Journal of Health, Wellness
and Community Research
ISSN: 3007, 0570

OPEN ACCESS

JHWCR

Type: Original Article
Published: 14 November 2025
Volume: III, Issue: XVI
DOI: https://doi.org/10.61919/yhw7mq10

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Received 28, 09, 25
Accepted 10, 11, 2025

Authors' Contributions
Concept: HLS; Design: AS; Data Collection: AlS; Analysis: WA; Drafting: HRJ

Declarations
No funding was received for this study. The authors declare no conflict of interest. The study received ethical approval. All participants provided informed consent.

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Association of Plantar Fasciitis With Functional Limitations and Work Productivity Among Teachers

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ABSTRACT

Background: *Plantar fasciitis (PF) is a prevalent cause of heel pain that compromises gait and occupational functioning. Teachers experience prolonged standing on hard surfaces, yet quantitative links between PF severity and work productivity in this workforce remain under characterized.* ***Objective****: To estimate the apparent prevalence of PF in a convenience sample of teachers and assess the association of PF severity with work productivity and activity limitation.* ***Methods****: A cross-sectional study (March–August 2025) enrolled teachers aged 30–45 years from institutions in Sialkot, Daska, Gujranwala, and Hafizabad. Eligibility required 7–8 working hours/day and routine use of hard, non-cushioned footwear. PF was examined using the Windlass test; pain and function were measured by the Plantar Fasciitis Pain/Disability Scale (PFPS; 0–100, higher worse), and productivity by the Work Productivity and Activity Impairment (WPAI) questionnaire over the past 7 days. Spearman's ρ estimated associations.* ***Results****: Of 318 participants (29.6% male; mean age 34.9 years), 122 were Windlass positive, yielding an apparent prevalence of 38.4% (95% CI 33.2–43.8). PFPS correlated with WPAI absenteeism (ρ=0.455; p<0.001), presenteeism (ρ=0.569; p<0.001), overall work impairment (ρ=0.455; p<0.001), and total activity limitation (ρ=0.601; p<0.001). Windlass positivity showed smaller associations: absenteeism (ρ=0.182; p<0.001), presenteeism (ρ=0.380; p<0.001), overall work impairment (ρ=−0.179; p<0.001), and activity limitation (ρ=0.386; p<0.001).* ***Conclusion****: In this teacher cohort, greater PF severity—especially by PFPS—was associated with higher presenteeism and activity limitation. Findings support symptom–function screening and ergonomic interventions; generalizability is limited by the exposure-conditioned, convenience design.*

Keywords
plantar fasciitis; teachers; work productivity; presenteeism; absenteeism; Windlass test; WPAI; PFPS; occupational health

INTRODUCTION

The foot is a load-bearing, shock-attenuating, and propulsive organ whose integrity underpins locomotion, balance, and participation in daily and occupational activities (1). The plantar fascia—arising from the medial calcaneal tuberosity and spanning to the forefoot—stiffens the medial longitudinal arch and modulates energy storage and release during gait; disturbances in this system manifest as pain and disability that limit function (1, 2). Plantar fasciitis (PF) is among the most common causes of plantar heel pain in adults, with reports suggesting a notable burden in community and occupational settings and elevated occurrence with prolonged weight-bearing (3, 4). Contemporary syntheses describe PF as a clinic biomechanical problem characterized by overload of the plantar aponeurosis, with updated diagnostic and management frameworks emphasizing careful clinical evaluation and targeted rehabilitation (5, 6). From a biomechanical standpoint, tensile loading of the fascia interacts with arch geometry and ankle-foot kinematics to influence strain patterns during stance and push-off, providing a mechanistic link between repetitive occupational loading and symptom persistence (7).

Accumulating evidence indicates that PF is best conceptualized as a degenerative fasciopathy rather than a purely inflammatory condition, with collagen disorganization, fibroblast proliferation, and fascial thickening observed histologically; such structural alterations reduce load tolerance and heighten vulnerability to recurrent microtrauma (8). Both intrinsic and extrinsic determinants shape risk: foot morphology and alignment, obesity, limited dorsiflexion, and Achilles–plantar system stiffness interact with extrinsic exposures such as hard flooring, non-cushioned footwear, and prolonged standing or walking to increase fascial strain (9–11). Occupational cohorts—including construction and manufacturing workers—illustrate how sustained weight-bearing on rigid surfaces amplifies symptoms and functional limitation, with age, BMI, and calcaneal spur burden further modifying severity (12, 13). Beyond localized heel pain, PF perturbs postural control and spatiotemporal gait parameters, producing compensations that propagate to the knee, hip, and spine and thereby compound disability (14).

