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Original Article

Osteoporosis among household women: A growing but neglected phenomenon

Maj R.N. Hiremath^a, Lt Col A.K. Yadav^{b,*}, Maj Sandhya Ghodke^c,
Jyoti Yadav^d, Maj Sumit Latwal^e, Brig Atul Kotwal, SM^f

^aOfficer Commanding, 121 Field Health Organisation, C/o 56 APO, India

^bPhD Scholar, AIIMS, New Delhi, India

^cAnaesthetist, Command Hospital (Northern Command), C/o 56 APO, India

^dSenior Medical Officer, Jaipur Golden Hospital, Delhi 110085, India

^eADH, HQ 12 Corps, C/o 56 APO, India

^fDy DGAFFMS (Pensions), O/o DGAFFMS, Ministry of Defence, 'M' Block, New Delhi, India

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ABSTRACT

Background: Osteoporosis is associated with variable morbidity and socio-economic burden and referred as a “silent epidemic” with increasing risk among Indian women. The present study was conducted to find prevalence of osteoporosis.

Methods: A descriptive cross-sectional study was conducted in Ranchi city with household women as participants. Data was collected by means of pre-tested structured questionnaire in Hindi language and bone status was screened utilizing calcaneal quantitative ultrasound as a diagnostic tool to estimate bone mineral density from 223 participants and statistical analysis was performed with SPSS software.

Results: The mean age of the participants was 37.9 (5.63) and majority (52.5%) of them were vegetarian. The prevalence of osteoporosis was 8.5% (5.2–13%) while 45.7% (39–52.5%) had osteopenia. We found no significant association of osteoporosis and osteopenia with income, physical activity, and dietary patterns on univariate analysis. There was no statistical significant difference between mean age and BMI of participant among normal, osteoporosis, and osteopenia participant (p value >0.5). Multivariate logistic regression analysis shows that 20% increase chances of risk with five years increase in age, the protective effect of physical activity (22%) and non-vegetarian diet (18%) though not statistically significant.

Conclusion: This study shows that significant number of women had osteopenia/osteoporosis within 35–40 years age group. Intensive information, education, and communication activities with regard to osteoporosis causative factors and preventive measures targeted to household women may play an important role, if started at young age.

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* Corresponding author.

E-mail address: arunyadavpsm@gmail.com (A.K. Yadav).

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Introduction

Osteoporosis accounts for a significant public health burden globally with varying mortality, morbidity, and adverse impact on socio-economic resources.¹ It causes severe affection and reduction of bony density and quality with eventual increased risk of fractures due to enhanced bony fragility.² It has been referred to as a “silent epidemic” as generally it goes undiagnosed prior to fractures, particularly of hip, that adversely affect the quality of life.¹ Moreover, fractures affecting vertebrae may result in grave consequences like loss of height, severe backache, and bony deformities.³ Osteoporosis differs from osteopenia, where the bone mass reduction is of lesser intensity due to higher bone resorption in comparison to bone synthesis.⁴

As per National Health and Nutrition Examination survey (NHANES III), about 14 million American elderly women (>50 years of age) are affected by low bone density (mostly at the hip joint). According to the World Health Organization (WHO), up to 70% of women (>80 years of age) have osteoporosis.⁵ However, nationwide data on Indian population is lacking.

Although India is a sun-rich country, deficiency of vitamin D has been reported at all age groups.⁶ Avoidance of sunlight exposure due to sociocultural reasons, poor dietary calcium, environmental pollution, and higher 25 (OH)-D-24-hydroxylase enzyme in Indians are few reasons for hypovitaminosis D. It has been observed that the annual incidence of osteoporotic fractures in women is much greater than the combined incidence rates of heart attack, stroke, and breast cancer.⁷

The non-modifiable risk factors of osteoporosis include age, sex, ethnicity, reproductive, and family history while modifiable risk factors comprise of body weight, sedentary lifestyle, diet, sun exposure, drugs, and history of smoking and alcohol consumption.¹ Prevention is the single most cost-effective means of managing osteoporosis. Effective prevention encompasses appropriate nutrition, exercise, and a healthy life style. Adequate knowledge and timely awareness about the risk factors among women are important aspects of primordial prevention of osteoporosis.⁸

