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RESEARCH ARTICLE

PREVALENCE OF OSTEOPOROSIS IN NORTH DELHI REGION MALES AND FEMALES OF INDIAN ORIGIN

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ABSTRACT

Osteoporosis, also known as the silent disease, occurs in women and men, and is associated with a loss of bone mass and increased risk of fracture. With aging there is a loss of bone mass and bone strength But does that mean that osteoporosis is a disease characteristic of aging, or that its incidence increases in old age? Data on prevalence of osteoporosis among women in India come from studies conducted in small groups spread across the country with 230 million Indians expected to be over the age of 50 years in 2015, 20% are osteoporotic. The DEXA scan & Qualitative ultrasound (QUS) methods are widely used for BMD analysis. Bone has a mechanically anisotropic structure, which ultrasound parameters are thought to reflect which is principle mechanism of QUS method. Methods: All 138 subjects between 20 – 70 years, 57 females & 91 males of north delhi region, in the study were examined by use of quantitative ultrasonography (QUS) method to evaluate their bone mineral density (BMD) at right calcaneus. Prevalence of osteoporosis or osteopenia in all males & females were calculated. Results: The results of present study were Indian females of north Delhi region depicts a high prevalence of 64.91% in 57 females and 62.63% in 91 male studied. Hence it was concluded that prevalence rate of osteoporosis as compared with previous studies has increased alarmingly to average 63% approximately in the studied population.

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INTRODUCTION

Bone is a composite structure, consisting of inorganic mineral crystals, an extracellular organic matrix, cells, lipids, and water. The mineral crystals are analogous to the geologic mineral, hydroxylapatite. Since bone mineral is made of OH-deficient nano-particles, we will refer to it here as hydroxyapatite (HA) (Boskey, 2007). Most of the mineral crystals contain impurities, mainly carbonate, magnesium, citrate, and other trace elements whose content depends on what the animal has ingested (Grynpas, 1993b). The organic matrix is mainly type I collagen, but other types of collagen and several non-collagenous proteins, reviewed elsewhere, are also present (Zhu *et al*., 2008). The cells, which produce, nurture, and remodel the mineralized extracellular matrix, also respond to mechanical and other signals, which determine the properties (morphology and function) of the bone. The relative composition of bone varies with health and disease, tissue site, and animal and tissue age. Bone serves mechanical and homeostatic functions, protecting the internal organs, allowing for locomotion and load-bearing, and serving as a home for marrow, and as a reservoir for calcium homeostasis. With aging, these functions become impaired, bone becomes more fragile and less able to perform its mechanical functions, and the calcium stores are often depleted which may predispose to fracture risk (Chan and Duque, 2002). There is scarcity of evidence related to comparative analysis of the rate of fracture and its healing in different age groups of humans. It is also important to realize that, although bone mineral density (BMD) decreases in some fragility diseases such as osteoporosis (Manolagas, 2010) however it can increase in other such conditions like osteopetrosis (Kaste *et al*., 2007). Thus, it is the tissue-level properties in combination with the bone geometry that determine fracture risk. There are reports that older individuals may have a 10-fold-increased 10-year fracture risk compared with younger individuals with the same BMD (Kanis, 2002). Since many investigators and clinicians believe that BMD is a marker of fracture susceptibility, because it declines with age in both women and men, it is important to examine why there is an age dependent increase in bone fragility or in brittleness of bone. Osteoporosis, also known as the silent disease, occurs in women and men, and is associated with a loss of bone mass and increased risk of fracture. As has been pointed out throughout many review, with aging there is a loss of bone

