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Correlation Between Chronic Heel Pain and Foot Arch Type Among Physiotherapists

Anjana[1], R. Deepak[2], Apoorva[3], R.K. Sharma[4] and Manish[5]

[1]MPT, Department of Physiotherapy, Santosh Paramedical College and Hospital, Ghaziabad

[2]*Professor/Principal, Department of Physiotherapy,

Santosh Paramedical College and Hospital, Ghaziabad, India

[3]Assistant Professor, Department of Physiotherapy, Santosh

Paramedical College and Hospital, Ghaziabad, India

[4]Dean, Santosh Paramedical College and Hospital, Ghaziabad, India

[5]Assistant Professor & Head, Department of Chest & TB, Santosh

Medical College, Santosh Deemed to Be University Ghaziabad, India

ABSTRACT

Chronic heel pain is a common complaint among physiotherapists and is frequently linked to biomechanical abnormalities of the foot arch. However, the association between foot arch type and heel pain remains underexplored in active physiotherapy professionals. To determine the correlation between chronic heel pain and foot arch type using the Arch Height Index (AHI) and Navicular Drop Test (NDT), and to analyze their relationship with pain intensity among physiotherapists. This cross-sectional, correlational study included 50 physiotherapists aged 20–50 years, recruited purposively from colleges, clinics, and staff departments. Participants reported heel pain persisting for more than three months. Exclusion criteria included foot trauma, surgery, congenital deformities, systemic or neurological disorders, pregnancy, and use of orthotics or special footwear. Ethical approval and informed consent were obtained. The AHI assessed static arch type (low, normal, high), while the NDT evaluated dynamic posture (pronated, normal, supinated). Pain intensity was measured using the Numeric Pain Rating Scale (NPRS). Data were analyzed using chi-square tests and Pearson's correlation ($\alpha = 0.05$). Among participants, 34% had low arches, 34% normal, and 32% high arches. AHI showed strong correlations with NDT ($r = 0.864$, $p < 0.001$) and NPRS ($r = 0.765$, $p < 0.001$). Individuals with low arches reported higher pain (mean NPRS 7.0 ± 1.2), with a significant association between arch type and pain ($p = 0.001$). Foot arch height significantly correlates with heel pain intensity. Flat feet are linked to increased pain, emphasizing the need for early biomechanical screening and preventive care.

KEY WORDS: ARCH HEIGHT INDEX, CHRONIC HEEL PAIN, FLAT FOOT, NAVICULAR DROP TEST, PHYSIOTHERAPISTS.

Article Information: *Corresponding Author: deepak.raghav@santosh.ac.in
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INTRODUCTION

Chronic heel pain remains one of the most frequent musculoskeletal conditions observed in both clinical and occupational environments. The disorder is predominantly attributed to plantar fasciitis, which involves degenerative and inflammatory changes in the plantar fascia, producing localized discomfort and functional limitations [1]. The burden of heel pain extends beyond local tissue irritation, as it affects walking mechanics, daily mobility, and quality of life.

Individuals engaged in professions requiring prolonged standing or walking are particularly vulnerable, and physiotherapists represent a notable example of such a group. Owing to the physical nature of their professional duties—standing for extended durations, moving repetitively between patients, and frequently demonstrating therapeutic maneuvers—they are exposed to substantial mechanical stress that may predispose them to the development of heel pain [2].

The structural and functional design of the human foot plays a central role in bearing body weight and facilitating locomotion. Among its key components, the medial longitudinal arch acts as a flexible yet resilient support mechanism that aids in efficient shock absorption and force distribution during standing, walking, and dynamic movement [3].

When deviations occur in the structure of this arch—such as flattening of the arch (pes planus) or excessive curvature (pes cavus)—the balance of load distribution across the plantar fascia is altered. This imbalance can lead to excessive tensile stress on the fascia and surrounding tissues, increasing susceptibility to inflammation and pain [4]. For this reason, accurate evaluation of foot posture has become a fundamental part of both clinical assessment and research focused on plantar fasciitis.

Two widely recognized methods for assessing foot posture are the Arch Height Index (AHI) and the Navicular Drop Test (NDT). The AHI provides an objective quantitative measure of the static height of the medial arch, offering insight into structural configuration. The NDT, by contrast, evaluates the change in navicular bone position from a seated to a standing position, thereby reflecting dynamic arch mobility [5].

