

## Research Article

# Preliminary screening of osteoporosis and osteopenia in middle aged urban women from Hyderabad (INDIA) using calcaneal QUS

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## ABSTRACT

**Background:** Osteoporosis is a major public health problem, associated with substantial morbidity and socio-economic burden. An early detection can help in reducing the fracture rates and overall socio-economic burden in such patients. The present study was carried out to screen the bone status (osteopenia and osteoporosis) above the age of 25 years in urban women population in this region.

**Methods:** A hospital based study was carried out in 316 women by calculating T-scores utilizing calcaneal QUS as diagnostic tool.

**Results:** The result suggested that a substantial female population had osteopenia and osteoporosis after the age of 45 years. The incidence of osteoporosis was (20.25%) and osteopenia (36.79%) with maximum number of both osteoporosis and osteopenic women recorded in the age group of (55-64 years). After the age of 65 years, there was an almost 100% incidence of either osteopenia or osteoporosis, indicating that it increases with age and in postmenopausal period, thereby suggesting lack of estrogenic activity might be responsible for this increasing trend. Religion, caste and diet had an influence on the outcome of osteopenic and osteoporosis score in present study, but still it has to be substantiated by conducting larger randomized clinical trials in future.

**Conclusions:** A substantial female population was screened for osteoporosis and osteopenia using calcaneal QUS method utilizing same WHO T score criteria that otherwise shall remain undiagnosed and face the complications and menace of osteoporosis.

**Keywords:** Osteopenia, Osteoporosis, Calcaneal QUS (quantitative ultrasound), BMD (bone mineral density)

## INTRODUCTION

Osteoporosis is a disease characterized by reduction in the bone mass and disruption of bone architecture leading to impaired skeletal strength and an increased susceptibility of fractures.<sup>1</sup> It is a major public health problem associated with substantial morbidity and socio-economic burden world wide.<sup>2</sup> Moreover, the proportion of elderly population is rapidly increasing in the developed as well as the developing world, which increases concern among aging population and public

health workers regarding disability, dependence, associated economic and social problems that are caused by osteoporosis. Osteoporosis does not have a dramatic clinical presentation except when fractures result. As age advances, the incidence of osteopenia and osteoporosis, the silent disease increases.<sup>3</sup>

Measuring the bone density 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 gold standard for measuring

bone density however is the Dual energy X-ray absorptiometry (DEXA), useful tool for both the axial and appendicular skeleton as the detection rate of osteopenia and osteoporosis is higher with it in comparison to calcaneal quantitative ultrasound (QUS) method.<sup>4</sup> But the commonest used modality of measuring bone density still remains to be calcaneal QUS.<sup>5</sup> It has gained the importance in the situation where tool like DEXA are not available. Since, calcaneal QUS is cost effective,<sup>6</sup> lacks deleterious effect of radiation and is portable.<sup>7</sup> Thus, it can be useful for an early diagnosis of osteoporosis so that intervention can be done at the earliest to such patients.

Although, similar studies evaluating bone status in women from outside India and within India are present in the literature.<sup>8-13</sup> but still the data is scanty, particularly from this region. Hence, the present pilot study was planned to screen bone status of healthy urban women above age of 25 years (when peak bone mass is formed) from this region utilizing calcaneal QUS (Hologic Sahara 0058 USG) as a diagnostic tool.

## METHODS

The present prospective, cross sectional hospital based study included healthy women attending Malla Reddy Hospital (MRH)/Malla Reddy Institute of Medical Sciences (MRIMS) and Shadan institute of medical Sciences coming from different parts of Hyderabad city over a period of 6 months from 01-10-2014 to 31-03-2015. Total 316 women were enrolled and were distributed in the following age groups, 25-34 years (n=36), 35-44 years (n=76), 45-54 years (n=88), 55-64 years (n=84) and above 65 years (n=32). Informed consent was taken from all the subjects who participated in the present study.

