RESEARCH PAPER

Knee Osteoarthritis in Rural Nashik, Maharashtra: Prevalence And Association With Gender And Body Mass Index: A Cross-Sectional Study

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ABSTRACT

Background: Knee Osteoarthritis (KOA) is a leading cause of functional disability and chronic pain in older adults, with a disproportionate burden in rural India owing to occupational, cultural, and lifestyle factors.

Objective: To find the prevalence of knee osteoarthritis and its correlation with gender and body mass index (BMI) among adults 50 years of age and above in the rural area of Nashik, Maharashtra.

Methods: A community-based cross-sectional study was conducted over six months in the rural areas of Nashik. A total of 352 participants aged ≥ 50 years were enrolled in the study using a cluster random sampling technique. Knee OA was diagnosed according to the American College of Rheumatology (ACR) clinical criteria. Pain intensity was assessed using the Numerical Pain Rating Scale (NPRS), and BMI was calculated using the Quetelet index. Descriptive statistics were used for prevalence; the chi-square test examined the association between OA and sex, and an unpaired t-test compared the mean BMI between participants with and without OA. Ethical clearance and informed consent were obtained for this study.

Results: The overall prevalence of knee OA was 51.14% (180/352). Females had a significantly higher prevalence (57.89%) than males (43.21%) (chi-square = 7.55, p = 0.0060). The mean BMI of participants with OA (25.16 +/- 3.15 kg/m2) was significantly higher than those without OA (23.97 +/- 1.42 kg/m2) (t = 4.53, p < 0.0001). Squatting (38.09%) and kneeling (24.87%) were the most frequently reported limited activities.

Conclusion: Knee OA is highly prevalent in rural Nashik, with female gender and higher BMI emerging as significant correlates. Community-based screening, weight management, and occupation and gender-sensitive physiotherapy interventions are to be advocated.

Keywords: Knee osteoarthritis, prevalence, gender, body mass index, rural population, physiotherapy.

Abbreviations: KOA – Knee osteoarthritis; BMI – body mass index; ACR – American College of Rheumatology; NPRS – Numerical Pain Rating Scale;

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INTRODUCTION

Osteoarthritis (OA) is a degenerative joint disease pathologically characterized by progressive articular cartilage degeneration, subchondral bone remodelling, osteophyte formation, and synovial inflammation, predominantly affecting weight-bearing joints such as the knee.[1] OA entails structural and biochemical alterations across all joint tissues, including the synovial membrane and joint capsule.[1] Types of OA are primary which is idiopathic in cause and age related; and secondary OA which has underlying metabolic, traumatic or inflammatory cause.[2]

Globally, the prevalence of OA is highest amongst rheumatologic conditions, with a reported prevalence of 14-18% in adults and 20-27% among those above the age of 40 years.[3] Symptomatic knee OA affects approximately 24.2% aged over 60 years, and nearly 54.1% above 70 years of experience some limitation of movement.[4] The condition is more common in women, particularly after the age of 45, with females experiencing greater functional

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compromise.[5] Hormonal and metabolic changes during the peri-menopausal period further accentuate vulnerability to knee OA among women.[6]

The etiology of knee OA is multifactorial, encompassing both personal and environmental risk factors. Established risk factors include advancing age, female gender, obesity, genetic predisposition, previous joint injury, occupational mechanical loading, vitamin D deficiency, and metabolic disorders.[7,15] Low-grade inflammation mediated by adipokines and pro-inflammatory cytokines such as tumour necrosis factor-alpha and interleukin-6 contributes to cartilage degradation, linking obesity with OA progression.[8] Body mass index (BMI) remains one of the most modifiable risk factors, and previous knee trauma has been reported to increase the risk of OA by approximately 3.8-fold.[9]

In India, ongoing demographic transition is driving a proportional and absolute increase in the elderly population, also increasing the prevalence of OA .[10] Knee OA accounts for nearly 80% of the total osteoarthritis burden in the country,[11] and worldwide OA has been estimated to be among the leading causes of non-fatal health burden .[12] Despite this, data from rural population of India remains limited. Rural populations are uniquely exposed to repetitive mechanical stressors-such as prolonged squatting, ground-level sitting, and bending and sustained postures due to agricultural activities-alongside limited access to healthcare and ergonomic awareness.[13,14]

The American College of Rheumatology (ACR) clinical criteria for OA remains the cornerstone in the diagnosis which requires knee pain plus at least three of the following: age greater than 50 years, morning stiffness lasting less than 30 minutes, crepitus on motion, bony tenderness, bony enlargement, and absence of palpable warmth.[16,17] Using these criteria, several Indian studies have documented widely variable rural prevalence estimates, ranging from approximately 27% to over 60%.[18-21]

Although the associations between OA and gender, and between OA and BMI, have been examined in urban and southern Indian cohorts, comparable data from rural Maharashtra are sparse. Understanding these correlations in the rural Nashik population is essential for designing a targeted, appropriate physiotherapy program based on demands in farming activities and public health interventions. Accordingly, the present study aimed to determine the prevalence of knee OA and its correlation with gender and BMI among adults in the rural area of Nashik.