Timely measurement of bone mineral density (BMD) for earliest detection of osteoporosis is an effective means of prevention and initiation of treatment. According to the criteria established by the WHO, BMD measurement is the main tool for diagnosis. DEXA (Dual energy X-ray absorptiometry) scan remains the gold standard for measuring BMD. In comparison to calcaneal quantitative ultrasound (QUS) method, it measures BMD for both the axial and appendicular skeleton. Hence, the detection rate of osteoporosis and osteopenia is much higher with the former. However, at places where facilities like DEXA scan is not available, calcaneal QUS method is used for detecting osteoporosis or osteopenia. Moreover, calcaneal QUS method is more cost-effective, with easily movable and a portable equipment and lesser radiation exposure. This method has, therefore, become very popular for early detection and intervention in progression of osteoporosis.⁹ Many developed countries are maintaining a normative data base for QUS findings for diagnosis of osteoporosis.¹⁰

There is a considerable void in knowledge regarding burden of illness of osteoporosis for developing countries like India.¹¹ The available literature is based on studies with a small sample size and in varied populations from which clear inferences could not be withdrawn.¹² Hence, the present study was conducted to estimate the prevalence of osteoporosis (including osteopenia) among reproductive and premenopausal/perimenopausal women of urban locality.

Materials and methods

A descriptive cross-sectional study was conducted in an urban locality of Ranchi city. The study area was demarcated in geographical continuity with the health care establishments in the urban area. The participants of the study were the household women with both reproductive and pre/perimenopausal age group. The purpose of the study was explained and a written and informed consent was obtained from all the women who participated in the study. All the household women available and providing consent at the time of survey were included in the study.

Sample size of 213 participant was calculated based on following criteria; expected prevalence in study population to be 40%, level of absolute precision to be 5%, level of confidence interval to be 95% and applying finite correction for our population. A total of 275 women were contacted and 223 (81.1%) women who consented were finally included in the study.

A pre-tested semi-structured questionnaire in Hindi language was used for interviewing the household women and bone status was noted utilizing calcaneal QUS. Physical activity was defined as at least 30 min of walking on at least 5 days in a week.

The calcaneal QUS was measured using GE lunar Achilles. The results are expressed as stiffness index – a composite of speed of sound (SOS) and broadband ultrasound (BUA). Real time image provides visual confirmation of proper heel placement. Based upon the T-score and Z score, the instrument gave the reading in terms of color coding which may be Green (Normal), Yellow (Moderate risk of fracture indicative of osteopenia), and Red (High risk of fracture indicative of osteoporosis). The participants suffering from moderate and high risk were informed about their bone status, appropriately advised, and referred to physician for further management.

Statistical analysis was performed using SPSS ver 14.0. The statistical significance among various variables was assessed using Chi-square test for trend. *p* value of <0.05 was considered statistically significant. Multivariate logistic regression analysis was also carried out by taking that outcome as a binary variable, whereas osteopenia and osteoporosis were treated as outcome of interest.

Results

The mean age and standard deviation (sd) of the participants was 37.9 ± 5.6 years (median age = 37 years). Half of them had monthly income of Rs. 20,000–30,000 while 34% had monthly income of Rs. 30,000–45,000. Majority (52.5%) of them were

vegetarians. Only 6%¹³ participants gave history of taking only eggs but no meat and they were classified along with non-vegetarians for statistical purposes. Majority (43.5%) of the women were overweight while only 3.1% were underweight. More than three-fourth (77.1%) of the study sample carried out physical activity. The prevalence of osteoporosis was found to be 8.5% (95% CI, 5.2–13%) while 45.7% (95% CI, 39–52.5%) had osteopenia. No statistically significant association was observed between osteoporosis and osteopenia with variables like income, physical activity, and dietary patterns (Table 1). Among participants with osteoporosis, majority were (73.4%) vegetarian. The distribution of age and BMI is shown in Figs. 1–3. Fig. 2 shows the odds of osteoporosis and osteopenia with different age categories. There was no statistically significant difference of outcomes between various age categories ($p > 0.05$).

