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Original Article

Factors Associated with Knee Osteoarthritis Among Postmenopausal Women in Lahore

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ABSTRACT

Background: Knee osteoarthritis is a common degenerative musculoskeletal condition among postmenopausal women and is frequently associated with pain, reduced mobility, functional limitation, and fear of falling. Postmenopausal hormonal changes, excess body weight, low physical activity, and reduced balance confidence may contribute to symptom burden and disease severity. Objective: To determine the association of pain intensity, fear of falling, physical activity level, and body mass index with knee osteoarthritis grade among postmenopausal women in Lahore. Methods: A cross-sectional observational study was conducted among 153 postmenopausal women aged 46–76 years with Grade 1 or Grade 2 knee osteoarthritis. Participants were selected through convenience sampling from Ali Raza Abad and the Physical Therapy Department of Mumtaz Bakhtawar Trust Teaching Hospital, Lahore. Data were collected through face-to-face interviews using a structured questionnaire, Numerical Pain Rating Scale, Falls Efficacy Scale, International Physical Activity Questionnaire, and anthropometric assessment. Data were analyzed using SPSS version 25. Frequencies, percentages, means, standard deviations, cross-tabulations, and chi-square tests were used. Results: Grade 1 knee osteoarthritis was present in 77 participants and Grade 2 in 76 participants. Low physical activity was reported by 99 participants, while 97 were overweight and 56 were obese. Pain intensity and Falls Efficacy Scale category were significantly associated with osteoarthritis grade ($p < .001$), whereas BMI category ($p = .082$) and physical activity level ($p = .197$) were not significantly associated. Conclusion: Pain intensity and fear of falling were significantly associated with knee osteoarthritis grade among postmenopausal women, while BMI and physical activity level were not statistically associated. Comprehensive management should include pain control, fall-risk screening, physical activity counseling, and weight-control strategies. Keywords: Knee osteoarthritis, postmenopausal women, pain intensity, fear of falling, physical activity, body mass index, Lahore.

INTRODUCTION

Knee osteoarthritis is a chronic degenerative joint disorder characterized by progressive structural changes in the articular cartilage, subchondral bone, synovium, and periarticular tissues, commonly resulting in pain, stiffness, functional limitation, reduced mobility, and impaired quality of life. It is one of the leading contributors to musculoskeletal disability, particularly among older adults, because the knee is a major weight-bearing joint exposed to cumulative mechanical loading across the lifespan. Inflammation, cartilage degradation, osteophyte formation, and altered joint biomechanics contribute to the clinical presentation of knee osteoarthritis, while symptom severity is commonly influenced by pain intensity, body composition, physical activity level, balance confidence, and functional capacity (1).

Postmenopausal women represent a clinically important population for knee osteoarthritis because the menopausal transition is associated with hormonal, metabolic, and musculoskeletal changes that may

accelerate degenerative joint processes. Declining estrogen levels after menopause have been linked with adverse effects on cartilage homeostasis, bone metabolism, muscle strength, and inflammatory regulation, which may increase susceptibility to knee joint degeneration and functional impairment. In addition to hormonal changes, several factors commonly observed in postmenopausal women, including increasing age, excess body weight, reduced quadriceps strength, comorbid metabolic conditions, and reduced balance control, may contribute to pain, reduced mobility, and fear of falling among women with knee osteoarthritis (2,3).

The clinical burden of knee osteoarthritis extends beyond structural joint changes because pain and functional restriction can limit walking, stair climbing, standing tolerance, household activities, and participation in daily social roles. Fear of falling is particularly relevant in postmenopausal women with knee osteoarthritis because pain, muscle weakness, proprioceptive impairment, altered gait mechanics, and reduced confidence during movement may increase avoidance behavior and further reduce physical activity. This creates a clinically important cycle in which knee pain and fear of falling may contribute to reduced mobility, while low physical activity may worsen muscle weakness, weight gain, and functional decline (4–7).

