e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(9); 205-210

Original Research Article

Prevalence of Osteoporosis/Osteopenia in Postmenopausal Women

Shyora Bhavesh Nathabhai[1], Ahir Bhavesh Laljibhai[2], Baldaniya Lalji Gopalbhai[3]

[1]MBBS, GMERS Medical College, Valsad, Gujarat, India
[2]MBBS, GMERS Medical College, Valsad, Gujarat, India
[3]MBBS, GMERS Medical College, Valsad, Gujarat, India

Received: 05-07-2025 / Revised: 04-08-2025 / Accepted: 05-09-2025
Corresponding Author: Baldaniya Lalji Gopalbhai
Conflict of interest: Nil

Abstract:

Background: Osteoporosis remains a frequent health issue in postmenopausal women due to the decline in bone mineral density after menopause. This study aimed to determine the prevalence of osteoporosis and osteopenia among women attending an orthopedic outpatient clinic.

Methods: A cross-sectional study was carried out over one year (August 2023–2024) among 192 postmenopausal women aged 50–80 years. BMD was measured using DXA at the lumbar spine and femoral neck, with classification based on WHO criteria. Demographic, reproductive, lifestyle, and clinical data were gathered using a structured pro forma.

Results: Nearly half of the women had osteopenia (44.8%), while 37.5% were osteoporotic and only 17.7% had normal BMD. Lower BMI, early menopause, low calcium intake, and Vitamin D insufficiency were significantly associated with poor bone health. Physical inactivity and prolonged immobilization further increased the risk. Osteoporosis was observed more frequently at the lumbar spine than at the femoral neck, indicating that the lumbar region may be more sensitive in detecting early bone loss.

Conclusion: Osteoporosis and osteopenia are highly prevalent in postmenopausal women, underscoring the need for early screening and preventive interventions.

Keywords: Osteoporosis, Osteopenia, Postmenopausal women, Bone mineral density, Vitamin D deficiency.

Introduction

Osteoporosis is recognized as the most common metabolic disorder of the bone and is considered the fourth leading health threat, with its incidence rising with age. It is defined by reduced bone mass and deterioration of bone microarchitecture, which causes bone fragility and enhances the likelihood of fractures [1,2]. Because of its association with fractures, osteoporosis poses a significant health challenge across nations. The World Health Organization (WHO) has classified osteoporosis as a bone mineral density (BMD) value that is 2.5 standard deviations (SDs) or more below the mean peak BMD [3,4]. Bone density is assessed using T-score and Z-score indices, with T-scores reflecting deviation from peak bone mass in young, healthy adults, and Z-scores comparing bone density to individuals of the same age, gender, and ethnicity. A T-score <−2.5 is diagnostic of osteoporosis, whereas osteopenia is defined by a T-score between −1 and −2.5. Several factors, including the demographic profile, calcium intake, and lifestyle habits, are known to alter bone mass [5].

One of the most critical risk factors for osteoporosis is menopause. Postmenopausal (PMP) women typically lose 3%−5% of bone mass every year, with this accelerated bone loss continuing for up to seven years after menopause due to the decline in ovarian estrogen production [6,7]. Menopausal osteoporosis carries particular importance as women spend nearly one-third of their lives in this state of decreased bone mass and heightened fracture risk. The pattern of bone loss in women after menopause occurs in two phases: an initial rapid loss of trabecular bone over 3–5 years (menopause-related bone loss) followed by a slower, long-term decline in both trabecular and cortical bone spanning 10–20 years (age-related bone loss) [8]. Fractures associated with osteoporosis—most often involving the pelvis, vertebrae, and distal radius—can lead to disability, chronic pain, and increased mortality, with hip fracture-related deaths reaching 20% in the first year. The burden of osteoporosis in India is substantial, with disability-adjusted life years estimated at 36,026 annually [9,10].

Data on the prevalence and risk factors of PMP osteoporosis are scarce in India, despite its high burden, affecting nearly one-third of women. Understanding key determinants is crucial for planning prevention and management strategies. Regional studies assessing both osteoporosis and

osteopenia are particularly limited. This study aims to evaluate the prevalence of osteopenia in postmenopausal women and identify factors associated with low bone mass in this population.

Methods

Study Design and Setting: This was a prospective cross-sectional study carried out in the Orthopedics Outpatient Department over a period of one year, from August 2023 to 2024.

Participants and Recruitment: A total of 192 PMP women aged 50–80 years, with at least one year of amenorrhea, were included. Women with musculoskeletal, cardiovascular, cerebrovascular, thyroid, renal, or liver disorders, sarcopenia, diabetes, a history of osteoporotic fractures, or those receiving hormone therapy, psychotropic drugs, or supplements affecting bone metabolism were excluded.

