

## Article

## Association of Parity with Knee Osteoarthritis in Postmenopausal Women

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## ABSTRACT

**Background:** Knee osteoarthritis (OA) is a prevalent degenerative joint disorder, particularly among postmenopausal women, yet the role of parity as a potential risk factor remains inconclusive in current literature. Limited regional data and methodological inconsistencies create a significant research gap in understanding reproductive factors contributing to OA. **Objective:** This study aimed to determine the association between parity and knee osteoarthritis in postmenopausal women, hypothesizing that higher parity may increase the risk of developing OA. **Methods:** A case-control observational study was conducted at Akhtar Saeed Trust Hospital involving 68 postmenopausal women (34 cases with knee OA and 34 controls without OA), aged  $\geq 50$  years. Participants were selected using non-probability convenience sampling. Data were collected via a structured questionnaire and parity was categorized as uniparous or multiparous. Statistical analysis was performed using SPSS version 27. Odds ratios (OR), 95% confidence intervals (CI), and p-values were calculated using the Chi-square test. Ethical approval was obtained from the institutional review board (IRB/ASMC/2023/029), and informed consent was secured per the Helsinki Declaration. **Results:** The odds of knee OA in multiparous women were higher but not statistically significant (OR = 0.622; 95% CI: 0.184–2.105;  $p = 0.493$ ). No significant association was observed between parity and knee OA. **Conclusion:** The findings suggest that parity is not significantly associated with knee osteoarthritis in postmenopausal women. Clinically, reproductive history alone may not warrant prioritization in OA risk stratification, and future research should explore multifactorial contributors.

**Keywords:** Knee Osteoarthritis, Postmenopause, Parity, Risk Factors, Case-Control Studies, Musculoskeletal Disorders, Hormonal Changes

## INTRODUCTION

Osteoarthritis (OA) is among the most prevalent chronic musculoskeletal disorders, particularly affecting individuals over the age of 50, with a disproportionately higher burden observed in women (1). The knee joint, as a major weight-bearing structure, is frequently impacted, leading to progressive pain, reduced mobility, and diminished quality of life. Postmenopausal women are particularly vulnerable to knee OA due to complex physiological changes associated with aging and hormonal decline, particularly the reduction in circulating estrogen levels (2). These hormonal fluctuations are known to influence inflammatory mediators and cartilage metabolism, potentially contributing to the pathogenesis of OA in this population (3).

While well-established risk factors for knee OA include age, obesity, joint injury, and mechanical loading, the role of

reproductive history—specifically parity—has received growing attention. Parity, defined as the number of live births a woman has experienced, may influence long-term joint health through both mechanical and hormonal pathways. During pregnancy, women experience significant changes in joint laxity, weight gain, and posture, which may place additional stress on the knee joint. Repeated exposure to these biomechanical demands could theoretically contribute to joint degeneration over time. Moreover, multiparity has been associated with fluctuations in estrogen levels, which could further affect cartilage integrity and inflammatory processes in postmenopausal years (4). Despite this plausible biological basis, the literature remains inconclusive, with some studies suggesting a potential link between higher parity and knee OA, while others have reported no significant association (5).

Recent epidemiological studies have underscored the need to explore gender-specific and life course-related risk factors for OA in women, particularly in regions where high parity is common due to cultural or socioeconomic norms. However, there remains a paucity of data from developing countries that examines parity as an independent risk factor for OA, especially in postmenopausal populations. Most existing studies either lack methodological rigor or fail to adequately control for potential confounders such as body mass index, occupational exposure, or physical activity levels. This gap highlights the need for region-specific, hypothesis-driven research that investigates the long-term impact of parity on musculoskeletal health in aging women.

Given these considerations, the present study aims to determine whether an association exists between parity and knee osteoarthritis in postmenopausal women. Understanding this relationship could inform preventive strategies and risk assessment models, particularly for populations where multiparity is common. This case-control study was conducted following ethical approval from the institutional review board of Akhtar Saeed Trust Hospital. Informed consent was obtained from all participants. The authors declare no conflicts of interest, and the research was supported by funding from the Foundation of Basic Research. The hypothesis guiding this study is that parity is significantly associated with the presence of knee OA in postmenopausal women.

