exposes the plantar fascia to repeated and prolonged weight-bearing forces.

Waclawski et al. systematically reviewed occupational weight-bearing and reported evidence of an association between plantar fasciitis and weight-bearing activities such as prolonged standing and walking, although they emphasized that the overall quality of evidence was low.⁹ The current study therefore adds supportive hospital-based data to the existing literature. However, because the present investigation is cross-sectional, prolonged standing should be considered an associated factor rather than proven to be a direct cause. The multivariate analysis strengthened this observation. Participants standing >6 hours/day had an adjusted odds ratio of 3.2 (95% CI 1.4–7.1; $p=0.004$) for plantar heel pain. This indicates that prolonged standing remained independently associated even after adjustment for selected other variables. From a preventive perspective, occupational interventions such as scheduled rest periods, modification of standing surfaces and appropriate footwear may be worth considering.

BMI was another important factor. The present study showed a significantly higher frequency of plantar heel pain among overweight and obese participants. Plantar heel pain occurred in 16.7% of participants with normal BMI, 38.5% of overweight participants and 62.5% of obese participants ($p=0.01$). The mean BMI of the study population was 27.4 ± 3.6 kg/m², indicating that the average participant was overweight. These findings agree strongly with previous evidence. Van Leeuwen et al. found higher BMI to be the most consistent clinical factor associated with plantar fasciopathy, with BMI >27 kg/m² associated with increased odds of the condition.⁷ Hamstra-Wright et al. similarly demonstrated that BMI and body mass were significant risk factors in physically active individuals.⁸ The mechanism is likely multifactorial, with increased body weight increasing

plantar loading and mechanical stress while potentially contributing to altered gait and foot biomechanics. The independent effect of BMI was also demonstrated by multivariate analysis, where BMI category had an AOR of 2.8 (95% CI 1.2–6.5; $p=0.01$). This suggests that weight management may have relevance not only for general health but also for reducing mechanical stress on the plantar foot. Footwear was significantly associated with plantar heel pain in the present study. The prevalence was highest among participants using slippers or sandals, at 47.1%, compared with 25.0% among those using formal/sports shoes and 25.0% among barefoot participants ($p=0.04$). This finding is clinically interesting because footwear influences cushioning, arch support, pressure distribution and stability.

Evidence from intervention studies also supports the importance of mechanical support. Vicenzino et al. demonstrated that contoured orthosis-shaped sandals were effective for plantar heel pain and performed better than flat sandals in certain outcomes.¹⁶ A randomized clinical trial comparing foot orthoses and corticosteroid injection also demonstrated that orthotic approaches have a role in managing plantar heel pain.¹⁷ Thus, footwear counselling may represent a relatively simple component of preventive and conservative management.

The study also demonstrated a strong relationship between ultrasound plantar fascia thickness and plantar heel pain. Among participants with plantar fascia thickness >4 mm, 80% had plantar heel pain, compared with only 9.76% among those with thickness <4 mm ($p<0.001$). This is consistent with previous imaging literature demonstrating thickening of the plantar fascia in plantar fasciitis.

Abul et al. reported that plantar fascia thickness was generally below 4 mm in asymptomatic adults and

described >4 mm as a meaningful threshold.¹¹ Similarly, high-resolution ultrasonography has demonstrated substantial diagnostic utility, with symptomatic patients showing increased plantar fascia thickness compared with controls.¹² Recent diagnostic work has further shown that ultrasound assessment of plantar fascia thickness can achieve good diagnostic performance, particularly when combined with other sonographic parameters.¹⁸

However, the 4-mm threshold should not be interpreted in isolation. Measurement technique, probe position, toe position and other technical factors may influence plantar fascia thickness. Therefore, ultrasound findings should be interpreted together with clinical history and examination rather than used as an isolated diagnostic criterion.

Calcaneal spur was also significantly associated with plantar heel pain. In the present study, 60% of participants with a calcaneal spur had plantar heel pain compared with 26.1% among those without a spur ($p=0.01$). Importantly, a calcaneal spur should not automatically be considered the primary cause of symptoms. Rather, it may reflect chronic traction, mechanical stress or enthesopathic change. The fact that calcaneal spur had the highest adjusted odds ratio in the multivariate model (AOR 3.6) suggests that it was an important structural marker in this population.

