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Osteoporosis risk assessment among rural women using osteoporosis self-assessment tool for Asians (OSTA)

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Abstract
Osteoporosis is one of the most prevalent of the degenerative diseases and now recognized as a silent epidemic disorder. With increasing longevity of the Indian population, it is now being realized that, as in the West, osteoporotic fractures are a major cause of morbidity and mortality in the elderly. The lower bone densities existing in the women need to be screened out as earlier as possible at the community level. However, the facility of Bone Mineral Density (BMD) is not always available and usually accompanied by relatively higher costs and in such situations, questionnaire based tools are much beneficial for earlier risk assessment. The Osteoporosis Self-Assessment Tool for Asians (OSTA) index is a simple tool based on age and body weight. Calcaneal quantitative ultrasound (QUS) is another simple and low-cost instrument used to prescreen osteoporotic subjects. Based on this background, the present study focused on prediction of osteoporosis risk and to compare against QUS-BMD measured at calcareous bone. The research was carried out in South Indian rural women aged 35 to 74 years who voluntarily participated in BMD campaigns. The study was analyzed in four different age groups Viz., 35-44 years (n=60), 45-54 years (n=80), 55-64 years (n=80) and 65-74 years (n=40) to evaluate changes in risk levels with the advancing age. The results well demonstrated a definite correlation between different levels of OSTA score and BMD classification of low and poor bone mass conditions of osteopenia and osteoporosis. Hence it can be inferred that OSTA found to be better prescreening tool to predict osteoporosis risk earlier especially among Asian postmenopausal women.

Keywords: Osteoporosis risk, rural women, osteoporosis self-assessment, bone mineral density

1. Introduction
The proportion of ageing population is being increased worldwide and simultaneously the problem of bone health also correspondingly increased. Osteoporosis is the major bone health problem affecting aged population. It is often referred to as pediatric disease with geriatric outcome as the roots are laid down since the childhood in fact from the womb of the mother. Diagnosis of osteoporosis in the initial stages may be useful to carry out further complications of osteoporotic fractures and increased mortality risk. Bore mineral density (BMD) is the measure of predicting low bone mass condition, osteopenia and poor mineral density status of osteoporosis. However, the facility of BMD testing is always not available and found to be expensive. In such circumstances, exploring questionnaire based screening tools are much beneficial in predicting osteoporosis risk levels. Osteoporosis Self-Assessment tool for Asians (OSTA) found to be the most reliable tool in predicting the proneness towards osteoporosis. In this regard, the selected women subjects were evaluated for OSTA and accordingly classified into normal, osteogenic and osteoporotic women.

Osteoporosis is a growing problem in Asia especially in India, where majority of women's nutritional status in low income groups are much neglected and suffering from anemia, reproductive problems and poor nutritional intakes. In rural India alone majority of women suffer from either osteopenia or osteoporosis because of very low calcium intakes and unlimited, unhealthy pregnancies and abortions. Many of women are ignorant of the disease and causative factors which are making them at risk. Early identification of high risk condition for osteoporosis is necessary by simple methods and screening tools.

Bone Mineral Density (BMD) measurements by Dual Energy X-rays Absorptiometry (DEXA) is the gold standard predictor of osteoporosis fractures and a surrogate measurement of osteoporosis. However, the BMD measurements are not widely available in most communities and the cost is still high.

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Hence it is beneficial to have alternative methods of easily adoptable screening tools to measure the risk levels of osteoporosis instead of dependant on BMD measurements (Chaovisitsaree et al (2007)) [1].

Adopting the screening tools for osteoporosis risk assessment is helpful to identify the women at risk of osteoporosis earlier and to initiate the preventive strategies by appropriate intervention program. Several screening tools have been proposed to help clinicians, stratify the risk of osteoporosis in women. Questionnaires have been variably effective in predicting central Bone Mineral Density (BMD). The purpose of such risk assessments is to determine which patients would benefit most from expensive and time-causing measures of BMD, such as dual energy X-ray absorptiometry (DEXA). Koh et al (2001) [2] developed the osteoporosis self-assessment tool to identify postmenopausal Asian women at increased risk of osteoporosis as defined by DEXA.

The clinical tool, OSTA has recently generated among Asian population to identify women with increased risk of osteoporosis. This index is developed for postmenopausal Asian women in eight different Asian regions by assessing multiple clinical risk factors associated with bone loss and osteoporosis and finally yielded as an index based on only age and body weight (Kung et al (2003)) [3].

