International Journal of Medical Research Professionals
P-ISSN: 2454-6356; E-ISSN: 2454-6364
DOI: 10.21276/ijmrp

IJMRP

Original Research Article.

Prevalence of Osteoporosis in Women Attending Midlife Health Clinic in a Tertiary Care Center in North India

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ABSTRACT

Objective: The aim of the present study was to determine the prevalence of osteoporosis in women attending Midlife Health Clinic and to observe its correlation with age, menopausal status, years since menopause (YSM), body mass index (BMI) and diet.

Materials And Methods: Total 172 women reporting to Midlife Health Clinic were included. Detailed history was recorded with height and weight. Dietary intake was assessed using 24-hour recall method. Quantitative ultrasound (QUS) of calcaneum was performed to assess bone health.

Results: Out of 172 women, 132 had low bone mineral density (BMD) i.e. <-1 SD. Participants were divided into three groups: Group I [n=40 (23.2%)] having normal BMD i.e. T score>-1SD; Group II [n=119 (69.2%)] with T-score between -1 and -2.5 (Osteopenia); and Group III [n=13 (7.6%)] with T-score < -2.5SD (Osteoporosis). The mean age in group I was found to be 48.7±7.4 years, 49.2±8.1 years in group II, and 57.5±5.3 years in Group III. All women with osteoporosis were >50 years old and postmenopausal. Most women in perimenopausal (75%) and postmenopausal (64.6%) group were osteopenic. BMD was found to decrease with increase in average YSM (p=0.06): Group I (Mean 6.2±2.8YSM), Group II (Mean 8.1±5.1YSM) and Group III (Mean 9.5±3.4YSM).59.4% women were overweight and obese but osteopenia was prevalent in all categories of BMI. All groups had a lower than recommended intake of calcium: 574±184mg, 501±146mg, 476±168mg in Groups I, II and III respectively.

Conclusion: Prevalence of low BMD increases with age, menopause and increasing number of years since menopause (YSM). QUS emerges as cost-effective screening tool for early detection of osteoporosis in a developing country like India.

Key messages: Prevalence of osteopenia and osteoporosis increases with increasing number of years since menopause. Quantitative ultrasound emerges as a cost-effective screening tool for early detection of osteoporosis in a developing country like India. This holds true especially for population with poor access to advanced modalities such as Dual-energy X-ray Absorptiometry (DXA).

Keywords: Bone Density, Calcium, Osteoporosis, Post menopause.

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Article History:

Received: 15-04-2021, **Revised:** 11-05-2021, **Accepted:** 27-05-2021

Access this article online	
Website: www.ijmrp.com	Quick Response code
DOI: 10.21276/ijmrp.2021.7.3.012	

INTRODUCTION

Osteoporosis is a progressive, systemic disease characterized by low bone mass and microarchitectural disruption of bone structure leading to increased skeletal fragility.[1,2] In 2013, 50 million people in India were estimated to be either osteoporotic (T-score <-2.5) or osteopenic (T-score between-1.0 and-2.5).[3] Osteoporosis is clinically diagnosed as fragility fractures, or T-score less than 2.5 standard deviations (SD) below the mean (Figure 1) based upon the bone mineral density (BMD) measurement by DXA scan (Dual-energy X-ray Absorptiometry). DXA scan is used to diagnose osteoporosis in absence of fragility fracture.[4]

The highest risk of fracture is seen in individuals with T-scores of ≤-2.5. However, maximum fractures are seen in patients with a T-score between -1 and -2.5 due to more individuals in this category.[5]

