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Original Article

Frequency of Patellofemoral Pain Syndrome Among Health Care Workers and Its Correlation With BMI

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ABSTRACT

Background: Patellofemoral pain syndrome (PFPS) is a leading cause of anterior knee pain, frequently aggravated by occupational and recreational activities involving repetitive knee flexion under load. Healthcare workers may be at increased risk due to prolonged standing, stair climbing, and squatting during work, yet limited data exist on PFPS prevalence and its association with body mass index (BMI) in this population. Objective: To determine the prevalence of PFPS among healthcare workers in Lahore, Pakistan, and evaluate its correlation with BMI. Methods: In this observational cross-sectional study, 138 healthcare professionals aged 20–40 years from hospitals and pharmacies in Lahore were assessed using the Kujala score, SNAPPS questionnaire, Clarke's test, and Numerical Pain Rating Scale. BMI was measured and categorized per WHO criteria. Data were analyzed with descriptive statistics and Pearson's correlation, with p<0.05 considered significant. Results: PFPS prevalence was 29.7% (95% CI 22.1–38.1). Prevalence increased from 9.0% in normal-weight participants to 50.0% in overweight and 85.7% in obese individuals. Pearson's correlation indicated a moderate positive association between BMI and PFPS (r=0.288, p<0.001). Conclusion: PFPS is common among healthcare workers and strongly associated with elevated BMI. Workplace prevention strategies should prioritize weight management and biomechanical risk reduction.
Keywords: patellofemoral pain syndrome, anterior knee pain, body mass index, healthcare workers, occupational health.

INTRODUCTION

Patellofemoral pain syndrome (PFPS) is one of the most prevalent causes of anterior knee pain, characterized by discomfort localized behind or around the patella, typically aggravated by activities involving knee flexion under load, such as squatting, stair climbing, running, or jumping (1). The patellofemoral joint, formed by the articulation between the patella and the distal femur, plays a critical role in knee biomechanics, and its dysfunction can substantially limit mobility and occupational performance (2). PFPS affects an estimated 22.7% of the general population, with higher rates of up to 28.9% reported in adolescents, and a disproportionately higher burden in females, likely due to anatomical and biomechanical differences such as increased Q-angle (3). In addition to musculoskeletal impairment, PFPS can lead to reduced physical activity levels, functional limitations, and a decline in quality of life (4).

Risk factors for PFPS are multifactorial, encompassing both intrinsic factors—such as lower limb malalignment, muscle weakness (particularly of the gluteus Medius), and altered hip biomechanics—and extrinsic factors, including high-impact sports and occupational demands (5,6). Among these, body mass index (BMI) has received particular attention, as excess body weight may increase patellofemoral joint loading and cartilage stress, potentially accelerating symptom onset (7). However, the relationship between BMI and PFPS remains debated; while several studies have found a positive correlation (8), others report inconsistent or non-significant associations (9). Importantly, occupational groups such as healthcare workers face unique ergonomic challenges—prolonged standing, frequent stair climbing, and repetitive bending or squatting—which may exacerbate PFPS risk, particularly in individuals with elevated BMI (10).

Assessment of PFPS commonly utilizes validated tools such as the Anterior Knee Pain Scale (Kujala score) and the SNAPPS questionnaire, both of which demonstrate strong reliability in diagnosing and grading symptom severity (11,12). Clarke's test provides a complementary clinical maneuver to confirm the diagnosis in suspected cases (13). While prevalence studies have been conducted in athletic, adolescent, and general community populations, there is a scarcity of research focusing on healthcare professionals, despite their known occupational exposure to biomechanical stressors (14). The identification of modifiable risk factors, including BMI, within this group could inform early detection and workplace interventions to prevent disability and maintain workforce efficiency. Therefore, this study aimed to determine the prevalence of PFPS among healthcare workers in Lahore and to evaluate its correlation with BMI. We hypothesized that PFPS prevalence would be substantial in this occupational group and positively associated with BMI, reflecting the combined influence of occupational strain and excess body weight on patellofemoral joint health.

MATERIAL AND METHODS

This observational cross-sectional study was conducted to determine the prevalence of patellofemoral pain syndrome (PFPS) among healthcare workers and its correlation with body mass index (BMI). The study was carried out in multiple hospital and pharmacy settings across Lahore, Pakistan, including Fauji Foundation Hospital, Ali Hospital, Rabia Welfare Hospital, Omar Hospital, Pakistan Air Force Hospital, Ganga Ram Hospital, and selected community pharmacies, over a defined data collection period in 2024 (15).