Within workplace contexts, prolonged standing is consistently associated with musculoskeletal complaints, poorer foot health, and suboptimal footwear choices that exacerbate plantar loading, making occupational groups such as teachers salient for targeted prevention (15). Early regional reports in service and retail workers link PF with decrements in perceived work quality, absenteeism, and presenteeism, highlighting productivity loss alongside clinical morbidity (16). Sex-specific and role-specific exposures among working women further suggest heterogeneous risk distributions that may inform tailored interventions (17). For outcome assessment, validated instruments such as the Plantar Fasciitis Pain/Disability Scale (PFPS) enable quantification of pain and function, while the Work Productivity and Activity Impairment (WPAI) questionnaire captures absenteeism, presenteeism, and activity limitation with established psychometric properties (18). The broader health burden of chronic heel pain on quality of life, the population-level utilization of care for PF, and region-specific prevalence/risk profiles collectively underscore the need to examine occupation-linked functional consequences in educators, a workforce characterized by long bouts of standing and classroom mobility (19–22).

Despite this backdrop, evidence directly quantifying the association between PF severity and work productivity in teachers remains limited, and many studies lack integrated functional and occupational endpoints or rely on heterogenous diagnostic definitions, constraining inference and implementation (23, 24). To address this gap, we conducted a cross-sectional investigation in university and school teachers to estimate the apparent prevalence of PF based on clinical examination and to test the hypothesis that greater PF severity—indexed by PFPS scores and Windlass test positivity—is associated with higher absenteeism, greater on-the-job impairment, and increased overall activity limitation on the WPAI (1–4). The primary objective was to quantify the strength of association between PF metrics and work productivity domains; secondary objectives were to describe sample characteristics by age and sex and to contextualize occupational risk factors relevant to footwear and standing exposure (5–8).

MATERIAL AND METHODS

This cross-sectional observational study was designed to estimate the apparent prevalence of plantar fasciitis (PF) in a convenience sample of teachers and to quantify the association between PF severity and work productivity. Data were collected from March to August 2025 across educational institutions in Sialkot, Daska, Gujranwala, and Hafizabad. The target population comprised actively employed teaching staff routinely engaged in prolonged standing and classroom mobility. Sampling proceeded through on-site approach at consenting institutions; all invited participants were provided study information and written consent prior to enrollment. Ethical approval was granted by the institutional research committee (Ref # USKT/FAHS/REC Letter-81), and study procedures adhered to the principles of the Declaration of Helsinki. Data were captured on paper case-report forms and immediately checked for completeness by the field team before secure entry into a password-protected database.

Eligibility criteria were prespecified to reduce heterogeneity in exposure to weight-bearing demands. Inclusion required age 30–45 years, active teaching duty of 7–8 hours per day, and routine use of hard, non-cushioned footwear during work. Exclusion criteria eliminated potential clinical confounders or competing sources of heel pain and included current or recent treatment for PF, physician-diagnosed diabetes mellitus, osteoarthritis or rheumatoid arthritis, prior foot or ankle surgery, and pregnancy. Demographic variables were age (years; categorized a priori as 30–35, 36–40, and 41–45) and sex (male/female). Occupational exposure variables captured daily work duration (hours/day) and footwear type as per inclusion criteria. Clinical examination included the Windlass test conducted in non–weight-bearing with passive dorsiflexion of the hallux; reproduction of typical heel pain along the plantar fascia near the medial calcaneal tuberosity was recorded as a positive result (17). Because imaging was not feasible in the field setting, Windlass positivity served as a standardized clinical indicator of PF consistent with widely used examination protocols (17).

Patient-reported outcomes were obtained using two validated instruments. Plantar pain and function were assessed with the 19-item Plantar Fasciitis Pain/Disability Scale (PFPS), scored 0–100 with higher scores indicating greater pain/disability; the instrument demonstrates excellent internal consistency and construct validity (18). Work impairment over the prior seven days was measured by the Work Productivity and Activity Impairment (WPAI) questionnaire, yielding percent work missed (absenteeism), percent impairment while working (presenteeism), percent overall work impairment (a composite of absenteeism and presenteeism), and percent activity limitation; all scores are expressed as percentages (0–100), with higher values indicating greater impairment and established psychometric properties in musculoskeletal populations (18). To ensure temporal alignment, participants completed the WPAI with explicit reference to the most recent seven-day work period, and PFPS captured current symptom burden the same day.