Physical activity and body mass index are frequently examined as modifiable factors in knee osteoarthritis. Excess body weight increases mechanical load across the tibiofemoral joint and may also contribute to systemic inflammation, whereas low physical activity may reduce muscle conditioning, balance, and functional resilience. However, the relationship between these factors and osteoarthritis severity is not always consistent, particularly in samples where most participants are already overweight, obese, or physically inactive. Therefore, examining how pain intensity, fear of falling, body mass index, and physical activity relate to knee osteoarthritis grade may provide clinically useful information for early identification and targeted management among postmenopausal women (8–10).

Although knee osteoarthritis is increasingly recognized as a major contributor to disability among women, local evidence regarding associated clinical and behavioral factors among postmenopausal women in Lahore remains limited. Understanding these associations in a local urban population is important because lifestyle patterns, obesity burden, access to rehabilitation, health-seeking behavior, and awareness of musculoskeletal health may differ across settings. Therefore, this study was conducted to determine the association of pain intensity, fear of falling, physical activity level, and body mass index with knee osteoarthritis grade among postmenopausal women in Lahore. The study specifically aimed to assess whether these factors differed between women with mild and moderate knee osteoarthritis.

MATERIAL AND METHODS

A cross-sectional observational study was conducted to assess factors associated with knee osteoarthritis grade among postmenopausal women in Lahore, Pakistan. The study was completed over a period of four months after approval of the synopsis and was carried out at Ali Raza Abad and the Physical Therapy Department of Mumtaz Bakhtawar Trust Teaching Hospital, Lahore. A cross-sectional design was selected because the objective was to examine the association of clinical, anthropometric, and behavioral factors with knee osteoarthritis grade at a single point in time rather than to determine causality or longitudinal disease progression.

The study included 153 postmenopausal women selected through non-probability convenience sampling according to predefined eligibility criteria. Women aged 46–76 years who had reached postmenopausal status and had radiographic Grade 1 or Grade 2 knee osteoarthritis were included. Women were excluded if they had a history of knee fracture, traumatic knee injury, knee tumor, knee joint replacement, or radiographic images of insufficient quality for grading. Eligible participants were recruited from the selected community and clinical settings after screening for age, menopausal status, knee osteoarthritis grade, and relevant exclusion criteria. Written informed consent was obtained before data collection, and participation was voluntary.

Data were collected through face-to-face interviews using a structured questionnaire that included demographic, anthropometric, clinical, and functional variables. Demographic and clinical data included age, height, weight, body mass index, socioeconomic status, comorbid conditions, postmenopausal status, and knee osteoarthritis grade. Body mass index was calculated from measured height and weight and categorized as overweight or obese according to standard BMI cut-off points. Knee osteoarthritis severity was operationalized as Grade 1 or Grade 2 disease, allowing comparison between mild and moderate osteoarthritis groups. Pain intensity was assessed using the Numerical Pain Rating Scale, which measures perceived pain severity on an 11-point scale ranging from 0 to 10, with higher scores indicating greater pain intensity. Fear of falling was assessed using the Falls Efficacy Scale, which evaluates concern or confidence related to performing daily activities without falling. Physical activity was assessed using the International Physical Activity Questionnaire, which records walking, moderate-intensity activity, vigorous-intensity activity, and sitting time and classifies physical activity according to total metabolic equivalent minutes per week.

The primary outcome variable was knee osteoarthritis grade, categorized as Grade 1 or Grade 2. The main explanatory variables were body mass index category, pain intensity category, physical activity level, and Falls Efficacy Scale category. Physical activity was categorized as low, moderate, or high according to reported MET-minutes per week. Pain intensity was categorized according to the reported NPRS classification used in the study analysis. Fear of falling was categorized into low concern, moderate concern, and high concern according to Falls Efficacy Scale scoring categories. Potential sources of bias were addressed by using standardized data collection tools, applying predefined eligibility criteria, collecting data through direct interviews, and maintaining uniform procedures across participants. Restriction of eligibility to women with Grade 1 or Grade 2 knee osteoarthritis reduced heterogeneity related to advanced disease, although the cross-sectional design and convenience sampling limited causal inference and generalizability.

