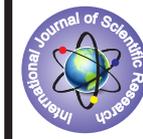


THE ASSESSMENT OF OSTEOPOROSIS AND RELATED FACTORS USING QUANTITATIVE ULTRASOUND IN INDIAN WOMEN.



Medicine

KEYWORDS: Bone mineral density, QUS, Osteoporosis, Calcium intake, women

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ABSTRACT

Osteoporosis an emerging public health problem in both developed and developing countries, affects women four times more than men. Objectives: To estimate the prevalence of osteoporosis and related factors, by using quantitative ultrasound (QUS). Methodology: A cross-sectional study was done among 210 women, measuring their bone mineral density (BMD) by using QUS; after the participants were interviewed using a proforma. Results: Their mean age was 43.22±13.67 years; mean height, weight and body mass index (BMI) were 152.82±3.32 cm, 50.37±7.97 kg and 21.75±3.29 respectively. The prevalence of osteoporosis was 24.74%. BMD and T-scores were much lower than values reported from the developed countries and indicated a high prevalence of osteopenia and osteoporosis. BMD was significantly associated with BMI, parity, socio-economic class (p<0.05). Age, menopause, calcium-rich food-intake, physical activity were other important determinants of BMD (p<0.05). Conclusion: This study highlights the urgent need for measures to improve the nutritional status, dietary calcium intake and thus the bone health of this population.

INTRODUCTION

Osteoporosis is a systemic skeletal disease characterized by low bone density and micro-architectural deterioration of bone tissue with a consequent increase in bone fragility¹. It is a multi-factorial, emerging global public health problem associated with substantial morbidity and socio-economic burden. With the increase in life expectancy, an alarming rise has been noted in the number of both men and women being diagnosed with clinical osteoporosis. One out of three women between age group of 50-60 years in India suffers from osteoporosis. Indian women have an early age of onset of osteoporosis as compared to their western counterparts. While data on prevalence of osteoporosis among Indian women comes from studies conducted in small groups spread across the country, prevalence of osteoporosis ranges from 8% to 62%.² There is need for early diagnosis, identification of high-risk groups and prevention and treatment of osteoporosis in the Indian context.³ Studies have suggested that osteoporosis or osteopenia is a condition that can be prevented and treated if diagnosed early and accurately. Unfortunately, it is often un-diagnosed until a fracture occurs; making the number of people who are screened for the disease very low. The exact prevalence of osteoporosis and osteopenia in developing countries is not well documented. Women's health issues in our country are often overlooked leading to high prevalence of various diseases among them. Bone health among women is also one such issue as female gender is an already established risk factor for low bone mineral density (BMD).

Measuring the BMD remains the only important tool in the early diagnosis of osteoporosis, so that effective preventive and therapeutic measures can be initiated at the earliest. The commonest used modality of measuring bone density still remains to be calcaneal QUS (Quantitative Ultrasonography) as it is cost effective, lacks deleterious effect of radiation and is portable, and therefore it can be useful for screening of osteopenia and osteoporosis.

Hence, we undertook this study to determine the prevalence and potential risk factors of low BMD among women, in this part of Odisha, India.

Objectives:

1. To determine the prevalence of osteoporosis using QUS, among the study population.
2. To examine the risk factors of osteoporosis among reproductive and post-menopausal women.

Materials and Methods:

Study design: Community based cross sectional study

Study participants: All adult women who were non-pregnant, non-lactating residing in the urban slums under the field practice area of Urban Health & Training Centre (UHTC), Kalinga Institute of Medical Sciences, Bhubaneswar, between the ages of 18 to 60 years were enumerated. The total number was 1,252. Of these, 210 women were randomly selected for the study. Background information was collected about their occupations, chronic illnesses, reproductive history including the number of children, duration of breast feeding, menopausal status and age at menopause. Heights and weights were measured using standard procedures. Dietary intakes of energy, proteins and other nutrients were assessed by the 24-hours recall method, which is a well-established tool.

Sample size:

Taking prevalence of osteoporosis as 13.3% from a previous study⁴, and taking 95% confidence and 5% relative error, the sample size was calculated using the formula, $n = 4pq/d^2$ and found to be 184, after adding 10% non-response rate the sample size was calculated to be 202. Therefore, a total of 210 women were included in the study who were satisfying the inclusion criteria and were willing to give consent to participate in the study.

Study Period: January to March, 2016

Inclusion criteria:

1. Women aged 18-60 years
2. Women giving consent.

Exclusion criteria:

1. Mentally unstable women.
2. Women who were pregnant and lactating.
3. Immediate post-operative cases.
4. Women with known diagnosed systemic diseases like renal and hepatic disorders; and endocrine disorders known to affect bone health, rheumatoid arthritis; prolonged immobilization and women with oophorectomy were excluded from study.
5. Women on long-term medication affecting the bone turn over were also strictly excluded.