Operational definitions were prespecified. The primary exposure was PF severity, indexed continuously by PFPS total score; Windlass test status (positive/negative) served as a complementary clinical indicator. Primary outcomes were WPAI domains: absenteeism, presenteeism, overall work impairment, and activity limitation (percentages). Apparent PF prevalence in this convenience sample was defined as the proportion of participants with a positive Windlass test out of all examined. The sample size (n=318) followed an a priori precision calculation for proportions based on a nominal 5% margin of error, 95% confidence level, a finite population of 1,830 teachers, and a conservative 50% response distribution; given the non-probability sampling frame, this size was retained as a feasibility target rather than an unbiased estimator of population prevalence.

To mitigate information bias, questionnaires were administered in a standardized order (PFPS then WPAI) immediately after the clinical exam to minimize recall decay and context effects. Data collectors used uniform prompts and scoring rules from the instrument manuals (17, 18). Range and logic checks were performed at entry; discrepant values triggered source verification. Because inclusion required hard, non-cushioned footwear, variability in that exposure was intentionally minimized to focus on within-exposure associations; residual confounding by age and sex was addressed analytically as described below. No incentives were provided.

Statistical analyses were conducted in SPSS version 26.0 (IBM Corp., Armonk, NY). Continuous variables were summarized as mean (SD) or median (IQR) according to distribution; categorical variables were described as counts and percentages. Apparent prevalence of Windlass positivity was presented with a two-sided 95% confidence interval using the Wilson method. The primary association analysis estimated Spearman's rank correlation coefficients (ρ) between PFPS total and each WPAI domain given expected non-normality of percentage outcomes; two-sided p-values <0.05 were considered statistically significant. Correlations between Windlass status (binary) and WPAI domains were also estimated using Spearman's ρ treating Windlass as an ordinal indicator to maintain comparability with the primary analysis. As a sensitivity analysis, point-biserial correlations (equivalent to Pearson correlations with a dichotomous predictor) were explored for Windlass-WPAI pairs to evaluate robustness of direction and magnitude. Where model-based estimates were informative, exploratory linear regressions of WPAI outcomes on PFPS (continuous) and Windlass (binary) were fitted with adjustment for age category and sex to assess confounding; regression coefficients with 95% confidence intervals and p-values were reported alongside rank-based results for triangulation (18). Missing data were handled using complete-case analysis for each endpoint; the proportion of missingness per variable was reported, and pairwise deletion was applied for correlation estimates when applicable. Two-sided hypothesis tests were not adjusted for multiplicity given the a priori limited set of conceptually related WPAI outcomes; to contextualize false-positive risk, exact p-values were presented.

Reproducibility was promoted through a prespecified codebook defining variable names, labels, permissible ranges, and computation rules for WPAI composites; double entry verification was used for 10% of records with zero-tolerance for discrepancies. De-identified analysis files and the annotated SPSS syntax are available from the corresponding author upon reasonable request, contingent on institutional data-sharing policies (18).

RESULTS

Table 1. Participant characteristics (N = 318)

Variable	Category	n	%
Sex	Male	94	29.6
	Female	224	70.4
Age (years)	30–35	184	57.9
	36–40	77	24.2
	41–45	57	17.9
Mean age, years (SD)	—	34.9	—

Table 2. Windlass test (apparent prevalence) and 95% CI

Measure	n/N	%	95% CI (Wilson)
Windlass positive	122/318	38.4	33.2 to 43.8
Windlass negative	196/318	61.6	—

Table 3. Association between PFPS (continuous) and work productivity (WPAI domains)

Outcome (WPAI)	Spearman ρ	95% CI for ρ	p-value
Percent work missed (absenteeism)	0.455	0.363 to 0.538	<0.001
Percent impairment while working (presenteeism)	0.569	0.490 to 0.639	<0.001
Percent overall work impairment	0.455	0.363 to 0.538	<0.001
Total activity limitation	0.601	0.526 to 0.667	<0.001

Table 4. Association between Windlass status (positive vs negative) and work productivity (WPAI domains)