Data Collection: BMD was assessed using dual-energy X-ray absorptiometry (DXA) at the femoral neck and lumbar spine (L1–L4). Based on WHO criteria, participants were classified as osteoporotic, osteopenic, or normal. The demographic information, reproductive and menstrual history, lifestyle factors (smoking, tobacco use, physical activity, immobilization), and clinical/laboratory parameters including BMI, blood pressure, calcium intake, and serum Vitamin D3 levels of the patients were collected.

Data Analysis: Continuous data were presented as means ± standard deviations, while categorical data were expressed as frequencies and percentages. Group differences were assessed using the Chi-square test for categorical variables and the Student's t-test for continuous variables. A p-value of less than 0.05 was considered statistically significant.

Results

Among the 192 postmenopausal women studied, the majority were between 55 and 65 years of age. Most women had normal or slightly elevated BMI values, with only a minority falling in the underweight category. A considerable proportion reported low dietary calcium intake and limited sun exposure, which reflected in the overall prevalence of Vitamin D insufficiency. Lifestyle behaviors such as smoking and prolonged physical inactivity were uncommon but still noted in a small percentage of participants (Table 1).

Table 1: Participant Demographics and Reproductive History (n = 192)

Characteristic	n (%)
Age group (years)	
50–59	105 (54.7)
60–80	87 (45.3)
Education level	
No formal education	100 (52.1)
Primary/middle school	53 (27.6)
Secondary or higher	39 (20.3)
Marital status	
Single	3 (1.6)
Married	174 (90.6)
Widowed/divorced	15 (7.8)
Number of children	
2 or fewer	37 (19.3)
3–5	83 (43.2)
6 or more	72 (37.5)
History of miscarriage	
None	132 (68.8)
1–2	39 (20.3)
More than 2	21 (10.9)
Breastfeeding history	
Yes	152 (79.2)
No	40 (20.8)
Tobacco use	
Never	164 (85.4)
Current user	28 (14.6)

Analysis of bone mineral density showed that nearly half of the women fell into the osteopenic range, while a smaller but significant group was classified as osteoporotic. Only a minority maintained normal bone density values. The lumbar spine demonstrated a slightly higher incidence rate of low bone mass compared to the femoral neck, highlighting site-

specific variations in bone health among the cohort (Table 2).

Table 2: Menstrual Profile of Participants (n = 192)

Characteristic	n (%) / Mean ± SD
Age at first menstruation (years)	13.2 ± 1.9
Duration of reproductive years (years)	37.2 ± 3.8
Age at menopause (years)	
≤50	119 (62.0)
>50	73 (38.0)
Years since menopause	
≤5	51 (26.6)
6–10	48 (25.0)
>10	93 (48.4)

When clinical factors were compared with BMD categories, higher age and lower BMI were consistently associated with poor bone health. Women with inadequate dietary calcium intake and insufficient Vitamin D levels, physical inactivity and a history of prolonged immobilization also correlated significantly with reduced bone density (Table 3).

Table 3: Clinical Features and Family Background (n = 192)

Characteristic	n (%)
Body weight status (BMI)	
Normal	17 (8.9)
Overweight	58 (30.2)
Obese	117 (60.9)
Exercise routine	
Active	32 (16.7)
Sedentary	160 (83.3)
Prolonged bed rest	
Yes	10 (5.2)
No	182 (94.8)
Diabetes status	
Yes	95 (49.5)
No	97 (50.5)
Hypertension status	
Yes	123 (64.1)
No	69 (35.9)
Daily calcium consumption	
<600 mg/day	59 (30.7)
600–1000 mg/day	85 (44.3)
>1000 mg/day	48 (25.0)
Use of cholesterol-lowering medication	
Yes	130 (67.7)
No	62 (32.3)
Vitamin D supplementation	
Yes	171 (89.1)
No	21 (10.9)
Serum Vitamin D status	
Normal (≥30 ng/mL)	115 (59.9)
Insufficient (20–29 ng/mL)	36 (18.8)
Deficient (<20 ng/mL)	41 (21.3)
Family history of low bone density	
Yes	61 (31.8)
No	131 (68.2)
Family history of fractures	
Yes	47 (24.5)
No	145 (75.5)

Personal history of fracture	
Yes	36 (18.8)
No	156 (81.2)