Eligible participants were male and female healthcare professionals aged 20–40 years, including physicians, nurses, laboratory technicians, and pharmacists, who were free of knee joint swelling and had no history of traumatic injury to the knee. Inclusion criteria required participants to report discomfort during at least one patellofemoral joint loading activity—such as stair ascent/descent, squatting, kneeling, or prolonged sitting—alongside a willingness to provide informed consent. Participants worked a minimum of six hours per day in their respective clinical roles. Exclusion criteria included pregnancy; history of recent knee trauma, contusion, or fracture; diagnosed osteoarthritis; presence of knee prosthesis; fractures of the femoral condyle or patella; gait abnormalities; neuromuscular disorders; psychological illness; or history of knee surgery (16).

A non-probability convenience sampling approach was employed to recruit participants from facilities with high accessibility and workforce density. Recruitment was performed through in-person invitation during working hours, with brief verbal screening for eligibility followed by written informed consent prior to data collection. Ethical approval for the study was obtained from the institutional review board of The University of Faisalabad, and all procedures adhered to the Declaration of Helsinki guidelines (17). Data were collected in a standardized sequence. Demographic variables (age, gender, occupation, marital status, and social status) and anthropometric measurements (weight in kilograms, height in meters) were recorded to calculate BMI using the Quetelet index formula: weight (kg) / height² (m²). BMI categories followed World Health Organization criteria: underweight (<18.5 kg/m²), normal weight (18.5–24.9 kg/m²), overweight (25.0–29.9 kg/m²), and obese (≥30 kg/m²) (18). All measurements were obtained using calibrated digital weighing scales and wall-mounted stadiometers, with participants wearing light clothing and no shoes.

Assessment for PFPS incorporated validated questionnaires and a functional clinical test. The Anterior Knee Pain Scale (Kujala score) was administered to quantify functional limitation, with a cutoff score of ≤65 indicating PFPS-positive status (19). The SNAPPS questionnaire was used to capture self-reported symptoms relevant to PFPS epidemiology and diagnosis (20). Clarke's test (patellar grind test) was performed by a trained physiotherapist to identify clinical signs of patellofemoral joint pathology (21). The Numerical Pain Rating Scale (NPRS) was used to assess pain intensity, ranging from 0 ("no pain") to 10 ("worst imaginable pain"), and categorized into no pain (0), mild (1–3), moderate (4–6), and severe (7–10) (22). To minimize bias, data collectors received uniform training on assessment protocols, and all instruments were applied in the same order for each participant. Data entry and statistical processing were conducted independently by two researchers to ensure accuracy and reproducibility.

The sample size of 138 participants was determined based on feasibility and prior PFPS prevalence estimates from similar occupational groups, targeting a margin of error of 5% and 95% confidence level (23). Statistical analyses were performed using IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were reported as frequencies and percentages for categorical variables and mean ± standard deviation (SD) for continuous variables. Pearson's correlation coefficient was used to evaluate the association between BMI and PFPS prevalence, with two-tailed p-values <0.05 considered statistically significant. No imputation was applied for missing data; cases with incomplete outcome variables were excluded from analysis. Subgroup analyses by occupation, gender, and BMI category were planned to explore potential effect modification.

RESULTS

Among the 138 healthcare workers enrolled, the mean age was 29.4 years (95% CI 28.5–30.4), with just over half of participants being female (59.4%). BMI values ranged from 17.2 to 34.6 kg/m², with a mean of 24.9 kg/m² (95% CI 24.2–25.6). Occupational distribution was balanced between doctors and nurses (each 31.2%), while pharmacists and laboratory technicians comprised 18.1% each. PFPS was identified in 29.7% of participants, corresponding to 41 individuals (95% CI 22.1–38.1).

Pain intensity assessment revealed that 43.5% reported no pain, 39.9% reported mild pain, 12.3% moderate pain, and 4.3% severe pain. Notably, the combined moderate-to-severe category encompassed 23 participants (16.6%), reflecting a clinically relevant subgroup with greater functional impairment. The mean NPRS score was 1.77 ± 0.82, indicating overall low to moderate symptom intensity across the sample.