The osteoporosis risk index tool, OSTA is comparable to other developed osteoporosis risk – assessment tools such as the Osteoporosis Risk Assessment Instrument (ORAI), the Simple Calculated Osteoporosis Risk Estimation Score (SCORE) and the osteoporosis index of risk (OSIRIS) in identifying osteoporosis in women. However, the advantages of the OSTA are that it is simpler to use and implement in the clinical setting and has a slightly better discriminative ability compared to the ORAI and SCORE among women (Lim et al (2009)) [4]. Based on the above background, during the present among the different available osteoporosis risk assessment screening tools, OSTA is purposively chosen as an osteoporosis screening risk index to identify women at risk of osteoporosis.

2. Methodology
2.1 Study Sample
The research was carried out nearby rural areas of Tirupati town of Chittoor district from Andhra Pradesh. The sample constituted of married women from rural area aged 35-74 years with four different age groups Viz., 35-44 years(n=60), 45-54 years(n=80), 55-64 years (n=80)and 65-74 years(n=40).

2.2 Osteoporosis self-assessment screening tool for Asians (OSTA) –Risk Assessment
The osteoporosis self-assessment screening tool for Asians (OSTA) was a prescreening tool that could help physicians to actively assess osteoporosis among Asian women and determine the need for BMD measurement before fracture actually occurs. The index is derived from the patients weight and age as is calculated as (weight in kilograms – age in years) x 0.2, truncated to an integer. Based on the OSTA risk score, the risk levels are categorized into low risk (OSTA ≥ 0), medium risk (OSTA: -1 to -3) and high risk (OSTA: ≤ - 4) Koh et al (2001) [2]. Accordingly, the women were grouped based on risk levels OSTA categorization.

2.3 Statistical Analysis
The statistical programme of SPSS 11.5 version is applied to test the statistical contents and accordingly the results are tabulated. The mean values of OSTA and standard deviation were calculated from the individual scores and the differences were evaluated by least significant differences.

3. Results and Discussion
The osteoporosis risk levels were analyzed from the selected women of four different age groups using Osteoporosis Self-assessment Screening Tool for Asians (OSTA). Accordingly, women were predicted for the osteoporosis risk as low, moderate and high risk. From the data obtained, mean values were calculated and percent values calculated as per risk level. The results thus arrived were interpreted and presented in table no 1.

Table No 1: Mean scores on Osteoporosis Self-assessment Screening Tool for Asians (OSTA) among rural women- Frequency and percent distribution

| Age (Years) | Mean scores of OSTA | | | | | |
| | Low risk (≥ 0) | | Moderate risk (-1 to -3) | | High risk (≥ -4) | |
	n (%)	Mean &± SD	n (%)	Mean &± SD	n (%)	Mean &± SD
35-44 (n=60)	60 (100.00)	1.45 ± (1.52)	Nil	Nil	Nil	Nil
45-54 (n = 80)	57 (71.25)	0.95 ± (1.35)	23 (28.75)	-1.54 ± (0.51)	Nil	Nil
55-64 (n = 80)	24 (30.00)	0.92 ± (1.10)	47 (58.75)	-1.96 ± (0.91)	9 (11.25)	-4.22 ± (0.44)
65-74 (n = 40)	2 (5.00)	0.67 ± (1.15)	12 (30.00)	-2.83 ± (0.39)	26 (65.00)	-5.32 ± (0.95)

The results indicated an inverse relationship of OSTA with osteoporosis risk levels. As the values of OSTA are lowered with age, correspondingly the risk levels for osteoporosis increased. It is clear and significant that with the gradual advancing age, the OSTA risk scores gradually shifted from low risk to moderate risk and moderate risk to high risk levels of osteoporosis.

The most important observation of the present study is that all young women (35-44 years) are at low risk level of osteoporosis. There is no well-defined evidence for the existence of risk status of osteoporosis at young aged women. The bone metabolic processes also indicate lower bone resorption levels at young age restoring better bone mass which supports lesser probability of osteoporosis risk status. Scientifically, the women at young age are at active reproduction potential and possess optimal levels of estrogen which may be beneficial to reduce the risk of bone resorption and proneness to osteoporosis.