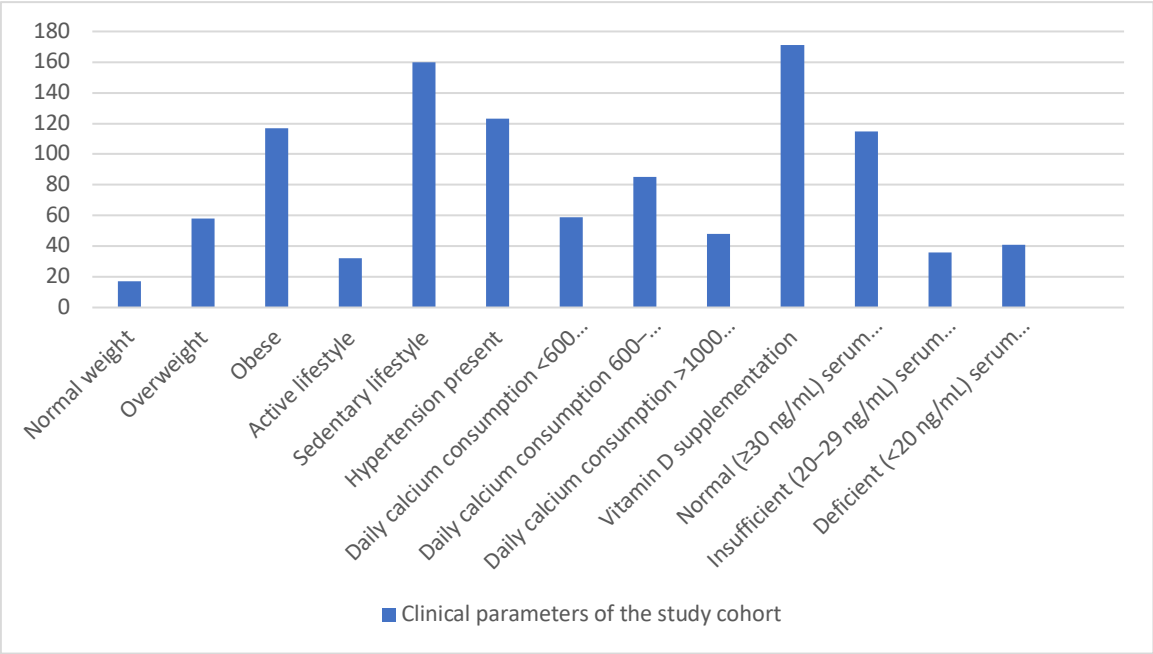

Figure 1: Clinical Features.

Reproductive and lifestyle history revealed that women with an earlier onset of menopause were more likely to develop low bone mass. Lack of regular physical activity further aggravated the risk. On the other hand, longer reproductive years and regular activity appeared to provide some protection against bone loss. The associations suggest the combined influence of both hormonal and lifestyle factors on bone health (Table 4).

Table 4: Bone Health Status Among Participants (n = 192)

Bone Health Category	Lumbar Spine, n (%)	Hip (Femoral Neck), n (%)	Overall, n (%)
Osteoporosis	62 (32.3)	28 (14.6)	72 (37.5)
Low bone mass (Osteopenia)	80 (41.7)	107 (55.7)	86 (44.8)
Normal bone density	50 (26.0)	57 (29.7)	34 (17.7)