Data were entered and analyzed using Statistical Package for the Social Sciences version 25. Descriptive statistics were calculated for all study variables. Continuous variables, including age, height, and weight, were summarized using mean, standard deviation, minimum, and maximum values. Categorical variables, including BMI category, socioeconomic status, comorbid condition, physical activity level, pain category, Falls Efficacy Scale category, and knee osteoarthritis grade, were summarized using frequencies and percentages. Associations between knee osteoarthritis grade and categorical explanatory variables were examined using cross-tabulation and chi-square tests. A p-value of less than 0.05 was considered statistically significant. Missing or incomplete responses were reviewed during data entry to maintain data integrity, and analyses were conducted using the available complete data for the relevant variables.

Ethical approval was obtained before the initiation of data collection. All participants were informed about the purpose of the study, the voluntary nature of participation, confidentiality of responses, and their right to withdraw at any stage without penalty. Informed consent was obtained before interview administration, and participant data were used anonymously for research and publication purposes.

RESULTS

A total of 153 postmenopausal women with Grade 1 or Grade 2 knee osteoarthritis were included in the analysis. The mean age of the participants was 59.39 ± 6.98 years, with an age range of 47–76 years. The mean height was 157.05 ± 2.69 cm, and the mean body weight was 72.97 ± 6.92 kg. Most participants were overweight, while more than one-third were obese. Middle socioeconomic status was the most frequent socioeconomic category, and comorbid conditions were common, with hypertension, diabetes mellitus, or both reported in most participants. The distribution of knee osteoarthritis grade was almost equal between the two study groups. Grade 1 knee osteoarthritis was present in 77 participants, while Grade 2

knee osteoarthritis was present in 76 participants, indicating a balanced comparison between mild and moderate disease categories.

Table 1. Demographic and Clinical Characteristics of the Study Participants

Variable	Category	n	%
Age, years	Mean ± SD	59.39 ± 6.98	47–76
Height, cm	Mean ± SD	157.05 ± 2.69	152–162
Weight, kg	Mean ± SD	72.97 ± 6.92	61–86
BMI	Overweight	97	63.4
	Obese	56	36.6
Socioeconomic status	Lower class	39	25.5
	Middle class	78	51.0
	Upper class	36	23.5
Comorbid condition	Hypertension	41	26.8
	Diabetes mellitus	41	26.8
	Hypertension and diabetes mellitus	40	26.1
	No comorbidity	31	20.3

SD, standard deviation; BMI, body mass index.

Table 2. Distribution of Knee Osteoarthritis Grade

Knee Osteoarthritis Grade	n	%
Grade 1	77	50.3
Grade 2	76	49.7
Total	153	100.0

The physical activity profile showed that low physical activity was the predominant category. A total of 99 participants were classified as having low physical activity, 42 as having moderate physical activity, and 12 as having high physical activity. This indicates that nearly two-thirds of the study population had low physical activity levels.

Table 3. Physical Activity Level According to IPAQ Classification

Physical Activity Level	n	%
Low physical activity	99	64.7
Moderate physical activity	42	27.5
High physical activity	12	7.8
Total	153	100.0

IPAQ, International Physical Activity Questionnaire.

Fear of falling was commonly reported in the study population. Moderate concern was the most frequent Falls Efficacy Scale category, reported by 76 participants. Low concern was reported by 39 participants, while high concern was reported by 38 participants. Overall, 114 participants had either moderate or high concern about falling.

Table 4. Falls Efficacy Scale Categories Among Study Participants

Falls Efficacy Scale Category	n	%	Cumulative %
Low concern	39	25.5	25.5
Moderate concern	76	49.7	75.2
High concern	38	24.8	100.0
Total	153	100.0	100.0

The association analysis showed that BMI category was not statistically associated with knee osteoarthritis grade. However, obesity was numerically more frequent among participants with Grade 2 osteoarthritis than among those with Grade 1 osteoarthritis. Pain intensity showed a statistically significant association with osteoarthritis grade, with all Grade 1 participants classified as having mild pain and all Grade 2 participants classified as having moderate pain. Physical activity level was not statistically associated with osteoarthritis grade. Falls Efficacy Scale category showed a statistically significant association with osteoarthritis grade, although the observed distribution requires cautious interpretation because all Grade 2 participants were classified in the moderate concern category, while Grade 1 participants were distributed between low and high concern categories.