Systemic diseases like renal and hepatic disorders rheumatoid arthritis, endocrine disorders like thyrotoxicosis, hyperpara- thyrodium, Addison's disease, Cushing syndrome and prolonged immobilization and women with oophorectomy were excluded from the study. Women on long term medication affecting the bone turnover (steroids, heparin, warfarin, thyroxine, hydrocortisone, phenytoin sodium, hormone replacement) were also strictly excluded. The exclusion was based on the clinical examination and if required specific investigations were carried. The questionnaire included information on socio demographic, obstetrics, menstrual and medical history. The bone mineral density was measured at the calcaneus by QUS and T-scores were calculated based on WHO criteria<sup>14</sup>.

Although, the use of the WHO T-score thresholds of -2.5 for osteoporosis and -1.0 for osteopenia may be inappropriate at skeletal sites other than the spine, hip and forearm or when other modalities, such as quantitative ultrasound (QUS) are used.<sup>15,16</sup> QUS yields a lower

incidence or prevalence of osteoporosis if this WHO T score is applied. Although studies are present.<sup>16</sup> suggesting alternate equivalent T score with calcaneal QUS method, but there is lack of any clear strategies or appropriate equivalent T score thresholds, hence QUS screening using same diagnostic criteria can at least confirm or rule out osteoporosis<sup>15</sup>. Moreover few studies have used same T score method for diagnosis of osteoporosis in past.<sup>15</sup>

T-score (Ratio between patients BMD and that of young adult population of same sex and ethnicity). T-score of >-1 was taken as normal, between -1 to -2.5 osteopenic and <-2.5 as osteoporotic. T-score was also utilized to find out the incidence and age wise trend of osteopenia and osteoporosis in present study. Z-score is the number of standard deviations the measurement is above or below the age matched mean bone mineral density. Z-score is less commonly used but may be helpful in identifying persons who should undergo a work-up for secondary causes of osteoporosis. The present study was planned to evaluate bone status of urban women above age of 25 years excluding secondary osteoporosis. Hence, Z score was not evaluated

Statistical analysis was performed with the help of computer software Epi-Info 6.2. The statistical significance among categories variables was assessed by the use of chi-square test for trend. P value of < 0.05 was considered statistically significant.

## RESULTS

In the present study, 316 women in between the age group of 25 to above 65 years were enrolled. The women included in the study belonged to middle income group strata with both housewives and working class. Among 316 total women maximum number were enrolled in the age group of (45-54) followed by (55-64) and (35-44) age group.

136 (43.03%) of women were normal as per WHO criteria T score, whereas 116 (36.79%) had osteopenia and 64 (20.25%) had osteoporosis. The mean  $\pm$  SEM, T-score at the calcaneum by QUS in the present study was -1.43 $\pm$ 0.56. Among total osteopenic woman, maximum number of osteopenics were recorded in the age group of (55-64 years) followed by 45-54 years and 35-44 years as 39.65%, 24.13%, 15.51% respectively. Whereas, among total (64) osteoporotic women, maximum were recorded in the age group at 55-64 year followed by above 65 year and then of 35-44 age group as 25% each. No women was found osteoporotic in the age group of (25-34) (Table 1). While studying the age wise trend, it followed age wise increasing trend uniformly. After the age of 65 years, there was an almost 100% incidence of either osteopenia or osteoporosis with 50% being osteopenic and 50%, osteoporotic (Table 2). Total incidence of osteopenia and osteoporosis increased significantly after age group of 55-64 years.