DXA is the most commonly used method for measuring BMD due to its precision and accuracy. However, it has disadvantages of high cost, nonportability and exposure to ionizing radiation. Quantitative Ultrasound (QUS) is another commonly used method for measuring bone health. QUS has advantages of lower cost, portability, and lack of exposure to ionizing radiation. Previous

studies have demonstrated that QUS indices are significantly associated with bone mass, microarchitecture and fracture risk.[6,7] QUS does not directly measure BMD but measures the transmission of ultrasound waves (speed of sound; SOS) through the bone or the reflectance of the ultrasound waves from the bone surface (broadband ultrasound attenuation; BUA). According to the International Society for Clinical Densitometry (ISCD), the calcaneus is the only validated anatomical site recommended for osteoporosis screening.[8] However, WHO's T-score cut-off of <-1 and ≤ -2.5 for osteopenia and osteoporosis in QUS remains controversial because the cut-off values are established based on DXA and the skeletal properties examined are different between DXA and QUS.[8]

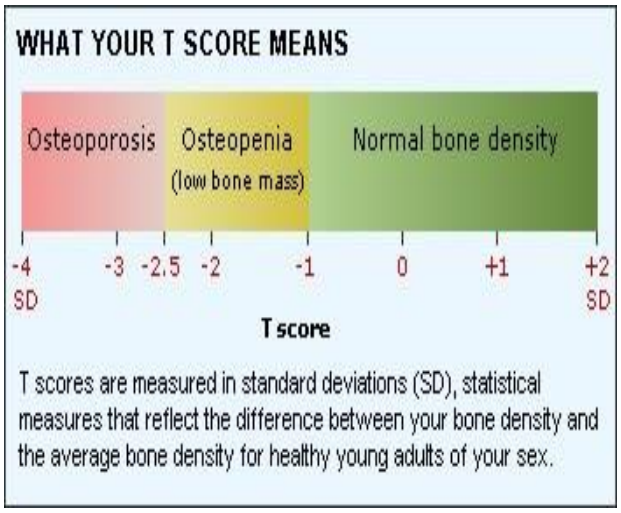

Figure 1: BMD assessment based on T score

Evidence shows that bone loss begins at 30-40 years of age in both men and women. In addition to age-related bone loss, women also experience post-menopausal bone loss. It is observed that menopause is associated with a decrease in bone mineral density within one year. This elevated rate of bone loss reaches equilibrium and merges into a continuous age-related loss in approximately 10 years after menopause.[9] Low body weight has been associated with a higher risk of fracture, even independent of the BMD.[10] The increase in Body Mass Index (BMI) was accompanied by the statistically significant increase in BMD in a study on 120 postmenopausal women with osteoporosis.[11] Prior to fracture, patients may not experience any symptoms of low BMD. But, current techniques allow us to detect high-risk patients, which can prevent as well as reduce the morbidity associated with such fractures.

Midlife health charitable clinic (MHCC) project, an initiative by the Indian Menopause Society, was started in our institute in 2017 with the aim of offering free consultation and counseling services to poor and needy midlife women for a better quality of life. MHCC is carried out on the 5th day of every month, starting- September 2017 in outpatient department of Obstetrics and Gynecology of our tertiary care center. The aim of the present study was to determine the prevalence of osteoporosis in premenopausal, perimenopausal and postmenopausal women of more than 40 years of age attending midlife health clinic at a tertiary care center in Patiala, Punjab and to observe its correlation with age, menopausal status, BMI and dietary intake.

MATERIALS AND METHODS

In our study, a total of 172 women reporting to our center in Midlife Health Clinic from January to June 2019 were included. Informed consent was obtained and the participation in the study was voluntary. A detailed medical, surgical, obstetrical, gynecological and drug history was recorded in a proforma designed for the study. Information about history of fracture on a trivial fall, family history suggestive of osteoporosis, socioeconomic status, educational status and occupation was documented. Women having history of endocrinological disorders (hypo/ hyperthyroidism, hypo/ hypergonadism, hypo/ hypercalcemia), receiving therapeutic agents (thiazide diuretics, glucocorticoids, osteoporosis treatment), having restricted mobility issues and with implants (at lumbar spine, hip and lower limbs) were excluded from the study. Their physical parameters such as height and weight were noted in light clothing and without footwear. General physical, breast and abdominal examination were performed in all women. Gynaecological examination including per speculum, per vaginum and PAP smear were offered to all patients and were done subject to consent. Food intake was assessed using the 24-hour dietary recall method, and nutritional value of each meal was assessed using the Indian database. Calcium and Vitamin D intake in diet was also assessed.