Table 1. Baseline characteristics of healthcare workers (N = 138)

Variable	n (%) or Mean ± SD	95% CI for Mean / Proportion
Age (years)	29.4 ± 5.6	28.5 to 30.4
BMI (kg/m²)	24.9 ± 4.3	24.2 to 25.6
Gender (Female)	82 (59.4%)	51.0% to 67.4%
Occupation: Doctor	43 (31.2%)	23.6% to 39.6%
Occupation: Nurse	43 (31.2%)	23.6% to 39.6%
Occupation: Pharmacist	25 (18.1%)	12.0% to 25.4%
Occupation: Lab Technician	25 (18.1%)	12.0% to 25.4%
PFPS Positive (Kujala ≤65)	41 (29.7%)	22.1% to 38.1%
NPRS Score	1.77 ± 0.82	1.63 to 1.91

Table 2. Distribution of pain intensity among participants (N = 138)

Pain Intensity Category	n (%)	95% CI for Proportion
No pain (0)	60 (43.5%)	35.3% to 52.0%
Mild (1–3)	55 (39.9%)	31.8% to 48.4%
Moderate (4–6)	17 (12.3%)	7.3% to 18.9%
Severe (7–10)	6 (4.3%)	1.6% to 9.1%

Table 3. Prevalence of PFPS by BMI category

BMI Category (kg/m²)	PFPS Positive n (%)	PFPS Negative n (%)	Total n (%)	Odds Ratio (95% CI)	p-value
Underweight (<18.5)	2 (18.2%)	9 (81.8%)	11 (8.0%)	0.58 (0.11–3.01)	0.518
Normal (18.5–24.9)	7 (9.0%)	71 (91.0%)	78 (56.5%)	Reference	—
Overweight (25.0–29.9)	14 (50.0%)	14 (50.0%)	28 (20.3%)	10.16 (3.53–29.24)	<0.001
Obese (≥30)	18 (85.7%)	3 (14.3%)	21 (15.2%)	60.86 (14.67–252.59)	<0.001
Total	41 (29.7%)	97 (70.3%)	138 (100%)	—	—

Analysis of BMI categories showed a strong gradient in PFPS prevalence: 9.0% in those with normal BMI, 50.0% in overweight individuals, and 85.7% in obese participants. The odds of PFPS were more than tenfold higher in overweight participants (OR 10.16, 95% CI 3.53–29.24, $p < 0.001$) and over sixtyfold higher in obese participants (OR 60.86, 95% CI 14.67–252.59, $p < 0.001$) compared to normal-weight counterparts. Pearson's correlation demonstrated a moderate, statistically significant positive association between BMI and PFPS prevalence ($r = 0.288$, $p < 0.001$), supporting a dose-response relationship between increased body mass and risk of patellofemoral joint dysfunction.