**Table 1: Age wise distribution of osteopenic and osteoporotic women.**

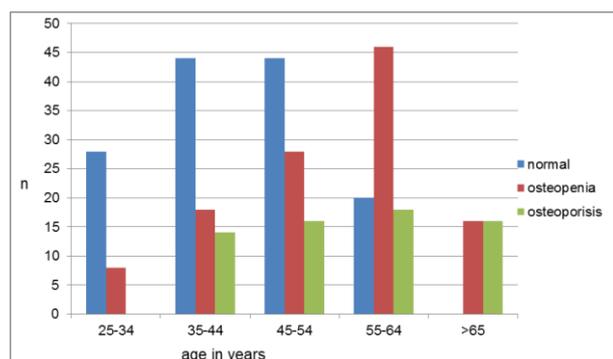
Age (years)	Number n (%)	Normal n (%)	Osteopenic n (%)	Osteoporotic n (%)
25-34	36 (11.39)	28 (20.58)	8 (6.8)	0(0)
35-44	76 (24.05)	44 (32.35)	18 (15.51)	14 (21.87)
45-54	88 (27.84)	44 (32.35)	28 (24.13)	16 (25)
55-64	84 (26.58)	20 (14.70)	46 (39.65)	18 (28.12)
>65	32 (10.12)	0 (0)	16 (13.94)	16 (25)
Total	316	136 (43.03)	116 (36.79)	64 (20.35)

Chi-square for trend 16.889,  $p = 0.00004$  (Highly significant)

**Table 2: Age wise trend.**

Age	Number n (%)	Normal n (%)	Osteopenia n (%)	Osteoporosis n (%)	Total Osteopenia+Osteoporosis n (%)
25-34	36	28(77.77)	8(22.22)	0 (0)	8(22.22)
35-44	76	44(57.89)	18(23.68)	14(18.42)	32(42.99)
45-54	88	44(50)	28(31.81)	16(18.18)	44(49.99)
55-64	84	20(23.80)	46(54.76)	18(21.42)	64(76.18)
>65	32	0 (0)	16(50)	16(50)	32(100)

Chi-square for trend 25.93,  $p = 0.0000$ (Highly significant). For the purpose of analysis >65 age category was clubbed with 55-64 age group



**Figure 1: Age wise trend.**

While studying the correlation between osteopenia/osteoporosis and other variables, it was revealed that among total 116 osteopenics and 64 osteoporotic, 68.96% and 87.50% were Hindus respectively and among hindus 90% and 92.4% osteopenic and osteoporotic were from upper caste. Of 116 total osteopenic women 8 (6.89%) were still menstruating, 12(10.34%) just achieved menopause and 76 (65.5%) were in post-menopausal period. Whereas, of 64 osteoporotic 4 (6.25%) were still

menstruating, 16 (25%) achieved menopause and 44 (68.75) were in post menopausal period. 38 (65.2%) of the osteopenic women and 40 (62.5%) of the osteoporotic women were vegetarian. Where as 20 (17.24%) and 12 (18.76%) of the osteopenic and osteoporotic women were non-vegetarian and rest were on mixed diet. Among the recorded osteopenic and osteoporotic women in the present study 65.2% and 62.5% were living active life respectively and two percent of these women gave history of tobacco/smoking and 90% of such women gave history of consuming tea and coffee regularly Table 3.

**Table 3: Demographic variables.**

Total	Osteopenic (n=116)	Osteoporotic (n=64)
Religion	n (%)	N (%)
Hindu	80(68.96)	56(87.50)
Muslim	22(18.96)	4(6.25)
Christian	12(10.34)	2(3.12)
Sikh	2(1.72)	2(3.12)
Chi-square (1) for trend 3.84, P=0.05(significant). For the purpose of analysis only two categories (Hindu's & Non-Hindu's)were analysed		
Caste among Hindu's		
Backward	56(70)	40(71.42)
Forward	20(25)	12(21.42)
SC/ST	4(5)	4(7.14)
Chi-square for trend 7.77, P=0.05(significant). For the purpose of analysis only two categories were analysed. i.e; upper caste = forward, lower caste = backward+SC/ST		
Menopausal status		
Still menstruating	8(6.89)	4(6.25)
Menopause	12(10.34)	16(25)
Post menopause	76(65.5)	44(68.75)
Chi-square(2) for trend 6.24, p=0.04 (significant)		
Diet		
Veg	76(65.5)	40(62.5)
Non-veg	20(17.24)	12(18.76)
Mix	20(17.24)	12(18.76)
Chi-square non significant		
Life style		
Active	76(65.5)	40(62.5)
Sedentary	40(34.48)	24(37.5)
Chi-square non significant		