Table 5. Association Between Knee Osteoarthritis Grade and Clinical, Anthropometric, and Functional Factors

Variable	Category	Grade 1 n (%)	Grade 2 n (%)	χ^2	df	p-value	Cramer's V
BMI	Overweight	55 (71.4)	42 (55.3)	3.027	1	.082	0.141
BMI	Obese	22 (28.6)	34 (44.7)				
NPRS	Mild pain	77 (100.0)	0 (0.0)	153.000	1	<.001	1.000
NPRS	Moderate pain	0 (0.0)	76 (100.0)				
IPAQ	Low physical activity	53 (68.8)	46 (60.5)	3.246	2	.197	0.146
IPAQ	Moderate physical activity	18 (23.4)	24 (31.6)				
IPAQ	High physical activity	6 (7.8)	6 (7.9)				
FES	Low concern	39 (50.6)	0 (0.0)	153.000	2	<.001	1.000
FES	Moderate concern	0 (0.0)	76 (100.0)				
FES	High concern	38 (49.4)	0 (0.0)				

BMI, body mass index; NPRS, Numerical Pain Rating Scale; IPAQ, International Physical Activity Questionnaire; FES, Falls Efficacy Scale; df, degrees of freedom. Cramer's V was derived from the reported chi-square statistics and total sample size.

The BMI distribution showed a higher proportion of obesity among participants with Grade 2 osteoarthritis compared with Grade 1 osteoarthritis, 44.7% versus 28.6%, but this association did not reach statistical significance. Pain intensity demonstrated complete separation across osteoarthritis grades, with mild pain reported among all Grade 1 participants and moderate pain among all Grade 2 participants. Physical activity was low in both groups, affecting 68.8% of Grade 1 participants and 60.5% of Grade 2 participants, with no statistically significant association between IPAQ category and osteoarthritis grade. Falls Efficacy Scale category also showed complete statistical separation, with all Grade 2 participants classified as having moderate concern, while Grade 1 participants were classified as having either low or high concern. These patterns indicate statistically strong associations for pain intensity and Falls Efficacy Scale category, but the complete separation of categories should be interpreted carefully and verified against the original scoring and coding procedures.