Multivariate logistic regression analysis was performed by taking outcomes – osteoporosis and osteopenia as binary variables and age, BMI, physical activity, and dietary pattern as predictor variables (Table 2). Age was converted into a new variable to find out the effect of five years increase of age on the outcome. The model shows 20% increased risk with every five years increase of age; however, the same was not statistically significant. Similarly, the model shows the protective effect of physical activity (22%) and non-vegetarian diet (18%) though the same were not statistically significant.

Discussion

The study found the prevalence of osteoporosis as 8.5%, which is at par with the lower value of range of 8–62% in Indian women reported by several studies.^{12–17} These studies have been mainly conducted in perimenopausal and postmenopausal women. A study among perimenopausal and postmenopausal women in Jammu observed the prevalence of osteoporosis as 13.3% and osteopenia 48.1% with maximum number of both conditions in the age groups 55–64 years and 45–54 years, respectively.¹⁷ In a hospital-based study, among urban women above age of 25 years, utilizing calcaneal QUS, the prevalence of osteoporosis and osteopenia was 20.25% and 36.79%, respectively with maximum number of both conditions recorded in the age group of 55–64 years.¹³ A study carried out among 289 women in the 30–60 year age group showed the prevalence of osteoporosis as 29% and 52% osteopenia and they also observed that BMD showed a decline after the age of 35 years in cases of the lumbar spine and femoral neck.¹² Another study observed osteoporosis and osteopenia as 12.5% and 41.4% among women above 20 years of age.¹⁸

The US preventive Services Task Force recommends routine screening for osteoporosis in women over 65 years.¹² In the study, 48% of women in less than 35 years age group had abnormal bone scan. Hence, there is a need to consider screening at an earlier age in our population. Further studies with large sample which adequately cover the socio-demographic variability may be needed to reach the consensus on the age at which it should be done in India. Since this study found the presence of abnormal scan in younger population (<35 years), the Information, Education and Communication

Table 1 – Association of osteopenia and osteoporosis with age, BMI diet pattern, and physical activity.

	N	Age ^a					BMI ^a				Diet		PA	
		<30	31–35	36–40	41–50	>50	<18.5	18.5–25	25–30	≥30	Veg	Non veg	Yes	No
Normal (N, row %)	102	5 (4.9)	37 (36.3)	36 (35.3)	24 (23.5)	0	2 (2)	41 (40.2)	52 (51)	7 (6.8)	57 (55.9)	45 (44.1)	81 (79.4)	21 (20.6)
Osteopenia (N, row %)	102	4 (3.9)	29 (28.4)	48 (47.1)	16 (15.7)	5 (4.9)	5 (4.9)	48 (47.1)	37 (36.3)	12 (11.7)	46 (45.1)	56 (54.9)	78 (76.5)	24 (23.5)
Osteoporosis (N, row %)	19	0	6 (31.6)	7 (36.8)	6 (31.6)	0	0	7 (36.8)	8 (42.1)	4 (21.1)	14 (73.4)	5 (26.3)	13 (68.4)	6 (31.6)
Total (N, row %)	223	9 (4)	72 (32.3)	91 (40.8)	46 (20.6)	5 (2.3)	7 (3.1)	96 (43.1)	97 (43.5)	23 (10.3)	117 (52.5)	106 (47.5)	172 (77.1)	51 (22.9)
Chi-square, p value				12.4, 0.1				8.9, 0.2			6.1, 0.05		1.1, 0.5	

BMI = body mass index, PA = physical activity.

^a Chi exact test is used.

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Fig. 1 – Box and whisker plot showing distribution of age in normal, osteoporosis, and osteopenia participant.

Fig. 2 – Odds of osteoporosis and osteopenia along with 95% CI with age categories.

Fig. 3 – Box and whisker plot showing distribution of BMI in normal, osteoporosis, and osteopenia participant.

Table 2 – Multivariate logistic regression with osteopenia and osteoporosis as binary outcome.