Quantitative ultrasound (QUS) measurement of calcaneum was performed using the gel-based Sonost 3000 bone densitometer (Guro-gu, Seoul, Republic of Korea) with a centre frequency of 0.5 MHz and broadband emission capability with frequency range of 50/60 Hz operated by trained technician. A standard procedure was followed according to the manufacturer's recommendations. All measurements were performed and analyzed by the same trained researcher. Participants were placed on a stable chair in a comfortable position directly in front of the instrument. The device uses Speed of sound (SOS in m/s) as the parameter to assess the bone health of the subjects. For our present study, T-score was generated based on the SOS and was used to classify the bone health status of the subjects**.** T-score values were obtained based on the population reference provided by the manufacturer. A T-score of ≤-2.5 indicates high risk for osteoporosis, T-score between -1 and -2.5 indicates moderate risk for osteoporosis, and T-score > -1.0 indicates low risk for osteoporosis.

On the basis of the result of the QUS bone health scan, women were counseled regarding the risks of development of osteopenia, osteoporosis, and their complications. Further information about diet rich in calcium, vitamin D and lifestyle modifications was provided. Women with osteoporosis were managed by orthopedics department.

Statistical Analysis

Data was analyzed in STATA version 15 (StataCorp, College Station, Texas). Participants were categorized into three groups (normal, osteopenia and osteoporosis) based on their bone mineral density (BMD) and clinical characteristics were described for each of the groups separately, along with appropriate tests of significance. Age, BMI and years since menopause (YSM) were described as mean (SD) for all 3 groups of bone mineral density and Krushall wallis test was performed to look for differences between the 3 groups. Participants were further categorized into groups for age (40-49 years, 50-59 years, 60 years and more) and BMI (<18.5, 18.5-22.9, 23.0-24.9, 25.0-29.9, ≥30.0), as per the WHO guidelines for the Asian population. For categorical

variables such as age categories, BMI categories and menopausal status, data was described as frequency(percentage) for all 3 categories of bone mineral density. Chi square test or fischer exact test was performed as appropriate to look for differences in distribution. We used a bivariable and multivariable linear regression model to look for the association between bone mineral density and age, BMI categories, menopausal status and number of years since menopause.

Table 1: Correlation of BMD with age

Group	I (Normal) (n=40)	II (Osteopenia) (n=119)	III (Osteoporosis) (n=13)	p-value
T Score	> -1	≤ -1 to -2.5	≤ -2.5	
Mean Age (SD) (years)	48.7 (7.4) years	49.2 (8.1) years	57.5 (5.3) years	0.001*
Age Groups (years)		Number (Percentage)		
40-49 [n=76]	21(27.6)	55(72.4)	0(0)	0.002#
50-59 [n= 68]	14(20.6)	47(69.1)	7(10.3)	
≥60 [n= 28]	5(17.9)	17(60.7)	6(21.4)	

*p-value calculated by Krushall Wallis test

p-value calculated by Fischer's exact test

Table 2: Correlation of BMD with menopausal status

Group	I (Normal) (n=40)	II (Osteopenia) (n=119)	III (Osteoporosis) (n=13)	p-value
T score	> -1	≤ -1 to -2.5	≤ -2.5	
Mean (SD) number of years since menopause (YSM)	6.2 (2.8) years	8.1 (5.1) years	9.5 (3.4)	0.06*
Menopausal Status		Number (Percentage)		
Pre-Menopausal [n= 7]	2(28.6)	5(71.4)	0(0)	0.014#
Peri-Menopausal [n=64]	16(25)	48(75)	0(0)	
Post-Menopausal [n=96]	21(21.9)	62(64.6)	13(13.5)	