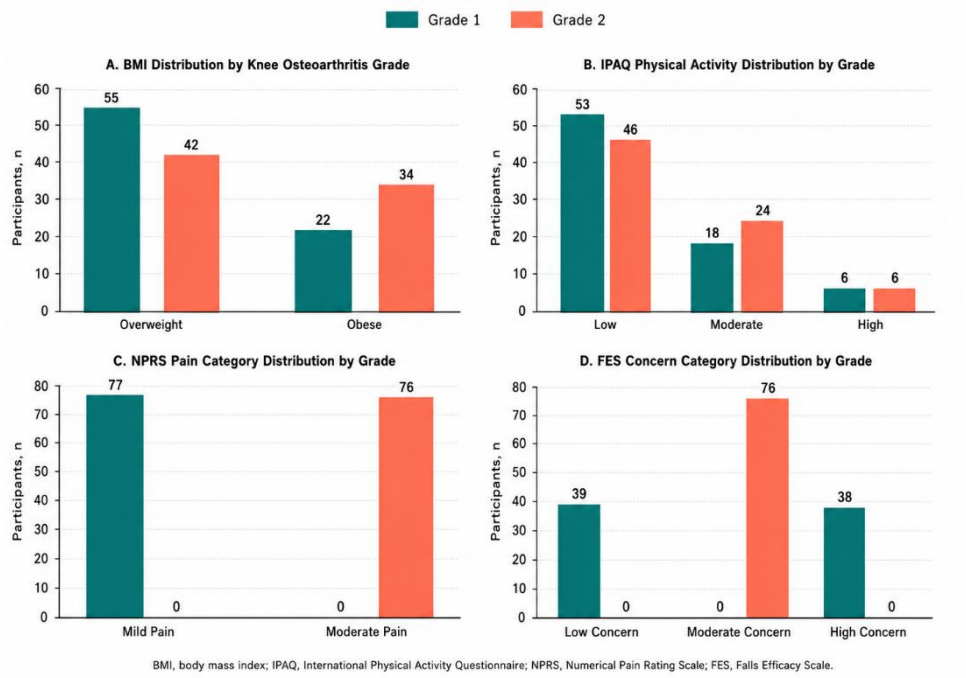

Figure 1 FES Concern Category Distribution by Grade

The panelled figure demonstrates distinct clinical and functional profiles across Grade 1 and Grade 2 knee osteoarthritis. Obesity was more frequent in Grade 2 than Grade 1 participants, increasing from 22/77 to 34/76, while overweight status was more common in Grade 1, 55/77 versus 42/76. Low physical activity predominated in both groups, affecting 53/77 participants with Grade 1 and 46/76 with Grade 2, whereas high activity was uncommon and equally distributed, 6 participants in each grade. Pain category showed complete separation, with all Grade 1 participants classified as having mild pain and all Grade 2 participants classified as having moderate pain. Falls Efficacy Scale categories also showed marked

separation, with Grade 2 participants concentrated entirely in the moderate concern category, while Grade 1 participants were distributed between low and high concern. These patterns support clinically important differences in pain and fall-related concern across osteoarthritis grade, although the complete category separation should be verified against the original scoring and coding before final publication.

DISCUSSION

The present cross-sectional study examined clinical, anthropometric, and functional factors associated with knee osteoarthritis grade among 153 postmenopausal women in Lahore. The study population was almost equally distributed between Grade 1 and Grade 2 knee osteoarthritis, allowing comparison between mild and moderate disease categories. The findings showed statistically significant associations of knee osteoarthritis grade with pain intensity and Falls Efficacy Scale category, while body mass index and physical activity level were not statistically associated with osteoarthritis grade. These findings suggest that, within this sample of postmenopausal women with early-to-moderate knee osteoarthritis, symptom severity and fall-related concern were more clearly differentiated across osteoarthritis grades than BMI category or physical activity classification.

The predominance of knee osteoarthritis in postmenopausal women is clinically plausible because menopause is associated with hormonal, musculoskeletal, and metabolic changes that may influence joint health. Reduced estrogen levels after menopause may affect cartilage metabolism, inflammatory regulation, muscle function, and periarticular tissue integrity, thereby increasing vulnerability to degenerative knee joint changes. Previous local and regional work has similarly emphasized the importance of postmenopausal status, parity, obesity, and age-related musculoskeletal changes in relation to knee osteoarthritis among women (11). A recent national burden analysis from Pakistan further supports the public health relevance of osteoarthritis, showing an increasing disease burden over time and a greater burden among women than men (12). The current findings therefore add local clinical data from Lahore and highlight the need to evaluate not only structural disease grade but also symptom burden, fear of falling, and functional risk in postmenopausal women.

Pain intensity showed a highly significant association with osteoarthritis grade in the present study. All participants with Grade 1 osteoarthritis were categorized as having mild pain, while all participants with Grade 2 osteoarthritis were categorized as having moderate pain. This finding is consistent with the expected clinical pattern that increasing structural severity may be accompanied by greater pain burden, although pain in knee osteoarthritis is multifactorial and may be influenced by synovial inflammation, subchondral bone changes, muscle weakness, central sensitization, psychological factors, and functional limitations. Previous evidence has shown that pain and reduced physical function are common among patients with knee osteoarthritis and may substantially impair activities of daily living (13). However, the complete separation of pain categories observed in the present dataset should be interpreted cautiously, as such a pattern may also reflect categorization effects, scoring thresholds, or data coding procedures. Reporting continuous NPRS scores in future analysis would provide a more precise understanding of pain distribution across osteoarthritis grades.

Fear of falling, assessed using the Falls Efficacy Scale, was also significantly associated with osteoarthritis grade. Moderate or high concern about falling was common in the study population, indicating that fall-related confidence is an important clinical issue among postmenopausal women with knee osteoarthritis. This association is biologically and functionally plausible because knee pain, reduced quadriceps strength, impaired proprioception, altered gait mechanics, and reduced balance confidence may increase fear of falling and movement avoidance. A systematic review and meta-analysis reported that knee and hip osteoarthritis were associated with increased risk of falls and fractures, supporting the clinical relevance of fall-risk assessment in osteoarthritis populations (14). In the present study, all Grade 2 participants were categorized as having moderate concern, while Grade 1 participants were distributed between low and high concern categories. Although this produced a statistically strong association, the

distribution pattern is unusual and should be verified against the original FES scoring and categorization before final interpretation.