## MATERIAL AND METHODS

This case-control study was conducted to evaluate the association between parity and knee osteoarthritis in postmenopausal women. The study was carried out over a six-month period at Akhtar Saeed Trust Hospital and within its surrounding community. The design was observational and analytical in nature, appropriate for identifying potential associations between exposure (parity) and outcome (knee osteoarthritis). Women aged 50 years and above who had reached postmenopausal status were eligible for inclusion. Cases were defined as postmenopausal women clinically diagnosed with knee osteoarthritis based on orthopedic consultation and radiological evidence, whereas controls were postmenopausal women without a clinical or radiographic diagnosis of knee OA. Exclusion criteria included women with a history of inflammatory arthritis, previous knee surgery or trauma, or any endocrine disorder known to affect joint health, in order to minimize confounding effects. Participants were recruited through convenience sampling from the outpatient department and nearby residential areas. Informed consent was obtained from all participants prior to enrollment. The study protocol was approved by the Institutional Review Board of Akhtar Saeed Medical and Dental College (Approval ID: IRB/ASMC/2023/029).

Data collection involved the use of a structured, self-administered questionnaire designed to capture demographic variables (age, educational status, BMI), reproductive history (parity, age at menarche, menopausal age), and clinical symptoms associated with OA. Diagnosis was confirmed using both clinical criteria and radiographic findings, although radiographic grading (e.g., Kellgren-Lawrence scale) was not

included. The primary outcome of interest was the presence or absence of knee osteoarthritis. The key independent variable was parity, categorized as uniparous or multiparous. Secondary variables such as BMI, age group, and joint laterality (unilateral/bilateral) were documented to explore potential confounders. Although imaging modalities and biochemical markers were not used, steps were taken to standardize data collection procedures and minimize interviewer bias by using trained female data collectors fluent in the local language. The questionnaire was piloted on a small subset of the population to improve content validity and ensure clarity.

The study adhered to the principles outlined in the Declaration of Helsinki. Confidentiality was maintained by anonymizing data and restricting access to study-related documents. Ethical concerns related to human subject participation were addressed through written consent and the provision of verbal explanations regarding the study's objectives and voluntary nature. Participants were assured that refusal to participate would not impact their medical care.

Statistical analysis was conducted using IBM SPSS Statistics version 27. Descriptive statistics (means, frequencies, and percentages) were used to summarize demographic and clinical characteristics. To test the association between parity and knee osteoarthritis, the odds ratio (OR) was calculated along with 95% confidence intervals (CIs). The Chi-square test was used to assess statistical significance between categorical variables, with a p-value of <0.05 considered statistically significant. No imputation was performed for missing data, as all questionnaires were cross-checked for completeness prior to analysis. While the analysis did not adjust for potential confounders through multivariable regression models, matching of cases and controls by age group helped reduce age-related confounding. Future studies with larger sample sizes and adjustment for multiple covariates are recommended to strengthen causal inference.

## RESULTS

A total of 68 postmenopausal women participated in the study, comprising 34 cases diagnosed with knee osteoarthritis and 34 age-matched controls without OA. The mean age of participants was  $61.2 \pm 6.7$  years. The majority of participants (98.5%) were aged between 50 and 70 years. A breakdown of age distribution is provided in Table 1. Most participants reported an educational level of high school or less, with similar distribution across both groups. The frequency distribution by age groups showed that 50.0% of the participants were aged 50–60 years, while 48.5% were aged 60–70 years. Only 1.5% were aged above 70 years. Regarding knee involvement, 50.0% of OA cases had bilateral knee OA, while 38.2% had unilateral involvement. These findings are detailed in Table 2.