*p-value calculated by Krushall Wallis test

p-value calculated by Fischer's exact test

Table 3: Association of Bone Mineral Density with age and number of years since menopause (YSM)

Variable	Adjusted Beta coefficient (95% CI)	P-value
Age (years)	-0.01(-0.04 to 0.02)	0.55
Number of years since menopause (YSM)	-0.05(-0.09 to -0.003)	0.03

Table 4: Correlation of BMD with BMI

Group	I (Normal) (n=40)	II (Osteopenia) (n=119)	III (Osteoporosis) (n=13)	p-value
T score	> -1	≤ -1 to -2.5	≤ -2.5	
Mean (SD) BMI	26.1(4.6)	26.6(5.0)	25.2(3.8)	0.06*
Body Mass Index (kg/m²)		**Number (Percentage)**		
<18.5 [n=5]	1(20)	4(80)	0(0)	0.914#
18.5-22.9 [n=43]	11(25.6)	28(65.1)	4(9.3)	
23-24.9 [n=20]	5(25)	12(60)	3 (15)	
25-29.9 [n=70]	16(22.9)	49(70.0)	5 (7.1)	
≥30 [n=32]	7(21.9)	24(75.0)	1 (3.1)	

*p-value calculated by Krushall Wallis test

p-value calculated by Fischer's exact test

RESULTS

Mean age of the 172 women participating in the study was 49.7 ± 8.1 years. Maximum women (77.4%) were homemakers; 11.6% women had job with moderate physical activity like Accredited Social Health Activist (ASHA) or schoolteacher, while the remaining 11% women were daily wage labourers. 58% women belonged to rural areas and the remaining 42% belonged to urban areas. 87% women belonged to low socioeconomic status. The mean BMI was 26.4 ± 4.9 kg/m². 96 (55.8%) were postmenopausal (natural menopause) and five women had had hysterectomy. Number of premenopausal women was 7 (4%) and perimenopausal were 64 (37.2%).

Out of 172 women, 132 women had a low bone mineral density i.e. <-1 SD. We divided all the participants into three groups as shown in Table 1. Group I [n=40(23.2%)] having normal BMD i.e. T score > -1 SD; Group II [n=119(69.2%)] included women with BMD between -1 and -2.5 SD (Osteopenia); and Group III

[n=13(7.6%)] included women with BMD <-2.5 SD (Osteoporosis). The mean age in group I was found to be 48.7 ± 7.4 years, 49.2 ± 8.1 years in group II, and 57.5 ± 5.3 years in Group III, which was statistically significant (p=0.001). Amongst the 13 women with osteoporosis, all were >50 years old. The participants of Group III were found to be approximately 8 years older, on an average, than Group I and II. The differences of age between age groups were found to be statistically significant (p= 0.002).

Most women in perimenopausal (75%) and postmenopausal (64.6%) group were osteopenic (Group II). Out of all women with osteopenia (Group II, n= 119), 62 (52.1%) were postmenopausal and 48 (40.3%) were perimenopausal. All women with osteoporosis were postmenopausal as shown in Table 2. The difference between BMD categories and menopausal status were statistically significant (p=0.014).

Of the total women who were post-menopausal [n=96], mean number of years since menopause (YSM) were 8.2 ± 4.8 years. In these women, the BMD was found to decrease with increase in the average number of years since menopause (YSM) (p=0.06): Group I (Mean 6.2±2.8 YSM), Group II (Mean 8.1±5.1 YSM) and Group III (Mean 9.5 ± 3.4 YSM) (Adjusted Beta coefficient= -0.05; 95%CI -0.09 to -0.003, p=0.03) as shown in Table 3.