Study tool: Data was collected through in-person interviews after obtaining written informed consent using a pre-tested, structured, interviewer-administered, standardized proforma which included information on selected socio-demographic characteristics, lifestyle behaviours and anthropometric measurements. All participants completed the structured questionnaire followed by bone mineral

density (BMD) assessment. The BMD was measured at the calcaneus (heel) by standardized Calcaneal QUS utilizing T-scores based on WHO criteria. A person was classified as having osteoporosis if her T-score was ≤ -2.5 , and osteopenia if the T-score was in between -1 and -2.5, and as normal if the score was ≥ -1 .

After BMD testing, people with low BMD were advised for Vitamin D estimation, proper calcium supplementation, dietary modifications and daily physical activity.

Statistical analysis: Data was entered into Microsoft excel spread sheet, and analysed using EpiInfo statistical software [version 7.1.5.2]. The data was analysed by descriptive statistics. The degree of association of the various parameters/risk factors like age, education level, occupation, income level was found out by chi-square test. A value of $p < 0.05$ was considered statistically significant.

Ethical consideration: The study was approved by Institutional Ethics Committee of KIMS Medical College.

Results

Out of the 210 subjects, osteopenia was found in 68(32.28%) and osteoporosis in 52 (24.76%); 19.5% had no formal education. 85.24% were married. As per modified Kuppaswamy scale 97.62% belonged to the upper lower group (Table-1). Their mean (\pm SD) age was (43.22 \pm 13.67) years, with a range of 18 to 60 years. Their mean (\pm SD) height, weight and body mass index (BMI), important indicators of the nutritional status of the population, were (152.82 \pm 3.32) cm, (50.37 \pm 7.97) kg and (21.75 \pm 3.29), respectively. The mean (\pm SD) parity of these women was (2.52 \pm 1.15). Of these, 100 (47.6 %) women were postmenopausal and 110 (52.4%) were in reproductive age-group.

The mean (\pm SD) age at menopause was (47.26 \pm 1.45) years in postmenopausal women.

Chi-square analysis showed that age, educational level, socio-economic status, marital status and parity showed significant associations (Table 1).

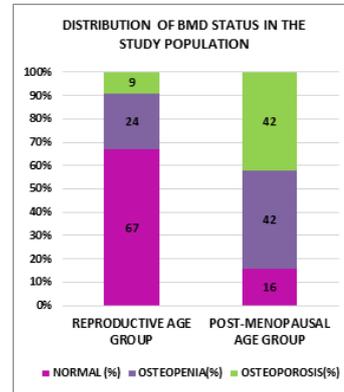
Table 1: Distribution of socio-demographic characteristics of the study participants with their bone mineral density [N= 210]

Socio- Demographic Characteristics	Normal BMD	Osteopenia	Osteoporosis	p value
Age Group (In Years)				
18-30	47	0	0	<0.0001
31-40	6	21	5	
41-50	26	10	16	
51-60	11	37	31	
Religion				
Hindu	68	58	37	0.0708
Muslim	21	9	11	
Christian	1	1	4	
Education				
Illiterate	21	10	10	<0.0001
Primary School Certificate	48	42	21	
Middle School Certificate	21	16	16	
\geq High School Certificate	0	0	5	
Socio- Economic Class				
Lower Middle	0	0	5	<0.0001
Upper Lower	90	68	47	
Marital Status				
Married	79	63	37	<0.0001
Unmarried	11	0	0	
Separated/ Divorced/ Widowed	0	5	15	
Parity				
≤ 1	31	5	0	<0.0001
2	15	31	11	
3	37	21	26	

4	5	5	11	
5	2	6	4	

In the study, among the 210 participants 110 (52.4%) were in the reproductive & 100 (47.6%) in the menopausal age group (Table 2); among the reproductive age group women 9% had osteoporosis and 24% had osteopenia, on the other hand, the postmenopausal age group had 42% osteoporotic women and 42% women having osteopenia (Figure 1).

FIGURE 1: Distribution of Bone Mineral Density Status in the Reproductive and Post-Menopausal Age Groups.



The mean T-SCORE of the study population was found to be (-1.36 \pm 1.16); the mean T-SCORES of the reproductive age group was (-0.831 \pm 1.058) and that of the post-menopausal age group was (-1.95 \pm 0.98).

Certain modifiable and non-modifiable risk-factors of osteoporosis were also assessed and compared between reproductive and post-menopausal age groups (Table 2).