Thyroid disorder was another noteworthy finding. Plantar heel pain occurred in 62.5% of participants with thyroid disorder compared with 28.0% without thyroid disorder, and the association was statistically significant ($p=0.02$). Thyroid dysfunction remained independently associated with plantar heel pain on multivariate analysis, with an AOR of 2.5 (95% CI 1.1–5.8; $p=0.03$).

This finding should, however, be interpreted cautiously. Direct evidence specifically connecting thyroid disease with plantar heel pain is limited. Thyroid disorders have

been associated with a variety of musculoskeletal and tendon manifestations, and recent literature continues to explore the relationship between thyroid dysfunction and tendinopathy.¹⁹ Therefore, the present finding may represent an important hypothesis-generating observation rather than evidence of a direct causal relationship.

The overall findings are consistent with the contemporary concept that plantar heel pain is multifactorial. Tenforde et al., in a systematic review of systematic reviews, emphasized the heterogeneity of risk factors, diagnostic approaches and treatment strategies across the plantar fasciitis literature.²⁰ The current study similarly identified multiple interacting factors rather than a single dominant cause. Recent epidemiological evidence further supports this multifactorial interpretation. A 2024 NHANES-based cross-sectional study evaluated the prevalence and associated risk factors of plantar heel pain in adults and reinforced the importance of considering demographic and health-related factors in population-level assessment.²¹ This supports the present approach of examining age, BMI and systemic factors together with local foot findings. The findings also have implications for contemporary management. The 2023 clinical practice guideline emphasizes evidence-based physical therapy approaches for plantar heel pain, while recent studies continue to investigate exercise, ultrasound-based assessment, taping, shockwave therapy and other interventions.^{22–24} The present study does not evaluate treatment outcomes, but identification of modifiable factors such as prolonged standing, excess body weight and footwear provides a logical basis for early preventive counselling.

Recent research published in 2026 has also demonstrated continued interest in exercise-based therapy, shockwave therapy and other non-surgical approaches for plantar

fasciitis. For example, a randomized controlled trial published in 2026 evaluated home exercise alone versus home exercise combined with high-intensity laser or radial shockwave therapy, demonstrating the continued evolution of conservative treatment strategies.²⁵ Recent systematic reviews have also evaluated minimally invasive treatments and taping techniques.^{26,27} These developments reinforce the importance of identifying patients early and addressing modifiable mechanical factors before symptoms become chronic. Overall, the present study demonstrates that plantar heel pain is associated with a combination of occupational loading, increased BMI, footwear, thyroid disorder and structural abnormalities such as plantar fascia thickening and calcaneal spur. The strongest independent associations were observed for calcaneal spur, prolonged standing, BMI and thyroid disorder. Because of the cross-sectional nature of the study, these findings should be interpreted as associations rather than causal relationships.

Conclusion

The present study demonstrates that plantar heel pain is a clinically important condition with multiple associated demographic, occupational, anthropometric, metabolic and structural factors. Among 66 participants, 36.4% had plantar heel pain. Early morning pain was the predominant clinical symptom. Significant associations were observed with increasing age, prolonged standing, occupational standing, footwear, increased BMI, thyroid disorder, calcaneal spur and increased plantar fascia thickness. On multivariate analysis, calcaneal spur, prolonged standing for >6 hours/day, increased BMI and thyroid disorder emerged as independent predictors of plantar heel pain. The findings highlight the importance of a comprehensive assessment that includes occupational history, BMI, footwear, systemic diseases and appropriate

imaging. Early identification of modifiable factors may help in prevention, patient counselling and individualized management.

Limitations

1. The study was conducted at a single tertiary-care hospital, which may limit generalizability.
2. The sample size was relatively small
3. The cross-sectional design does not establish a cause-and-effect relationship.

Declarations

Consent to participate: There is consent to participate.

Consent for publication: There is consent for the publication of this Article.

Authors' contributions: Author equally contributed the work.

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