The mean BMI in group I was found to be 26.1 ± 4.6 kg/m2, 26.6 ± 5.0 kg/m2 in group II, and 25.2 ± 3.8 kg/m2 in Group III (p=0.06). Maximum number of women [n=70(40.7%)] belonged to the BMI of 25-29.9 kg/m^2, classified as pre-obese according to WHO Asian guidelines and 18.6% had BMI≥30 kg/m2. Amongst all categories of BMI, maximum women were seen to be osteopenic as shown in Table 4. In our study, no significant correlation was established between BMI and BMD.

This could be attributed to poor calcium and protein intake, sedentary lifestyle as well as a smaller sample size. All groups had a lower intake of Calcium and vitamin D, as compared to the recommended daily intake. The mean intake of calcium was found to be 574 ± 184 mg, 501 ± 146 mg, 476 ± 168 mg in Groups I, II and III respectively.

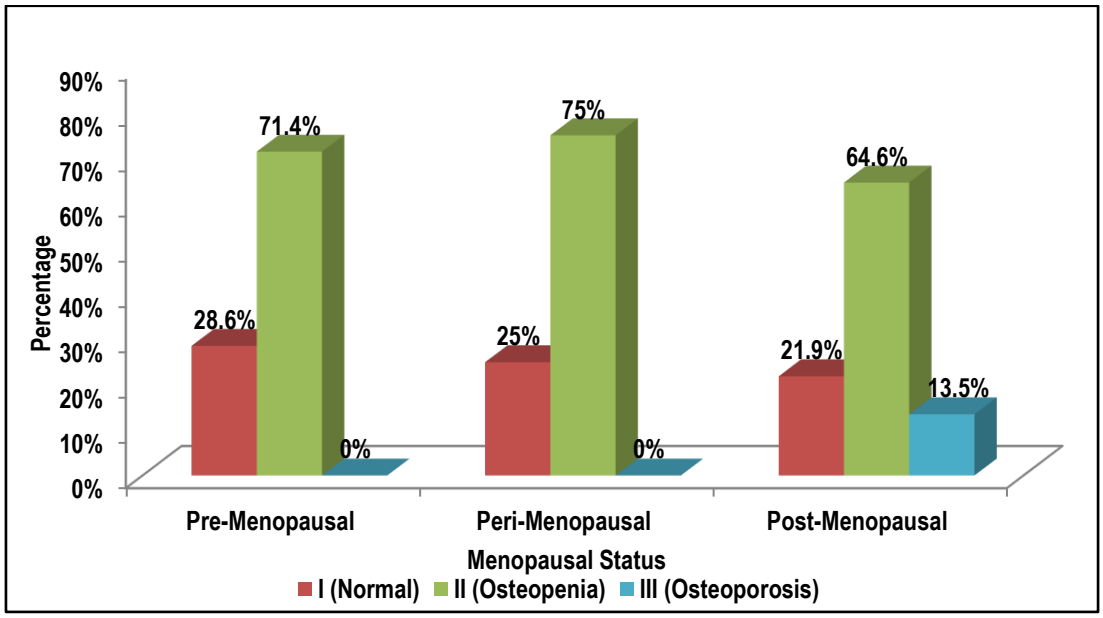

Figure 2: Bar diagram showing correlation of BMD with Menopausal status

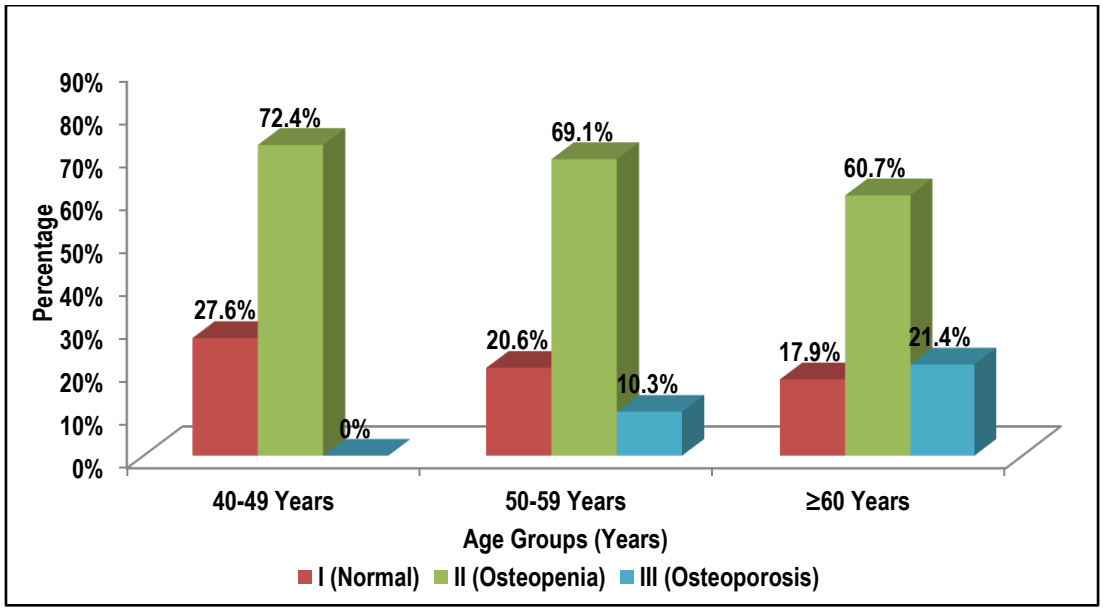

Figure 3: Bar diagram showing correlation of BMD in various age groups

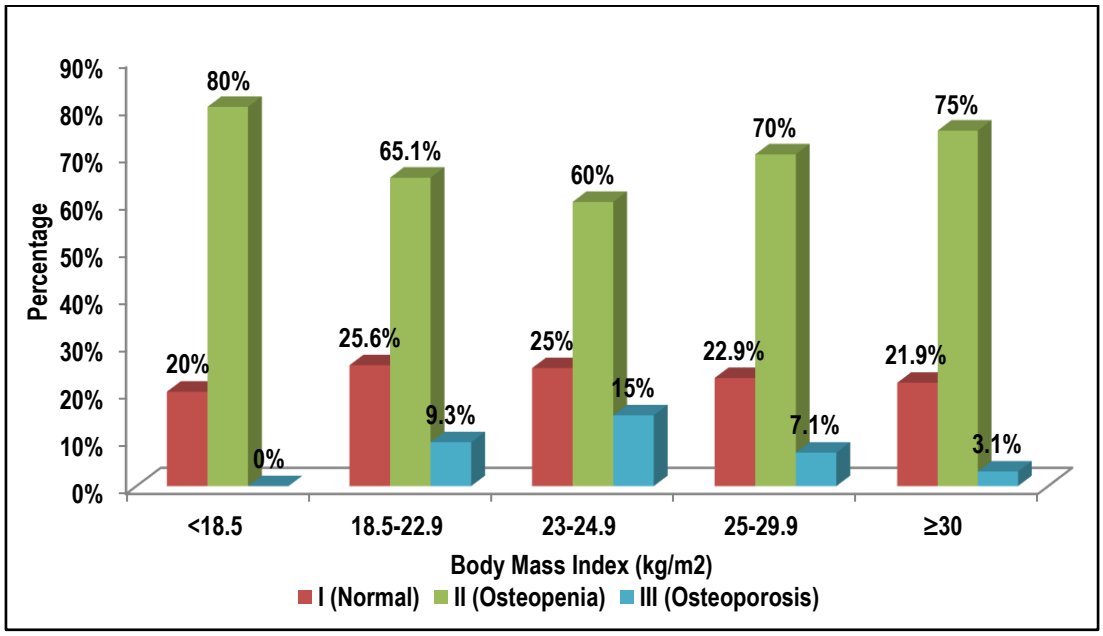

Figure 4: Bar diagram showing correlation of BMD with BMI

DISCUSSION

In India, current estimates suggest that more than 61 million Indians have osteoporosis; of these, around 80% patients are females.[10,12] Although several studies on the regular screening of this silent epidemic have been published in India but poor literacy rate and poor family support continue to act as roadblocks to widespread knowledge and adherence. In our study, over 75 percent of perimenopausal and postmenopausal women had low bone mineral density (Figure 2), as compared to 81% in a study conducted in slums of Mumbai[13] and 53% percent in a study in Chandigarh.[12]