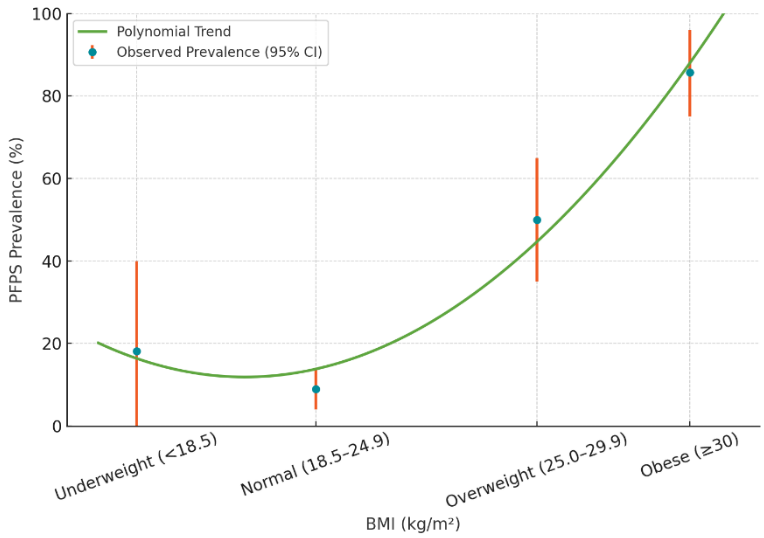

Figure 1 Prevalence of Patellofemoral Pain Syndrome Across BMI Categories

The plotted data show a steep, nonlinear rise in PFPS prevalence with increasing BMI, with a marked inflection between normal weight and overweight ranges. The prevalence nearly quintuples from 9.0% in normal-weight participants to 50.0% in overweight individuals, and peaks at 85.7% in the obese group. Confidence intervals indicate increasing precision in the middle BMI ranges but broader uncertainty at the extremes, reflecting smaller subgroup sizes. The polynomial trendline visually reinforces a dose–response relationship, suggesting that even modest BMI elevation above normal significantly elevates PFPS risk, with a disproportionately high burden observed in obese healthcare workers

DISCUSSION

This study demonstrated that nearly one-third of healthcare workers met the diagnostic criteria for patellofemoral pain syndrome (PFPS), with prevalence rising sharply in overweight and obese participants. The positive correlation between BMI and PFPS ($r = 0.288$, $p < 0.001$) supports the hypothesis that excess body weight contributes to patellofemoral joint dysfunction in occupational groups exposed to repetitive lower-limb loading. Notably, obese participants were over 60 times more likely to present with PFPS compared to their normal-weight counterparts, underscoring BMI as a strong risk factor in this cohort (24).

Our findings align with earlier reports linking elevated BMI to increased patellofemoral joint stress and symptomatic PFPS. Ribeiro et al. observed a significant association between BMI and Kujala scores in patients with anterior knee pain, with symptom severity rising proportionally to weight status (25). Similarly, Mohammad and Elsais documented a higher PFPS prevalence among overweight individuals, independent of gender, in a community-based study (26). In the present study, the pattern was even more pronounced, potentially reflecting the combined influence of occupational demands—such as prolonged standing, stair climbing, and kneeling—and biomechanical loading in healthcare workers.

The clinical relevance of these findings extends beyond musculoskeletal discomfort. PFPS can impair mobility, reduce work productivity, and predispose to chronic knee pathology if unaddressed (27). In healthcare settings, where rapid mobility and prolonged weight-bearing are often essential, the functional limitations associated with PFPS may affect both worker well-being and patient care delivery. Preventive strategies, such as targeted strength training of the quadriceps and hip abductors, ergonomic modifications to reduce repetitive knee loading, and workplace wellness programs addressing healthy body weight, should be prioritized for at-risk staff (28,29).

The observed prevalence of moderate-to-severe pain in 16.6% of participants indicates a subgroup with potentially greater functional limitation and higher healthcare needs. Previous studies have highlighted that such pain levels are associated with poorer outcomes in conservative management and may require longer recovery times (30). Screening and early intervention in this subgroup may reduce the risk of long-term disability.

This study has several limitations that should be acknowledged. The cross-sectional design precludes establishing causality between BMI and PFPS. The use of a non-probability convenience sample limits generalizability, as participants may differ systematically from the broader healthcare workforce. Additionally, reliance on self-reported questionnaires introduces potential recall bias, though this was mitigated by combining subjective measures with objective clinical testing. Small subgroup sizes in underweight and obese categories widened confidence intervals for prevalence estimates, particularly at the extremes. Nonetheless, the consistent trend across BMI categories and the strength of association support the robustness of the observed relationship.

Future research should consider longitudinal designs to track the development of PFPS over time in relation to BMI changes, occupational workload, and physical activity patterns. Multi-center studies with larger, randomly selected samples would enhance representativeness. Furthermore, interventional trials evaluating workplace-based preventive measures, such as targeted strengthening programs and weight management support, could provide high-quality evidence to inform policy and practice in healthcare settings.

CONCLUSION

The present study identified a 29.7% prevalence of patellofemoral pain syndrome among healthcare workers, with a clear and statistically significant positive correlation between BMI and PFPS risk. Overweight and obese participants demonstrated markedly higher odds of developing PFPS compared to their normal-weight counterparts, highlighting body mass as a critical modifiable risk factor in this occupational group. These findings underscore the importance of targeted workplace interventions—such as weight management programs, ergonomic modifications, and preventive strength training—to reduce the burden of PFPS and maintain workforce health and efficiency. Longitudinal and interventional studies are warranted to confirm causality and evaluate the effectiveness of tailored preventive strategies in healthcare settings.

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