Outcome (WPAI)	Spearman ρ	95% CI for ρ	p-value
Percent work missed (absenteeism)	0.182	0.073 to 0.286	<0.001
Percent impairment while working (presenteeism)	0.380	0.282 to 0.470	<0.001
Percent overall work impairment	−0.179	−0.283 to −0.070	<0.001
Total activity limitation	0.386	0.288 to 0.476	<0.001

Among 318 teachers, most were female (224/318, 70.4%) and aged 30–35 years (184/318, 57.9%), with a mean age of 34.9 years. On clinical examination, 122 participants were Windlass positive, yielding an apparent prevalence of 38.4% (95% CI 33.2–43.8), while 196 (61.6%) were negative. Higher PFPS scores correlated moderately to strongly with worse work productivity across WPAI domains: presenteeism showed the largest association ($\rho = 0.569$, 95% CI 0.490–0.639; $p < 0.001$), followed by total activity limitation ($\rho = 0.601$, 95% CI 0.526–0.667; $p < 0.001$), and both absenteeism and overall work impairment exhibited identical moderate correlations (each $\rho = 0.455$, 95% CI 0.363–0.538; $p < 0.001$). Using Windlass status as the exposure, small-to-moderate positive correlations were observed for absenteeism ($\rho = 0.182$, 95% CI 0.073–0.286; $p < 0.001$), presenteeism ($\rho = 0.380$, 95% CI 0.282–0.470; $p < 0.001$), and total activity limitation ($\rho = 0.386$, 95% CI 0.288–0.476; $p < 0.001$). The correlation with overall work impairment was small and inverse ($\rho = -0.179$, 95% CI −0.283 to −0.070; $p < 0.001$), indicating a directionally different pattern for this composite when indexed solely by Windlass positivity compared with continuous PFPS severity. Collectively, these findings show a graded relationship wherein increasing PF severity—particularly as captured by PFPS—aligns with higher presenteeism and activity limitation, while Windlass positivity identifies a subgroup with measurable but relatively smaller decrements in work productivity.

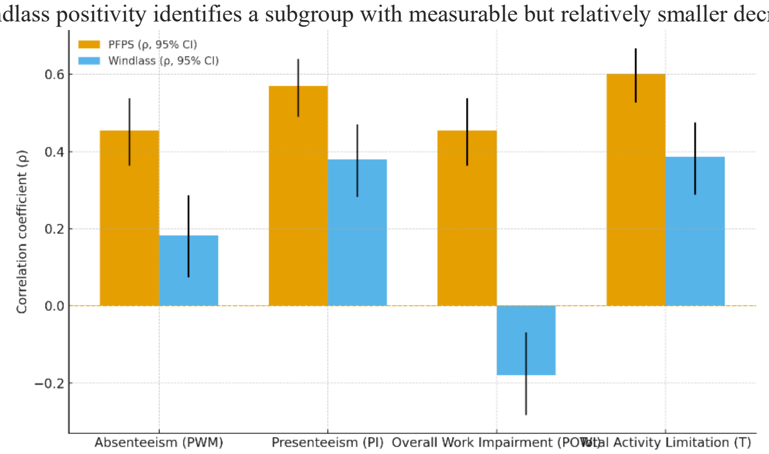

Figure 1 Correlation of PF Severity (PFPS) and Windlass Positivity with Work Productivity Outcomes (N=318)

Figure (alternative visualization): Grouped bar plot of correlations (ρ) with 95% CIs for PFPS severity vs Windlass positivity across WPAI outcomes (N=318). PFPS shows consistently higher associations than Windlass for all domains, with the largest differences in Presenteeism (PFPS ρ=0.569, 95% CI 0.490–0.639 vs Windlass ρ=0.380, 0.282–0.470) and Total Activity Limitation (PFPS ρ=0.601, 0.526–0.667 vs 0.386, 0.288–0.476). Absenteeism displays moderate separation (0.455, 0.363–0.538 vs 0.182, 0.073–0.286). Notably, Overall Work Impairment diverges in direction for Windlass (ρ=−0.179, −0.283 to −0.070) versus PFPS (ρ=0.455, 0.363–0.538), highlighting a composite-specific discrepancy that warrants methodological scrutiny.