Physical activity level was not significantly associated with osteoarthritis grade in this sample. Most participants were classified as having low physical activity, and low activity was common in both Grade 1 and Grade 2 osteoarthritis groups. This finding may indicate that reduced physical activity is widespread among postmenopausal women with knee osteoarthritis regardless of mild or moderate grade. It may also reflect limited variability in activity behavior, reducing the ability to detect statistically significant differences between groups. Previous studies have reported low physical activity levels among individuals with knee osteoarthritis and have emphasized that pain, fear of movement, lack of confidence, and perceived functional limitation may restrict participation in regular activity (15). Therefore, although physical activity level was not statistically associated with osteoarthritis grade in the present analysis, physical activity promotion remains clinically relevant for maintaining mobility, muscle strength, balance, and cardiometabolic health in postmenopausal women with knee osteoarthritis.

Body mass index was also not statistically associated with osteoarthritis grade, although obesity was numerically more frequent among participants with Grade 2 osteoarthritis than among those with Grade 1 osteoarthritis. This pattern suggests a clinically relevant trend that did not reach statistical significance in the current sample. The lack of statistical significance may be related to the restricted BMI distribution because all participants were either overweight or obese, with no normal-weight comparison group. This may have created a ceiling effect and reduced the ability to detect a graded relationship between BMI category and osteoarthritis severity. Prior research from Lahore has reported a high prevalence of knee osteoarthritis among postmenopausal women and has emphasized the contribution of obesity and excess body weight to knee joint loading and symptom burden (16). Broader epidemiological evidence also supports the role of obesity as an important risk factor for the development and progression of knee osteoarthritis through both mechanical loading and metabolic-inflammatory pathways (17). Therefore, the non-significant BMI finding in the present study should not be interpreted as evidence that weight status is clinically unimportant.

The findings of this study have practical implications for screening and rehabilitation planning. In postmenopausal women with knee osteoarthritis, clinical assessment should extend beyond radiographic grade and include pain intensity, fall-related concern, physical activity level, body weight, and comorbid conditions. Pain management, fall-prevention strategies, balance training, strengthening exercises, education regarding safe physical activity, and weight-control counseling may be important components of a comprehensive management plan. However, because this study was cross-sectional, the observed associations should be interpreted as relationships rather than causal effects. The study cannot determine whether higher osteoarthritis grade led to greater pain and fear of falling, or whether pain, reduced confidence, and activity limitation contributed to worsening functional status.

This study has several limitations. The use of convenience sampling may limit the generalizability of the findings beyond the selected community and clinical settings in Lahore. The analysis was limited to women with Grade 1 and Grade 2 knee osteoarthritis, so the findings may not apply to women without osteoarthritis or those with advanced disease. The categorization of NPRS, FES, and IPAQ may have reduced the granularity of the data, and continuous score reporting would strengthen future analysis. The absence of multivariable adjustment limits interpretation because age, BMI, comorbidity, and physical activity may confound the relationship between osteoarthritis grade and functional outcomes. Finally, the complete separation observed for NPRS and FES categories should be verified using the original dataset before final publication.

CONCLUSION

This cross-sectional study found that pain intensity and fear of falling were significantly associated with knee osteoarthritis grade among postmenopausal women in Lahore, while body mass index and physical activity level were not statistically associated with osteoarthritis grade. The findings suggest that symptom burden and fall-related concern may be important clinical indicators among women with early-to-moderate knee osteoarthritis. Although obesity and low physical activity were highly prevalent in the sample, their lack of statistical association with osteoarthritis grade may reflect limited variability within the study population. Comprehensive assessment and management of postmenopausal women with knee osteoarthritis should therefore include pain evaluation, fall-risk screening, physical activity counseling, strengthening and balance interventions, and weight-control guidance, while recognizing that causal relationships cannot be inferred from the present cross-sectional design.

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