When these two tools are used together, they allow a comprehensive assessment of both static morphology and dynamic adaptability of the foot, facilitating the identification of subtle biomechanical variations that may otherwise go unnoticed6. This dual assessment is especially relevant in the study of chronic heel pain, as altered foot mechanics can influence plantar fascia tension and the subsequent manifestation of pain.

Despite considerable investigation into the biomechanical links between foot posture and plantar heel pain, the literature presents inconsistent conclusions [7,8]. Some researchers have reported strong correlations between abnormal foot arches and the incidence of plantar fasciitis, whereas others have found these associations to be weak or statistically insignificant [9].

One possible reason for such variability lies in the diversity of study populations. A substantial proportion of prior research has centered on athletic or general populations, often neglecting occupational groups such as healthcare professionals. Physiotherapists, due to their repetitive and physically demanding roles, may face distinctive mechanical stresses that differ from those experienced by athletes or sedentary workers. Therefore, a more focused exploration of heel pain among physiotherapists is warranted to address this evident research gap [10].

An additional shortcoming identified in current evidence is the scarcity of direct comparisons between various foot posture assessment methods and their relationships with perceived pain intensity. Although both AHI and NDT are considered valid and reliable diagnostic tools, few studies have concurrently analyzed their outcomes alongside subjective pain measurements to establish a more integrated understanding of the condition [11].

Pain assessment tools such as the Numeric Pain Rating Scale (NPRS) and the Visual Analog Scale (VAS) are widely utilized to quantify discomfort levels, yet these are seldom used in conjunction with mechanical measurements like AHI and NDT. The combined evaluation of these parameters can provide valuable insights into how structural and functional variations of the foot influence the degree of pain experienced by affected individuals [12].

Examining physiotherapists as a specific population holds notable clinical and occupational relevance. Professionally, these individuals frequently engage in tasks that demand physical exertion, such as transferring patients, maintaining awkward postures during treatments, and demonstrating movement patterns repeatedly. Such occupational demands are known to increase the risk of musculoskeletal disorders, including lower limb and foot conditions. Reports suggest that the prevalence of work-related musculoskeletal pain among physiotherapists is considerably high, with the lower extremities—particularly the feet and heels—being common sites of discomfort [1].

Identifying predisposing factors such as foot posture deviations at an early stage could enable the design of preventive interventions. These might include ergonomic adjustments in clinical environments, appropriate footwear prescriptions, and strengthening or stretching programs aimed at maintaining optimal arch support and reducing plantar fascia strain [2,6].

From a broader clinical perspective, physiotherapists not only manage their own musculoskeletal well-being but also play a vital role in educating and treating patients with similar disorders. Persistent heel pain in these professionals can therefore have implications that extend beyond

individual health—it may compromise their capacity to demonstrate exercises, sustain prolonged standing during therapy sessions, or effectively deliver patient care.

Consequently, understanding the prevalence, risk factors, and biomechanical associations of heel pain in this population carries both preventive and occupational significance [11]. Through such inquiry, it becomes possible to enhance workplace ergonomics, inform evidence-based physiotherapy practices, and contribute to overall professional sustainability within healthcare settings.

In summary, chronic heel pain, often arising from plantar fascia overload, is a multifactorial condition influenced by foot structure, occupational activity, and repetitive mechanical stress. Despite extensive research in athletic and general populations, there remains limited evidence addressing how variations in foot posture, as quantified by AHI and NDT, relate to pain intensity among physiotherapists. Investigating this relationship will not only help to bridge an important gap in the literature but also support the development of targeted strategies to prevent and manage heel pain in this essential healthcare workforce [6,12].

METHODS

Study Design and Participants: This study utilized a cross-sectional, correlational design to investigate the relationship between chronic heel pain and foot arch variations among physiotherapists. A total of 50 practicing physiotherapists, aged between 20 and 50 years, were recruited through purposive sampling from the staff, college and various physiotherapy clinics Ghaziabad. Physiotherapists were specifically chosen because of their occupational exposure to prolonged standing, walking, and active demonstration of therapeutic exercises, which are factors known to predispose them to musculoskeletal discomfort, particularly heel pain. All participants reported experiencing chronic heel pain for a duration of more than three months, either unilaterally or bilaterally.