The other finding noted that the osteoporosis risk was initiated from the middle age as evidenced by 28.75 percent

women at moderate risk. The striking feature to be considered that the high risk condition of osteoporosis started at the age of 55 years indicating that from the age of 55 years onwards the chances of proneness to osteopenia and osteoporosis was increased. The moderate risk status is enhanced by more than fifty percent and about one tenth of them appeared to be high risk of osteoporosis. The remarkable point highlighted that the high risk condition of osteoporosis as per OSTA was well demonstrated in the elderly group as much as 65 percent. This denoted that elderly women were more susceptible to maximum risk of osteoporosis.
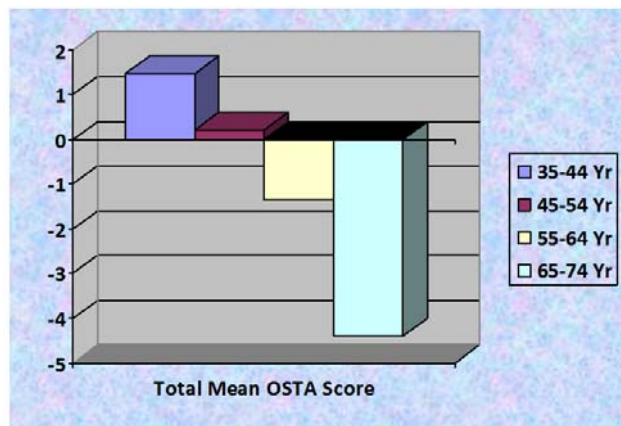

Fig 1: Total mean Osteoporosis Self-assessment Screening Tool for Asians (OSTA) Score of rural women in different age groups

The total mean irrespective of risk category for each age group was depicted graphically to understand the changes in risk levels with advancing age (Figure No:1). The total OSTA risk scores represented that the mean value of young and middle aged women found to be at low risk level of ≥ 0 of OSTA. However, the mean OSTA score of middle aged women was nearer to the borderline of moderate risk level of osteoporosis. The elderly rural and rural farm women are at higher risk of osteoporosis as per the range of high risk category of OSTA.

The mean score of aged women was at moderate risk score indicating the need of utmost care from the age of 55 years. The mean OSTA score among elderly women after the age of 64 years denoted a definite risk in elderly age due to unavoidable changes associated with ageing process. The results provided a clear picture of risk increments from the ages of 45 to 54 years and an increasing trend after 55 years. The effectiveness of the screening tool might be validated for testing osteoporosis only when it was being compared to the bone mineral density which was a direct measure of evaluating the conditions of osteopenia and osteoporosis. OSTA was an indirect scale of assessing the proneness to osteoporosis risk by considering the body weight and age of a person. QUS directly assessed the bone mineral density of bone at calcareous region. The relationship between OSTA index scores in assessing risk for osteoporosis into three categories like low, moderate and high risk levels in relation to bone mineral density in the select women groups was expressed by least significant differences and the significant levels of mean differences in BMD T-scores of the women. The results obtained were tabulated in the table no 2.

Table 2: Distribution of select women as per scores on Osteoporosis Self-Assessment Tool for Asians (OSTA) Risk index: A comparison with BMD T-Scores and calculated least significant differences

OSTA risk index	Mean OSTA score &± SD	Mean BMD T-score &± SD	OSTA risk index – Least significant differences in BMD T-scores			BMD T-Score at 95% confidence	
			High	Moderate	Low	Lower bound	Upper bound
Low (n = 143)	1.15 ± (1.40)	-1.15 ± (0.89)	2.20*	0.90*	-	-1.30	-1.00
Moderate (n = 82)	-1.86 ± (0.85)	-2.05 ± (0.80)	1.29*	-	-0.90*	-2.23	-1.88
High (n = 35)	-4.03 ± (1.08)	-3.35 ± (0.79)	-	1.29*	-2.20*	-3.62	-3.08