Prevalence of osteoporosis in women above the age of 50 years was found to be 13.9 % in our study (Figure 3). Whereas Marwaha et al. reported a prevalence of osteoporosis of 42.5% in women above 50 years of age.[14] Lu et al. have reported a prevalence of 18.4% in women above the age of 50 years in China.[15] while Lee at al reported 24.4% prevalence in Korean women aged more than 50 years.[16] However, these studies have not classified women based on their menopausal status.

Several risk factors can account for this higher prevalence observed in the present study. These include increasing age, especially after menopause, low education, low socioeconomic status, high parity, poor diet and sedentary lifestyle, all of which have been associated with osteoporosis.

In our study, no significant correlation was established between BMI and BMD (Figure 4). This could be attributed to poor protein intake, sedentary lifestyle as well as a smaller sample size. Past studies have demonstrated a significant positive correlation between BMI and BMD.[17]

In postmenopausal women, our study showed a decrease in BMD with increase in the average number of years since menopause (YSM) (p=0.06): Group I (Mean 6.2±2.8 YSM), Group II (Mean 8.1±5.1 YSM) and Group III (Mean 9.5 ± 3.4 YSM). In a study conducted by Kadam et al, prevalence of osteoporosis was 18.4% in postmenopausal women <5 YSM and 37% in postmenopausal women more than 5 YSM.[18] In our study, all groups I, II and III had a lower intake of Calcium and vitamin D, as compared to the recommended daily intake. Calcium is an essential mineral required in the process of formation of bone and its deficiency leads to low bone mineral density. A report by the Indian Council of Medical Research showed that Indian diet does not fulfill the daily requirements of 600 mg/day of calcium.