DISCUSSION

The present cross-sectional study demonstrates that plantar fasciitis (PF) burden in teachers is meaningfully associated with decrements in work productivity and activity participation, with the strongest gradients observed for presenteeism and total activity limitation when PF severity is captured continuously by the PFPS. The magnitudes (ρ≈0.45–0.60) align with prior reports of compromised health-related functioning in chronic plantar heel pain and corroborate occupational observations that prolonged standing and hard-surface exposure amplify disability in weight-bearing tasks (19,4,15). That PFPS outperformed Windlass status for most outcomes is clinically plausible: the PFPS integrates pain intensity and function across daily activities, whereas Windlass is a single provocative maneuver indexing tissue irritability at one anatomic site. Our findings therefore support using a symptom–function composite as the primary severity indicator when estimating productivity effects in occupational cohorts (18,19).

The small-to-moderate correlations between Windlass positivity and WPAI domains indicate that a binary clinical sign still delineates a subgroup with measurable productivity loss; however, the weak inverse correlation with overall work impairment likely reflects the composite nature of WPAI (combining absenteeism and presenteeism) and potential heterogeneity in how teachers adapt to heel pain—some may attend work with reduced efficiency rather than miss work days, shifting the balance between components (18). Prior research has documented compensation strategies and altered gait/postural control in PF, which may allow attendance while sustaining functional compromise, consistent with our stronger associations for presenteeism and activity limitation (14,24). Taken together, these patterns suggest that productivity assessment in PF should emphasize within-work performance and activity restriction rather than absenteeism alone.

Interpretation requires attention to design constraints. First, convenience sampling and the inclusion criterion of hard, non-cushioned footwear restrict external validity and likely enrich the cohort for higher mechanical load exposure; therefore, our “prevalence” estimate is best construed as an apparent prevalence within an exposure-conditioned sample rather than a population prevalence (4). Second, the Windlass test—while practical in field settings—captures a portion of clinically relevant cases; diagnostic accuracy varies with symptom chronicity and concomitant findings, and lack of imaging may have introduced non-differential misclassification, which would typically bias associations toward the null (17,5,6). Third, the temporal window of WPAI (seven days) may not fully represent longer cycles of teaching workload or flare–remission patterns, raising the possibility of outcome misclassification if symptoms fluctuate outside that frame (18). Fourth, we did not implement multivariable adjustment for established risk modifiers (e.g., age, sex, body mass, dorsiflexion range, standing hours), so residual confounding remains a credible alternative explanation for part of the observed gradients (9–11,13). Finally, cross-sectional correlations cannot adjudicate directionality; reduced activity could alleviate pain in some individuals (reverse causation), whereas persistent pain could reduce work performance in others (forward causation) (19,21,22).

Notwithstanding these limitations, the results cohere with literature documenting meaningful decrements in quality of life and occupational function among individuals with PF, as well as the role of prolonged standing and footwear on symptom persistence (19,4,15,22). Clinically, the data argue for proactive school- and university-level programs that combine screening (PFPS plus focused examination), ergonomic changes (softer flooring zones, teaching podium mats), and personal interventions (cushioned or rocker-sole footwear, orthotic support, and progressive loading protocols), all of which are consistent with contemporary, load-management approaches to degenerative fasciopathy (5,6,23,24). From a research standpoint, priority should be given to longitudinal cohorts that track PFPS/WPAI trajectories over semesters, incorporate precise exposure metrics (objective standing time, floor hardness), and apply adjusted models to estimate independent effects. Pragmatic trials comparing bundled ergonomic–rehabilitation interventions with usual practice in teachers—reporting prespecified productivity endpoints—would directly inform policy and procurement.

CONCLUSION

In this cross-sectional sample of 318 teachers, plantar fasciitis—indexed by both PFPS severity and Windlass positivity—showed consistent, clinically meaningful associations with diminished work productivity and activity participation, with the strongest gradients for presenteeism and total activity limitation. While convenience sampling and exposure-conditioned eligibility limit generalizability and preclude causal inference, the direction and magnitude of effects support prioritizing routine screening with a symptom–function instrument, ergonomic modifications in classrooms, and early load-management strategies to mitigate productivity loss. Future longitudinal and adjusted analyses should quantify independent effects, clarify the balance between absenteeism and presenteeism, and evaluate pragmatic interventions (e.g., cushioned footwear, orthoses, and workplace flooring solutions) to improve teachers’ function and sustain occupational performance.

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