The data clearly indicated that the bone densities were being lowered significantly (p < 0.05) from low to moderate and moderate to high risk condition of osteoporosis in among women. The mean BMD T-scores in the moderate risk category of OSTA were in correspondence to the mean range of osteopenia exactly matching the relationship between moderate risk status and osteopenia. Similarly, the mean BMD T-score of high risk group of OSTA coincided well with the range of osteoporotic BMD T-score. The mean OSTA score of low risk level was at borderline of osteopenia, but almost nearer to normal BMD T-score. This identified the trend in OSTA index risk scores in direct association with the bone mineral density levels diagnosed through Quantitative Ultra Sound (QUS) bone densitometry. This situation needs to be corrected at war foot basis through appropriate life style and dietary modifications to prevent age-related bone loss and minimizing the further risk of osteoporosis. The improvement in nutritional and health status was augmented to maintain the strong and healthy bone health. The condition challenges to bring awareness on the suitable measures to maintain preserve and improve the bone density levels to strength the bone and

minimize the risk of future age-related bone loss. The overall results represented a significant difference in calculated least significant values between BMD T-scores and OSTA index score at five percent level between low to moderate, moderate to high and low to high levels of osteoporosis risk. The comparative results demonstrated that OSTA index score was an indirect measure of predicting moderate and high risk groups by OSTA and proneness for the risk of osteopenia and osteoporosis. Thus OSTA may be a reliable and useful tool on a large scale for screening women for risk of poor bone health leading to osteoporosis at different age groups.

Kung et al (2003) [3] compared OSTA in identifying subjects with low BMD by DEXA in 722 Southern Chinese postmenopausal women recruited from the community in Hong Kong. Using the published cut-off value of –1.0 for OSTA to identify subjects with femoral neck BMD T-score $\leq - 2.5$, the sensitivity and specificity was 88 percent and 65 percent respectively. The authors conclude that the simple clinical risk assessment tool OSTA is a free and effective method for identifying subjects at increased risk of osteoporosis in developing countries. The present study results also confirmed the suitability of OSTA index as a screening tool against QUS BMD and indicated as a simple measure in identifying women at risk of osteoporosis.

Park *et al* (2010) evaluated the performance of OSTA using a sample of 1101 postmenopausal women from a clinic in Korea who had femoral neck BMD measurements by DEXA. The OSTA had a high sensitivity and good specificity (67%) for identifying osteoporosis. The prevalence of osteoporosis ranged from 2% among women classified as low risk (OSTA > –1) to 64% among those classified as high risk (OSTA < –4). The results reveal that the OSTA performed well in the postmenopausal Korean women. The current research findings among rural women revealed good suitability of the OSTA index score in postmenopausal women after the age of 45 years in identifying moderate and high risk groups with that of osteopenia and osteoporosis conditions as young women are absolutely at low risk of osteoporosis as per OSTA index score. Tao *et al* (2006) [5] analyzed the relationship between quantitative ultrasound and OSTA score and non-vertebral fracture in 513 postmenopausal Chinese women. Using cut-offs of OSTA –4 and –1 in categorization of osteoporosis risk, there is a decrease in SOS of radius, phalanx and tibia with increasing risk of osteoporosis and increased prevalence of non-vertebral fractures. Combination of OSTA and phalanx QUS gave a sensitivity of 83 per cent and specificity of 84 percent to identify postmenopausal women with a history of postmenopausal non-vertebral fracture. It is concluded that OSTA and phalanx QUS are effective measures for identifying postmenopausal women at increased risk of non-vertebral fracture. The present study though not analyzed the fractures, it is much clear that the OSTA is effective in predicting the osteoporosis risk condition in postmenopausal women.

The present study results provided sufficient information on the relative decrease in BMD T-score as assessed by quantitative ultrasound (QUS) with the decrease in OSTA index score. The comparative results tested for the change in BMD T-score with the three different risk categories of OSTA are well explained by the direct proportionate relationship between OSTA index score and BMD T-score. However, the major limitation with the OSTA index score is that as the weight is increased, the OSTA index score shows high score and relatively lower risk even for the obese individuals which seems to be a risk factor for osteoporosis. Further extensive studies are required in relation to bone mineral density to establish cut-off points considering the threat of very high body weights and the risk levels for osteoporosis.

4. Summary and Conclusion
The findings of the study well demonstrated significant relationship between OSTA risk score and the corresponding levels of Bone Mineral Density (BMD) classification of low and poor bone mass conditions of osteopenia and osteoporosis. The data clearly explained the fact that age was an important unavoidable risk factor of osteoporosis as evidenced by a definite decline in bone mass with the progressing age. Adopting appropriate healthy lifestyle modifications especially to maintain ideal body weight for their height including good nutrition certainly helpful to attenuate and restore bone mass. The increase in the ageing population challenges the task of suitable measures since the gross root level through dissemination of required health education to the community and to make necessary policy decisions for the wellbeing of elderly.

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