Inclusion criteria were actively practicing physiotherapists reporting chronic heel pain. Exclusion criteria included any history of foot trauma or surgical intervention, congenital foot deformities, systemic or neurological conditions such as diabetes mellitus, arthritis, or neuropathies, pregnancy, and current use of orthotic devices, braces, or specialized footwear. These criteria were established to ensure a homogeneous sample and to minimize confounding factors that could independently affect heel pain or foot biomechanics.

Ethical clearance was obtained from the institutional ethics committee (REF NO.- SCOP/OCT-24/ECN-94510023682), and written informed consent was collected from all participants in accordance with established ethical guidelines for human research. Foot posture assessment included both static and dynamic measures. The Arch Height Index (AHI) was employed to classify the medial longitudinal arch as low (flat foot), normal, or high (pes cavus), providing insight into the static structure of the foot.

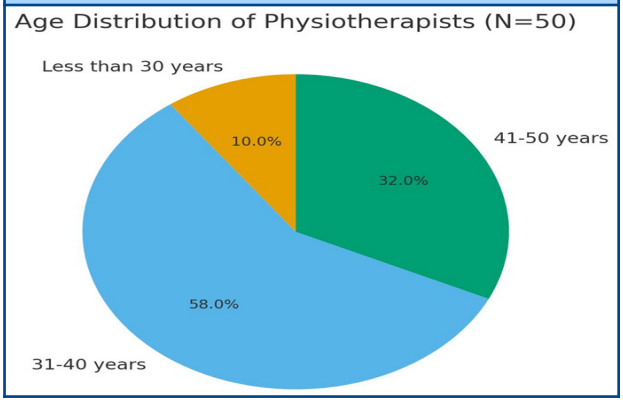
The Navicular Drop Test (NDT) was used to measure dynamic mobility by quantifying navicular displacement from a non-weight-bearing seated position to a standing weight-bearing position, allowing classification into pronated, normal, or supinated foot types). Pain intensity was assessed using the Numerical Pain Rating Scale (NPRS), where participants were asked to rate their heel pain on a scale ranging from 0, indicating no pain, to 10, representing the worst possible pain.

In this study, participants underwent a single-session evaluation to explore the link between foot structure, mobility, and heel pain. Arch Height Index (AHI) was measured by assessing dorsum height relative to foot length. Numeric Pain Rating Scale (NPRS) captured pain intensity. All measurements were carefully recorded, with repeats performed when needed for reliability. The focus was on identifying associations rather than providing interventions. By integrating static, dynamic, and subjective measures, the study offered a comprehensive perspective on foot biomechanics, aiming to enhance understanding of occupational heel pain and guide preventive strategies for physiotherapists.

Table 1. Descriptive statistics of Age of physiotherapists N=50

Age	No. of Patients	Percentage
31-40 years	29	58.0%
41-50 years	16	32.0%
Less than 30 years	5	10.0%
Mean ± SD	38.06 ±5.622 years	

Figure 1



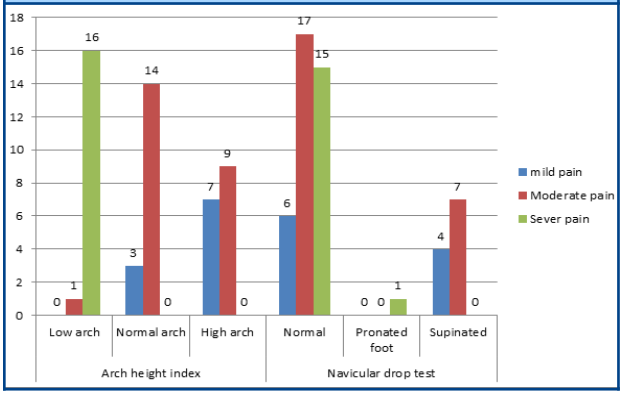
RESULTS

All data were compiled and analyzed using Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics such as mean, standard deviation, and percentages were calculated for demographic and clinical variables.