[19] A large study from china recently showed that higher dietary calcium intake was associated with fewer vertebral fracture in women.[20] The sedentary and indoor lifestyle of the subjects in our study may also be an important factor in deficiency of Vitamin D, due to inadequate exposure to sunlight. Several studies in the Indian population have proven that Indians are deficient in Vitamin D.[21] A metanalysis by Thakur et al concluded that calcium and Vitamin D intake, in adequate amounts, along with combinations of various exercises could serve as a preventive measure for the fall in bone mineral density in postmenopausal women.[22]

CONCLUSION

To summarize, menopause is an important event in a woman's life cycle which affects bone health with the prevalence of osteoporosis and osteopenia increasing with increasing age and YSM. Based on the study, we were able to identify a large problem for peri- and post-menopausal women attending the midlife health clinic and create awareness about this silent disease among them and educate them regarding preventive measures like adequate calcium intake, Vitamin D supplementation and other lifestyle changes to avoid fractures secondary to osteoporosis.

QUS technology emerges as cost-effective screening tool for early detection of osteoporosis for a large population in developing country like India with poor accessibility to DXA which would allow to create awareness and take preventive measures to hinder the progression of the disease.

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Source of Support: Nil.

Conflict of Interest: None Declared.

Cite this article as: Sangeeta Aggarwal, Balwinder Kaur, Hari Om Aggarwal. Prevalence of Osteoporosis in Women Attending Midlife Health Clinic in a Tertiary Care Center in North India. Int J Med Res Prof. 2021 May; 7(3): 43-48.
DOI:10.21276/ijmrp.2021.7.3.012