## DISCUSSION

The incidence of osteoporosis in the present study was (20.25%) and osteopenia (36.79%) with maximum number of both osteoporotics and osteopenic recorded in age group of (55-64 years). Hundred percent of population above 65 was either osteopenic or osteoporotic. The variations from

the present study in incidence of osteoporosis and osteopenia by both calcaneal QUS and DEXA methods have been shown in Table 4.

**Table 4: Incidence of osteoporosis & osteopenia study.**

Study	Osteoporosis	Osteopenia	Age
Present study	QUS 20.25%	36.79%	25 to > 65 years
Outside India			
Sallin <i>et al</i> <sup>(8)</sup>	DEXA 92%	8%	58-95 years
Sadat-Ali <i>et al</i> <sup>(9)</sup>	DEXA 46.7%	30.5%	Average age 57.62 years
Deplas <i>et al</i> <sup>(10)</sup>	DEXA 86%	-	Mean age 80.6+/- 7.1 years
Indian study			
Pande, 2002 <sup>(11)</sup>	Digital X-ray radiogrammetry 50%	-	Above age 50 years
Shatrugna <i>et al</i> <sup>(12)</sup>	DEXA Prevalence 29%	-	30-60 years

Identifying women with osteoporosis remains a clinical challenge. Although the results of present study in comparison to the various studies.<sup>8,9,10,11,12</sup> clearly reflect the under diagnosis of osteoporosis by QUS in comparison to DEXA, but QUS still remain the commonest modality of measuring bone density of cancellous bone (peripheral bone measurement) in the heel, with advantage of low cost, lack of radiation and portability. Hence, DEXA, remains the gold standard for measuring bone density but underscoring fairly good number of women to be osteopenic and osteoporotic in present study suggest that USG method can be use full particularly in situation where DEXA is not available, who other wise will remain totally undiagnosed. The incidence indicated in the present study may not be the true incidence of the population as QUS yield a lower incidence or prevalence of osteoporosis if the same WHO T score is applied.<sup>15,16</sup> However, QUS screening conclusively confirms or rules out osteoporosis or osteopenia in any population.

Maximum number of osteopenic and osteoporotic were in post-menopausal period followed by who just achieved menopause. Hence, the current study suggests that age and duration of menopause have negative correlation with the bone mineral density, as incidence of osteopenic and osteoporotic women increases with age and in post-menopausal period. As age advances, the incidence of osteopenia and osteoporosis (the silent disease) increases with a resultant increase in the osteoporotic fractures.<sup>3</sup> This might be because there is an increased imbalance between bone resorption and formation with aging, which is an important cause of osteoporosis in elderly.<sup>1</sup>

Hindus upper cast were most affected population in our study but this aspect still has to be substantiated, as the

present study was not randomized. Vegetarian were more affected population although they varied non-significantly from other dietary patterns. This may be due to deficient diet in calcium or low nutrients status.<sup>12,18</sup>

The present study has some limitations less number of patients were screened over a period of six months only. QUS method may be used for osteoporosis screening but confirmation of osteoporosis may be done on the basis of DEXA or bone resorption markers, which were not carried out in the present study due to non-availability of the facilities. Moreover Study has not considered stiffness index.

## CONCLUSION

The present study suggests that calcaneal QUS method utilizing same WHO T score criteria is an attractive screening tool because of the low cost, feasibility and help in identifying osteopenia and osteoporosis in a substantial female population who otherwise shall remain undiagnosed and face the complications and menace of osteoporosis.

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