Table 2. Association between Numeric Pain Rating Scale and Arch height index & Navicular drop test of physiotherapists

Scale	Category	Numeric Pain Rating Scale			Chi-square test value	DF	P-value
		mild pain	Moderate pain	Sever pain			
Arch height index	Low arch	0 (0%)	1 (4.2%)	16 (100%)	49.707	4	0.001 (Significant)
	Normal arch	3 (30%)	14 (58.3%)	0 (0%)			
	High arch	7 (70%)	9 (37.5%)	0 (0%)			
Navicular drop test	Normal	6 (60%)	17 (70.8%)	15 (93.8%)	8.762	4	0.067 (insignificant)
	Pronated foot	0 (0%)	0 (0%)	1 (6.2%)			
	Supinated	4 (40%)	7 (29.2%)	0 (0%)			

Figure 2



The Chi-square test was applied to determine the association between categorical variables such as foot arch type (AHI) and pain intensity levels (NPRS), as well as between NDT and NPRS classifications. To explore linear relationships among continuous variables, Pearson's correlation coefficient (r) was calculated for AHI, NDT, and NPRS scores. A p-value < 0.05 was considered statistically significant. The statistical methods were selected to appropriately match the cross-sectional, correlational design of the study and to validate the strength and direction of relationships between foot posture and chronic heel pain severity.

Above table shows mean age of physiotherapists was 38.06 years and majority of 58% physiotherapists belonged to 31-40 years age group, 32% physiotherapists belonged to 41-50 years age group and 10% physiotherapists belonged to less than 30 years age group.

Above table shows that there was statistically significant association between arch height index and pain rating scale of physiotherapists with P<0.05. And there was no statistically significant association between navicular drop test and pain rating scale of physiotherapists with P>0.05.

DISCUSSION

This study examined the relationship between foot-arch morphology and chronic heel pain in a sample of 50 practising physiotherapists. Key findings were: 34% of participants classified as low-arched, 34% normal-arched, and 32% high-arched; a strong positive correlation between Arch Height Index (AHI) and Navicular Drop Test (NDT) ($r = 0.864$, $p < 0.001$); strong correlations between AHI and pain intensity (NPRS) ($r = 0.765$, $p < 0.001$) and between NDT and NPRS ($r = 0.780$, $p < 0.001$); a significant chi-square association of arch type with categorical pain levels ($\chi^2 = 49.707$, $df = 4$, $p = 0.001$); and a non-significant chi-square for NDT versus categorical pain ($\chi^2 = 8.762$, $p = 0.067$). Participants with low arches reported the highest mean pain (NPRS 7.0 ± 1.2) and most severe pain cases in the sample.

The large correlations linking static arch height (AHI) and dynamic navicular mobility (NDT) with pain intensity support the biomechanical plausibility that altered medial longitudinal arch structure and mobility increase tensile load through the plantar fascia and associated tissues [3,4]. The particularly strong AHI–NDT correlation ($r = 0.864$) indicates that, in this occupational sample, static and dynamic measures are highly related and frequently co-occur—low static arch typically accompanied by greater navicular displacement. The strong AHI–NPRS and NDT–NPRS correlations ($r \approx 0.76$–0.78) suggest that both structural height and dynamic mobility relate to symptom intensity, consistent with mechanistic models that link abnormal load distribution to plantar fascia overload [1,13].

However, the discrepancy between the significant chi-square for arch type ($p = 0.001$) and the borderline/non-significant chi-square for NDT ($p = 0.067$) deserves attention. The chi-square result for arch type indicates that categorical grouping of AHI aligns with pain categories, while NDT's categorical classification may not map as cleanly onto coarse pain categories—despite NDT showing strong continuous correlation with NPRS. This suggests that dichotomizing or categorizing inherently continuous measures may reduce sensitivity; continuous correlations preserved more information and therefore remain significant whereas coarse categorical tests can lose power [5,14].

The use of Pearson's r for continuous associations was appropriate to quantify linear relationships, but the cross-sectional design precludes causal inference—high correlation does not prove that arch morphology causes heel pain [1].