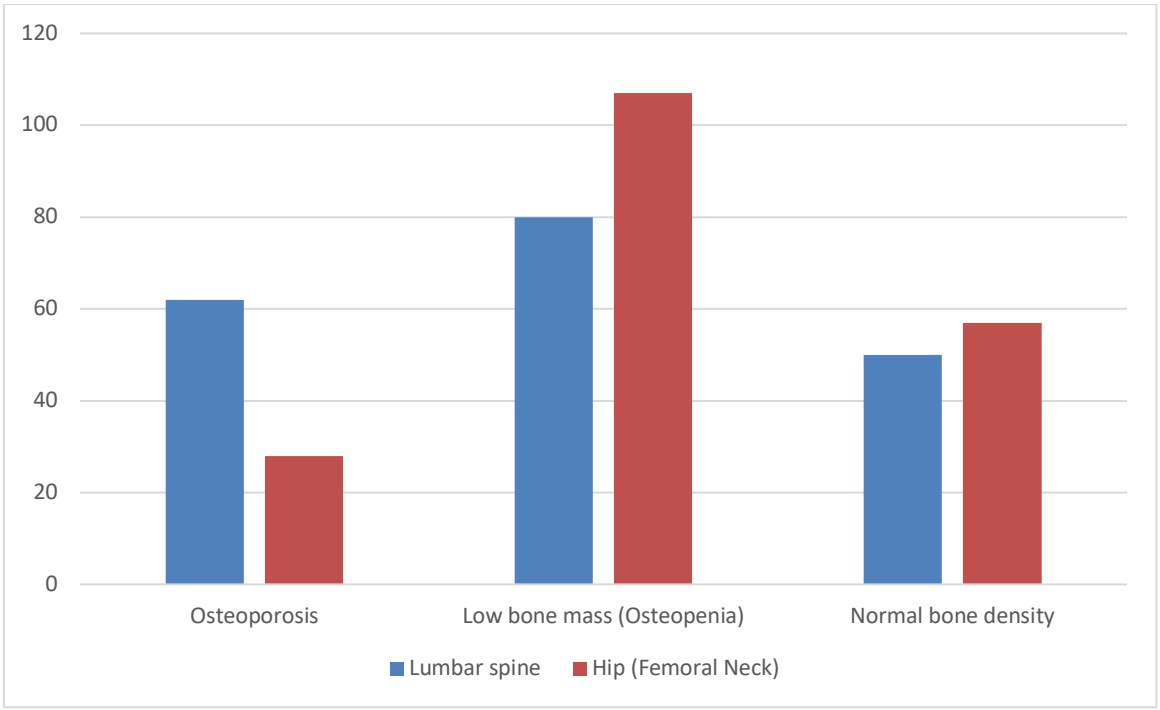

Figure 2: Bone Health Status Among Participants.

Discussion

Osteoporosis is a systemic skeletal disorder which according to the WHO is defined by DXA as a BMD 2.5 SDs below the reference for young Caucasian women [2,11]. Although DXA remains the gold standard, its high cost and limited access make it impractical for mass screening in resource-constrained settings. In our study of 192 postmenopausal women, the prevalence of osteoporosis was 37.5%, which is comparable to the rates reported in Indian studies, where more than 61 million individuals are estimated to be affected, with women forming nearly 80% of this burden [12-14]. Pande et al. [15] reported an age-related decline in BMD in both sexes above 50 years, while Patni [16] observed that mean BMD values in Indian women were almost 2 SDs lower than in Western populations. Our findings align with these reports and reinforce that PMP women in India are disproportionately affected by osteoporosis.

Vitamin D deficiency, an important determinant of bone health, is widespread worldwide, affecting over one billion individuals [11]. Prevalence is relatively low in countries with fortified foods (1.6%–14.8%) [17], but much higher in Asian nations, including India, where 30%–50% of the population is deficient [12]. In our study, a substantial proportion of women showed Vitamin D insufficiency or deficiency, correlating strongly with reduced BMD. These results are consistent with earlier reports from Tunisia (47.6%) [18], Boston (24.1%) [12], and China (45.2% in females) [19]. The high prevalence in India is further compounded by cultural practices such as limited sun exposure, predominantly vegetarian diets, and unaffordability of supplements, especially in women from lower socioeconomic strata. Our findings also reflected the well-established link between low BMI and osteoporosis risk, which has been repeatedly highlighted in Indian populations [15,16].

Several socio-demographic and lifestyle determinants emerged in our study population. Nearly one-fifth (18.9%) of women reported a history of fragility fractures, closely mirroring the trends reported by Nikose et al. [20], who found significant correlations between BMD, socioeconomic status, and family support in over 3500 women. Similarly, we observed higher osteoporosis prevalence in women with lower education, poor dietary calcium intake, and reduced physical activity. These factors, together with early menopause and repeated childbirth, compounded bone loss in our cohort. The prevalence of osteoporosis in our study (37.5%) is slightly higher than some regional Indian reports, but remains within the wide range noted across studies [15,16]. This emphasizes the urgent need for pragmatic screening tools such as FRAX [21] and simplified risk assessment methods developed for Indian women [22], given the limited access to DXA. Community-based awareness programs, affordable Vitamin D and calcium fortification, and culturally sensitive interventions targeting dietary practices remain essential to reducing the growing burden of osteoporosis in PMP women.

Conclusion

This study highlights a high prevalence of osteoporosis (37.5%) and osteopenia (44.3%)

among postmenopausal women, with nearly one-fifth reporting a history of fragility fractures. Low Vitamin D status, inadequate calcium intake, obesity, reduced physical activity, and socio-demographic factors such as low education and multiparity were key contributors to poor bone health in this cohort. These conclusions emphasize the need for early screening, nutritional interventions, lifestyle modifications, and community-based awareness programs to reduce the burden of this disorder in PMP women, particularly in low-resource settings.

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