**Table 1: Age Distribution of Participants**

Age Group (years)	Frequency	Percent (%)
50–60	34	50.0
60–70	33	48.5
70–80	1	1.5
<b>Total</b>	<b>68</b>	<b>100.0</b>

**Table 2: Knee Osteoarthritis Diagnosis Type**

Diagnosis Type	Frequency	Percent (%)
Unilateral	26	38.2
Bilateral	34	50.0
None (Control)	8	11.8
Total	68	100.0

An odds ratio analysis was performed to assess the association between parity and knee osteoarthritis. Parity was categorized as uniparous (1 child) and multiparous (2 or more children). Among uniparous women, 40.0% had OA, while 60.0% were in the control group. In contrast, 51.7% of multiparous women had OA, and 48.3% were controls. The calculated odds ratio (OR) was 0.622, indicating a lower odds of OA among uniparous women. However, the result was not statistically significant, with a 95% confidence interval (CI) of 0.184–2.105 and a p-value of 0.493

**Table 3: Association Between Parity and Knee Osteoarthritis**

Parity	OA Present (n)	OA Absent (n)	Total (n)	% with OA	OR (95% CI)	p-value
Uniparous	4	6	10	40.0%	0.622 (0.184–2.105)	0.493
Multiparous	30	28	58	51.7%	–	–
Total	34	34	68	–	–	–

Despite the lack of statistical significance, the descriptive trend of slightly higher OA prevalence among multiparous women suggests a possible subclinical association that may require further exploration in larger, more diverse populations.

## DISCUSSION

The findings of this study demonstrate no statistically significant association between parity and the risk of developing knee osteoarthritis (OA) in postmenopausal women, with an observed odds ratio of 0.622 and a non-significant p-value. These results are consistent with previous studies that questioned the role of parity as an independent risk factor for OA, particularly in populations where other dominant factors such as obesity, aging, and genetic predisposition are more prevalent (5,17). Some literature has suggested a potential biomechanical or hormonal link between multiple pregnancies and knee joint degeneration due to repetitive musculoskeletal loading and estrogen fluctuations (4,6), while others, like the studies by Muthuri et al. and Wills et al., have highlighted the overshadowing impact of age, BMI, and physical inactivity on OA risk (17,19). The present study adds to this discourse by reaffirming that parity alone, in the absence of confounding high-risk variables, may not be a significant contributor to postmenopausal knee OA.

An important strength of this study lies in its focused case-control design, which matched participants by age and controlled for menopausal status. However, several limitations must be acknowledged. The small sample size of 68 participants limits the statistical power to detect subtle associations, especially in subgroup analyses. Additionally, the use of non-probability convenience sampling introduces potential selection bias, limiting the generalizability of the findings. The reliance on a self-developed questionnaire, though piloted for clarity, may also introduce recall bias or measurement errors in exposure assessment. The absence of multivariate analysis further

(Table 3). These findings suggest no significant association between parity and the risk of knee OA in this population. Although multiparity was more frequent among OA cases, the difference did not reach statistical significance. This outcome supports the null hypothesis, indicating parity is not a significant risk factor for knee OA in postmenopausal women within the study sample.

No significant interaction effects were observed between parity and other potential modifiers such as BMI or age subgroup when stratified analysis was attempted. Due to the limited sample size, further multivariate regression analyses were not conducted, and subgroup comparisons should be interpreted with caution. Future studies may consider increasing sample size and performing adjusted logistic regression models to account for residual confounding.

restricts the ability to adjust for potential confounders such as physical activity level, BMI, and socioeconomic status.

Alternative interpretations of the findings could consider that parity's potential effects on joint degeneration may be mediated through intermediate factors such as weight gain or physical inactivity during and after pregnancy, rather than parity itself acting as a direct risk factor. Furthermore, hormonal alterations in postmenopausal women might overshadow the earlier effects of pregnancy-related hormonal changes. These nuances highlight the complex, multifactorial nature of OA pathogenesis. Future studies with larger, multicenter cohorts and longitudinal designs are needed to examine not just the count of pregnancies but their timing, spacing, and associated weight and hormonal shifts. Incorporating radiographic grading, objective biomechanical assessments, and hormonal profiling could offer more conclusive insights.

## CONCLUSION

In conclusion, this study found no significant association between parity and the development of knee osteoarthritis in postmenopausal women, suggesting that parity may not independently influence OA risk in this population. These findings align with previous research that downplays parity as a major contributor to knee OA and emphasize the need to focus on more modifiable and well-established risk factors. Clinically, the results suggest that screening and preventive strategies for knee OA in postmenopausal women should prioritize weight management, joint protection, and physical activity rather than reproductive history alone. Further research is warranted to explore the interplay of reproductive, hormonal, and biomechanical variables in joint health across the female life course.

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