TABLE 2: Distribution of Risk Factors of Osteoporosis with Bone Mineral Density

RISK FACTORS	POST-MENOPAUSAL AGE GROUP (n= 100)			REPRODUCTIVE AGE GROUP (n=110)		
	NOR	OP	OS	NOR	OP	OS
NON-MODIFIABLE						
FAMILY HISTORY						
YES (n=68)	0	21	21	5	11	10
NO (n=74)	11	5	0	53	5	0
Don't know (n=68)	5	16	21	16	10	0
MODIFIABLE RISK FACTORS						
BMI CATEGORY						
UNDERWEIGHT (n=26)	0	0	16	5	0	5
NORMAL (n=142)	16	32	15	48	26	5
OVERWEIGHT (n=37)	0	5	11	21	0	0
OBESE (n=5)	0	5	0	0	0	0
DIET						
VEGETARIAN (n=37)	6	5	21	0	5	0
NON-VEGETARIAN (n=173)	10	37	21	74	21	10
MILK AND MILK PRODUCTS CONSUMPTION DAILY						
YES (n=120)	16	36	0	63	5	0
NO (n=90)	0	6	42	11	21	10
PHYSICAL ACTIVITY (DAILY)						
YES (n= 116)	16	10	11	74	5	0
NO (n=94)	0	32	31	0	21	10
SUN EXPOSURE						
<1hr (n= 109)	16	21	26	25	16	5
1-2hrs (n= 64)	0	21	11	27	5	0
>2- 3hrs (n= 26)	0	0	5	16	0	5
>3hrs (n= 11)	0	0	0	6	5	0

NOR= Normal BMD, OP= osteopenia, OS= osteoporosis

Chi-square test was applied to find out the association between the risk factors of osteoporosis and the BMD status of the women. A highly significant association ($p < 0.0001$) was established between BMD status and family history of osteoporosis, body mass index, dietary habits, consumption of milk and milk products daily, physical activity. Significant association ($p < 0.05$) was found for sun exposure. Regarding menopause status, postmenopausal women had a higher risk of osteoporosis (42%) than reproductive age group (9.09%) women. After menopause, there was an increase in prevalence of both osteopenia and osteoporosis (Table 3), and this was also found to be statistically significant.

TABLE 3: Association of Time since Menopause and Bone Mineral Density.

Time Since Menopause (In Years)	NORI (N=16)	OP (N=42)	OS (N=42)	p-Value
≤5	5	5	11	<0.0001
6-10	11	21	5	
>10	0	16	26	

NOR= Normal BMD, OP= osteopenia, OS= osteoporosis

Discussion:

This study was conducted among the women residing in the UHTC field practice area of KIMS, Bhubaneswar. Among the 210 women included in the study, the prevalence of osteoporosis was found to be 24.76% and osteopenia was 32.38%. The results were almost similar to another study by Sharma S et al⁵, where prevalence of osteoporosis was recorded as 20.25% and osteopenia was 36.79%. Agarwal T et al⁴, shows the prevalence of osteoporosis to be 13.3% and osteopenia to be 48.1%. These studies also used calcaneal QUS as method of analysis like our study. Other studies like Gandhi AB et al⁶, also reported similar results but used DEXA (Dual energy X-ray absorptiometry) to measure BMD at proximal femur and spine.

In this study, it was found that among the reproductive age group women 9.09% had osteoporosis and 23.63% had osteopenia. On the other hand, the postmenopausal age group had 42% osteoporotic women and 42% women had osteopenia. Another study⁷ done among peri and post-menopausal women, low BMD (osteoporosis and osteopenia) was found in 53% women.

The mean T-SCORE of the study population reported in this study was found to be (-1.36±1.16). Agarwal T et al⁴ reported the mean T-SCORE to be (-1.58±0.044), which was almost similar as both fall under low BMD.

A highly significant association was established between low BMD and age group, marital status parity, menopausal status, family history of osteoporosis, BMI, dietary habits, consumption of milk and milk products daily and physical activity in this study. Agarwal T et al⁴ also shows significant association of Low BMD and age group, menopausal status, and physical activity. Family history of osteoporosis was also found to be significantly associated in studies like Thokchom S et al⁵.

Conclusion: The study found the prevalence of osteoporosis and osteopenia was 24.76% and 32.38% respectively, showing that the overall prevalence of low BMD being very high among the women. In addition, the data indicated differing distributions of osteoporosis between reproductive and post-menopausal group; the women of postmenopausal group having an even higher prevalence of low BMD. This study also provides convincing evidence that BMD is significantly associated with nutrition, calcium rich food and physical activity. Thus, lifestyle modifications are greatly necessary to achieve an optimum bone health in these women.

There is also an increasing need of awareness in the area of bone health. Osteoporosis being a silent morbidity often goes undiagnosed until the occurrence of a fracture, thus causing a huge personal and economic burden.

It is a known fact that women in general are at a higher risk for osteoporosis or low BMD; it increasing further in postmenopausal women. Thus, early screening and diagnosis by measurement of BMD and adopting preventive strategies can be implemented to improve bone health.

Limitations: This study was a cross-sectional study, and we could not measure all factors affecting the risk of osteoporosis. Moreover, using a prevalence measure to assess risk factors also has limitations because the factors associated with osteoporosis may not reflect the real cause-effect relation. Risk factors assessed by using prevalence measures can only suggest the hypothesis for a possible cause-effect relation. Thus, a prospective study is needed to confirm any association between low speed of sound and risk factors and to explain the differing patterns of osteoporosis distribution.

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