MATERIALS AND METHODS

Study design and setting

A community-based cross-sectional study was conducted in the rural areas of Nashik, Maharashtra, for a duration of six months. The cross-sectional study was carried out under the Department of Physiotherapy, M.V.P. Samaj's College of Physiotherapy, Nashik and NIMS University Jaipur.

Participants and sampling

Adults aged ≥ 50 years residing in the rural area of Nashik and willing to participate in the study were eligible for inclusion. Participants were recruited using simple random sampling. The sample size was calculated using the formula for estimating a single proportion, $n = Z^2pq/d^2$, which yielded a minimum required sample size of 352 participants. A total of 352 individuals were enrolled in the study.

Inclusion and exclusion criteria

The inclusion criterion was individuals of both the gender aged 50 years and above.[17] Participants with rheumatoid arthritis, a history of old knee trauma, previous total knee replacement, reactive arthritis, bed-ridden participants, or those unwilling to participate were excluded.[13]

Outcome measures

Numerical Pain Rating Scale (NPRS): an 11-point scale (0 = no pain, 10 = worst imaginable pain) used to grade knee pain at rest and on activity.

Body Mass Index (BMI): derived using Quetlet's index (weight in kilograms divided by the square of height in metres), with categories defined as normal (18.5-22.9 kg/m^2), overweight (23.0-24.9 kg/m^2), and obese type I (25.0-29.9 kg/m^2).

OA knee screening questionnaire: a validated structured screening tool capturing demographic data, signs and symptoms, functional limitations, comorbidities, lifestyle factors, and awareness of physiotherapy.

Procedure

Ethical clearance was obtained from the Institutional Ethics Committee, and informed consent was secured from all participants prior to enrolment in the study. Participants meeting the inclusion criteria were approached in their community settings. The examination and screening procedure was explained in the local language. The OA knee screening questionnaire was administered, and anthropometric measurements were recorded for BMI calculation. Knee OA was diagnosed based on the ACR clinical criteria. Data were subsequently compiled and analysed.

Statistical analysis

Data were analysed using descriptive statistics (frequency and percentages. The chi-square test was used to examine the association between OA and gender, and an unpaired t-test was used to compare mean BMI between participants with and without OA. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 352 participants aged 50 years and above were assessed. The sample comprised 190 females (53.98%) and 162 males (46.02%). The largest age group was 50-59 years (45.17%), followed by 60-69 years (31.25%), 70-79

years (18.18%), and 80-89 years (5.40%). The majority of participants were overweight (73.58%), while 17.61% had a normal BMI and 8.81% were classified as obese type I (Table 1).

Table 1: Demographic characteristics of participants (N = 352)

Variable	Frequency (n)	Percentage (%)
Gender		
Female	190	53.98
Male	162	46.02
Age group (years)		
50-59	159	45.17
60-69	110	31.25
70-79	64	18.18
80-89	19	5.40
BMI category		
Normal (18.5-22.9)	62	17.61
Overweight (23.0-24.9)	259	73.58
Obese type I (25.0-29.9)	31	8.81

The overall prevalence of knee OA in the study population was 51.14% (n = 180), while 48.86% (n = 172) of participants did not meet the diagnostic criteria (Table 2).

Table 2: Prevalence of knee osteoarthritis (N = 352)

Category	Frequency (n)	Percentage (%)
With knee OA	180	51.14
Without knee OA	172	48.86

Correlation with gender

Among males, 43.21% (70/162) had knee OA, whereas 57.89% (110/190) of females had knee OA. The chi-square test revealed a statistically significant association between gender and knee OA (chi-square = 7.55, degrees of freedom = 1, p = 0.0060), indicating that females were significantly more likely to have knee OA than males (Table 3).

Table 3: Association between gender and knee osteoarthritis

Gender	With OA (n)	Without OA (n)	Prevalence (%)
Male	70	92	43.21
Female	110	80	57.89
Chi-square = 7.55; df = 1; p = 0.0060			

Correlation with BMI

The mean BMI of participants with knee OA (25.16 +/- 3.15 kg/m^2; standard error 0.24) was significantly higher than that of participants without OA (23.97 +/- 1.42 kg/m^2; standard error 0.11). The unpaired t-test confirmed this difference to be statistically significant (t = 4.53, p < 0.0001) (Table 4).

Table 4: Comparison of BMI between participants with and without knee OA

Group	n	Mean BMI (kg/m^2)	SD	SE
With OA	180	25.16	3.15	0.24
Without OA	172	23.97	1.42	0.11
Unpaired t = 4.53; p < 0.0001				

Pain and functional limitations

The mean NPRS score were 0.99 at rest and 3.86 on activity. Squatting was the most commonly limited activity (38.09%), followed by kneeling (24.87%), climbing stairs (19.57%), and cross-legged sitting (17.98%). Weight gain over the preceding five years was reported by 64.55% of participants. Diabetes mellitus (54.49%) and hypertension (24.87%) were the most frequently reported comorbidities. A sedentary lifestyle was observed in 17.98% of participants, and 73.54% were aware of physiotherapy services.