The study reports strong r values; yet correlation coefficients can be inflated by outliers or restricted range. The manuscript does not report diagnostic checks (normality, linearity, homoscedasticity), nor sensitivity analyses such as outlier removal or non-parametric confirmation, which would strengthen confidence in the reported r values. Similarly, the chi-square ($\chi^2 = 49.707$) is numerically large; it would be helpful to provide cell counts and expected counts to confirm that test assumptions hold and that no cells had very low expected frequencies (which can invalidate chi-square and favour Fisher's exact interpretation).

Inter-rater and intra-rater reliability of the measurements (AHI and NDT) are critical because both are operator-dependent14. The manuscript states trained evaluators performed assessments, but it lacks reported reliability statistics (ICC or kappa). Absent reliability data, measurement error could either attenuate or spuriously inflate associations. Repeated measures or reporting of assessor agreement would materially strengthen internal validity5.

Sampling, bias, and confounding: Purposive sampling of physiotherapists from a limited geographic and institutional pool reduces generalisability. The sample size (N = 50) is modest; while correlations were large, the small sample increases the chance of type I or II errors in subgroup or categorical analyses and limits the stability of estimates. Selection bias is plausible: physiotherapists experiencing heel pain may have been more likely to participate, inflating prevalence of symptoms relative to the broader population of clinicians [10].

Crucially, several potential confounders were not adjusted for in the analyses: body mass index, footwear habits, weekly standing/work hours, prior lower-limb injury, comorbidities (e.g., diabetes) and activity level. These factors can independently influence both arch morphology and heel pain (Alotaibi, 2020; Boob et al., 2024). The absence of multivariable modelling means observed bivariate associations may be partly confounded; for instance, higher BMI both flattens the arch and increases plantar load, presenting an alternative causal path to pain [3]. Clinical relevance and practical implications.

Despite limitations, the findings have practical import. Static AHI is readily measured in clinics and, in this sample, appears to be a useful screening marker for elevated heel pain risk—a point relevant for occupational health in physiotherapy staff. Implementing routine foot posture assessment and early preventive measures (ergonomic adjustments, footwear advice, targeted strengthening/orthotic programmes) could plausibly reduce occupational burden [2,6]. However, clinicians should avoid assuming causality—intervention studies testing whether correcting arch mechanics reduces pain are needed before recommending widespread corrective programmes [1].

Future work should: adopt prospective or interventional designs to probe causality; recruit larger and multi-centre samples to improve external validity; report measurement reliability (ICC); include potential confounders and use multivariable regression; and prefer continuous analyses over crude categorization to maintain statistical power. Mechanistic outcomes (plantar pressure mapping, gait analysis, ultrasound of plantar fascia) would clarify pathways linking structure to pain7,8. Finally, randomised trials of orthoses or exercise regimens in symptomatic physiotherapists would test whether modifying biomechanics reduces pain and improves function [6,12].

The study offers compelling preliminary evidence that in this occupational sample, lower arch height and greater navicular mobility are associated with greater heel pain intensity. Yet, methodological limitations—small purposive sample, possible confounding, absence of reliability reporting, and cross-sectional design—mean the findings are hypothesis-generating rather than definitive. Addressing these limitations in future research will determine whether foot-arch screening and targeted biomechanical interventions should become routine elements of occupational health for physiotherapists [1,13,15].

CONCLUSION

This study shows how something as simple as the shape of our foot arch can greatly impact comfort and health, especially for physiotherapists who spend long hours standing and moving. It found that those with low arches often experienced more heel pain compared to colleagues with normal or high arches. By measuring arch height and foot mobility, researchers confirmed a strong link to pain levels. These findings remind us of the importance of regular foot assessments and supportive measures—like proper footwear, exercises, and workplace adjustments—to prevent discomfort, protect long-term foot health, and maintain overall well-being in demanding professions.

Future Scope: The future scope of this study highlights important avenues for advancing occupational health. Expanding research across larger and varied populations will strengthen evidence on the link between foot arch type and heel pain. Longitudinal studies can provide insight into the long-term impact of foot biomechanics, while intervention-based research may evaluate the effectiveness of orthotics, targeted exercise, and supportive footwear. Additionally, ergonomic workplace modifications should be explored to minimize strain. Incorporating digital tools, such as foot scanners and wearable devices, offers opportunities for early detection, proactive management, and improved quality of life for physiotherapists and other high-risk professionals.

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