	Unadjusted odds ratio	Adjusted odds ratio	P value (for adjusted OR)	95% Confidence interval for adjusted odds ratio	
Age/5	1.21	1.19	0.18	0.91	1.55
BMI	0.98	0.98	0.59	0.92	1.04
Physical activity	0.79	0.78	0.45	0.41	1.48
Diet pattern	0.77	0.81	0.45	0.47	1.40

(IEC) activity may target the younger age group population of <35 years.

In this study, there was 20% increase in risk with five years increase in age (statistically not significant after adjusting for other variables). Similar trend has been reported more among Indian women than men.¹⁹ With increase in life expectancy in India and estimated 34% of total population to be older than 50 years by 2050, it is likely that increased number of people will be affected by osteoporosis.²⁰

There was no statistically significant association between BMI and osteoporosis and osteopenia in the study. BMI <18.5 kg/m² has been widely linked to an increased risk of fracture.²¹⁻²⁵ There are only few studies regarding the relationship between excess weight and bone health in reproductive and premenopausal women. Cohen et al.²⁶ and Bredella et al.²⁷ observed that trunk fat was inversely associated with trabecular bone volume and bone formation rate while Ishii et al.²⁸ observed linear association between BMI and BMD.

Physical activity showed protective effect of 22% reduction, and this effect was in consonance with studies done elsewhere.²⁹ Physical exercise, especially weight bearing exercise, helps in improving and maintaining bone strength.¹⁴ Physical inactivity has been found to be associated with lower BMD among Indian women.¹⁵ Hence, the study recommends physical activity (30 min walking five days a week) for household women. The study finds protective effect of non-vegetarian diet (statistically not significant). This may be due to higher quantity of absorbable calcium in non-vegetarian diet. Further, a study among healthy rural and urban adults noted higher ratio of phytates to calcium in Indian diet, which may hinder the calcium absorption from the already calcium deficient diet.³⁰ However, detailed dietary history to make specific recommendations was not taken. Hence, there is a need to study dietary component in detail in study population as a risk factor of reduced bone density to make specific recommendations.

The study has various limitations. QUS cannot yet be used to reliably confirm a diagnosis of osteoporosis. Indeed, there is great variation in the sensitivity and specificity of QUS, which results in more or fewer diagnosis depending on the T score, both age- and gender-dependent, generating confusion. However, it may be noted that highest number of studies have been performed on GE Lunar Achilles. The cut-off T scores of QUS need to be validated with DEXA scan and need to generate population-specific age and gender 'T' score. This kind of study has been carried out in certain developed countries which has country-specific cutoff 'T' score for QUS. However, no clear-cut guidelines exist for cutoff 'T' values for GE Lunar Achilles device in India and to generate 'T' score was

beyond the scope of the study. However, on review of studies conducted with GE Lunar Achilles, it was found that with WHO criteria, they are likely to miss some of the cases of osteoporosis. But correlation with the future risk of fracture is good and hence it was decided to persist with the "T" score for WHO DEXA scan. Secondly, as the study was limited to women of one city only, hence the generalizability of the study is limited. Thirdly, the study was designed to estimate the prevalence of the osteopenia and osteoporosis and not particularly designed to study the association of various risk factor in the study population or to study the etiopathogenesis of osteoporosis which may differ in reproductive and perimenopausal women. Lastly, the information gathered on risk factors was simplified, did not cater for complexities associated with measurement of these risk factors, for example diet, physical activity, etc.

The strength of the study is that it highlights the high prevalence of osteoporosis and osteopenia among the study population and the need to conduct further study with larger sample size and multiple centers to confirm or refute the known risk factors and assess novel risk factors/preventive factors in our study population.

Conclusion

Although routine BMD screening of women is not recommended till 50 years in Indian setting, this study shows that significant number of women had osteopenia/osteoporosis within 35–40 years age group. Thus, even if screening is not possible, frequent Intensive IEC activities with regard to osteoporosis causative factors and preventive measures targeted to women may play an important role, if started at young age. The study has also highlighted newer research areas and the need for conducting a multicentric study with large sample size to assess the problem and frame a preventive policy.

Conflicts of interest

The authors have none to declare.

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