DISCUSSION

The present community-based cross-sectional study determined the prevalence of knee OA and its correlation with gender and BMI among adults aged 50 years and above in rural Nashik. The overall prevalence of 51.14% reflects a substantial disease burden and aligns with several Indian and international studies conducted in comparable rural settings. Jaiswal et al. (2021) reported a prevalence of 64.3% among elderly individuals in rural Haryana, suggesting that knee OA remains a major public health concern in non-urban populations.[18] Suriyan et al. (2024) and Jadhao and Dambhare (2021) documented prevalence rates of 42% and 34.7% in rural Karnataka and Maharashtra respectively, while Venkatachalam et al.

(2018) reported a prevalence of 27.1% in rural Tamil Nadu.[19-21] Kandasamy et al. (2024) highlighted the increasing incidence of OA among adults aged 40 years and above in South India, attributing the trend to lifestyle transitions and increased longevity.[13] The increased prevalence observed in this group can be linked to the occupational and cultural habits typical of rural settings. Engaging in activities such as extended squatting, sitting at ground level, and frequent bending during farming tasks places significant mechanical strain on the knee, a modified hinge joint, affecting both the tibiofemoral and the patellofemoral joints. This situation is exacerbated by limited access to healthcare and a lack of ergonomic knowledge, creating an environment where mechanical and biological risk factors intersect.[13,19-21]

A key finding of the study is the significant association between higher BMI and the presence of KOA. Participants with KOA exhibited a markedly higher mean BMI than those without, corroborating the well-established link between increased body weight and knee degeneration. Zheng and Chen (2015), in a systematic review of prospective studies, demonstrated that elevated BMI substantially increases the risk of knee OA, primarily through mechanical overload.[22] Jiang et al. (2012) quantified this risk, reporting an approximate 35% increase in OA likelihood for every 5-unit rise in BMI,[23] while Reijman et al. (2007) observed that individuals with a BMI exceeding 27 kg/m^2 had nearly three times the risk of developing knee OA.[24] Pal et al. (2016) identified BMI as one of the strongest modifiable determinants of OA prevalence in India,[7] and Zhou et al. (2014) demonstrated a clear dose-response relationship between incremental BMI categories and OA risk.[25]

The obesity-OA nexus is mediated by biomechanical and metabolic pathways. Excess body weight increases joint loading during ambulation, accelerating cartilage wear, subchondral bone changes, and joint instability. Concurrently, adipose tissue promotes systemic inflammation through adipokines such as leptin and pro-inflammatory cytokines including tumour necrosis factor-alpha and interleukin-6, which hasten joint tissue degradation.[8,26] In rural populations, these mechanisms may be amplified by dietary imbalances, reduced physical activity, and limited healthcare access, reinforcing the need for weight management, lower-limb strengthening, and movement retraining as core physiotherapy strategies.[27,28]

Gender differences observed in this study further illuminate the interplay of biological and lifestyle factors in OA. Females demonstrated a significantly higher prevalence of knee OA than males, consistent with large-scale epidemiological evidence. Srikanth et al. (2005), in a meta-analysis, established that women have approximately 1.5 times the risk of knee OA compared with men, with the disparity intensifying after menopause.[29] Szilagyi et al. (2022) developed gender-specific OA prediction models confirming not only higher prevalence but also faster progression and greater symptom severity among women.[30] Thati et al. (2021) reported similar trends in Indian populations, attributing the heightened female risk to postmenopausal hormonal changes, lower muscle strength, and sociocultural barriers to early healthcare access.[31] Park et al. (2024) demonstrated that women aged 60 years and above were nearly five times more likely to develop knee OA than men,[32] and Segal et al. (2024) further noted that women experience greater pain intensity and functional impairment.[33]

Participants with confirmed knee OA also exhibited significant functional limitation, particularly in squatting, kneeling, stair-climbing, and cross-legged sitting-activities central to rural Indian daily life. This functional burden reflects how OA extends beyond radiographic change into tangible disability, restricting mobility, occupational participation, and quality of life.[13,34]

Strengths and limitations: This study provides contemporary, community-level prevalence data from rural Maharashtra, a setting underrepresented in the literature. The use of validated ACR clinical criteria enhances diagnostic reliability in a field context. Limitations include the cross-sectional design, which precludes causal inference; the absence of radiographic confirmation; and restriction to a single district, which may limit generalisability. Future longitudinal studies incorporating radiographic grading and multi-site sampling are warranted.

CONCLUSION

Knee osteoarthritis is highly prevalent in the rural population of Nashik, affecting over half of adults aged 50 years and above. Female gender and higher body mass index emerged as significant correlates of knee OA. These findings underscore the need for community-based screening, weight management, and gender-sensitive physiotherapy interventions tailored to the cultural and occupational realities of rural India.

CLINICAL IMPLICATIONS

- Early screening and detection programmes targeting middle-aged and elderly adults in rural communities.
- Weight management and lifestyle interventions integrating exercise, nutritional counselling, and ergonomic education.
- Gender-specific preventive strategies addressing post-menopausal risk, muscle strengthening, and functional mobility for women.
- Community-based physiotherapy programmes delivering joint-protection education, strengthening exercises, and functional mobility training to reduce disability and enhance quality of life.

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