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mass and bone strength. But does that mean that osteoporosis is a disease characteristic of aging, or that its incidence increases in old age? It is our contention that these are not the same, and for reasons discussed below, osteoporosis is not necessarily a disease of aging (Carrington, 2005). Osteoporotic bone, by definition, is bone that fractures easily. Both trabeculae and cortices are often thinner, the mineral content per area of tissue is often increased, and the mean crystal size, collagen maturity, and carbonate contents are increased relative to those of age-matched controls (Gourion-Arsiquaud *et al*., 2010). The incidence of fragility fractures and decreased bone strength (Banks *et al*., 2009) increases exponentially with age in males and females (Nieves *et al*., 2009) there are several reasons for the conclusion that aging is not causative factor for bone fragility. First, and most obvious, is that not all the elderly, here referring to people over age of 60 yrs, show signs of skeletal fragility or have fractures (Mellibovsky *et al*., 2007). Second, while there are specific genes associated with bone loss in rodents and humans (Richards *et al*., 2009), their presence or absence does not offer specific protection to any age group, and finally, because osteoporosis does occur in the very young example, in idiopathic juvenile osteoporosis, a disease of skeletal fragility found in teenagers (Rauch, 2002). To argue against osteoporosis being a disease of aging, as opposed to a disease which has a greater prevalence in older individuals, we point to the case of two centenarians and their relatives (one being 113 years old) who had no fractures and no genetic abnormalities that could be linked to their younger-appearing bone properties (Mellibovsky *et al*., 2007; Richards *et al*., 2009). Thus, because there is only an association, rather than causality, we maintain that while oral bone loss may be accelerated in aging, in both animals and humans, the loss of bone is not directly attributable to aging. Thus considering ageing and bone strength to be related a cumulative data depicting the prevalence of Osteopenia or Osteoporosis and changes in measurement parameters s.a. BMD is predictive and should be studied globally to identify its actual prevalence in the community. According to a three-year long pan-India data mining survey (2012–2014) on vitamin D released by SRL Diagnostics 80.63 per cent of some 73 lakh samples of men screened showed abnormal levels of vitamin D, vital for bone health (Rauch, 2002; Posted, 2005).

According to Ms. Anuradha VK study with increasing longevity and a greater proportion of the Indian population over the age of 50 years are likely to result in an increased number of people affected by osteoporosis and in 2013, estimates suggested that approximately 50 million people in India had T-scores of < –1 (Mithal, 2012). Therefore a high prevalence of osteoporosis or osteopenia is expected among Indian population. The strength of bone as a tissue is determined by the amount of mineral that is there (usually provided clinically as a two dimensional BMD and a T- or Z-score comparing the value with that of healthy sex-matched 25-year-olds or with healthy age matched control individuals, respectively), and the way that mineral is distributed relative to the forces applied to the bone (Ammann, 2003). With aging, sex-related differences (not discussed here) in the distribution (geometry and morphology) become more pronounced, and these differences are believed to contribute to increased fracture incidence in the extremely elderly population (Yates *et al*., 2007). The DEXA scan & Qualitative ultrasound (QUS) methods are widely used for BMD analysis. Bone has a mechanically anisotropic structure, which ultrasound parameters are thought to reflect which is principle mechanism of QUS method. The velocity (SOS) and attenuation of transmitted ultrasonic waves (BUA) can be measured (Antich *et al*., 1991). QUS measurements are applied to peripheral bone, mostly the Tibia & heel (Yates *et al*., 2007) and the WHO has defined Osteoporosis as a T-score at or below –2.5 and osteopenia below –1.0 up to –2.5 (Kröger *et al*., 1995; Kanis, 1994). Kim Beerhorst, *et al*. in 2013 studied the feasibility of calcaneal quantitative ultrasonography (QUS) as a screening method for increased risk of osteoporosis in a unique population of people with chronic epilepsy, intellectual disability (ID), and chronic use of antiepileptic drugs. A total of 205 patients underwent dual-energy X-ray absorptiometry (DXA) and QUS of the calcaneus. T-scores for both DXA and QUS were calculated and correlated. Results of 195 patients (95.1%) were successfully measured with DXA and 204 (99.5%) with QUS. High correlations were found between DXA and QUS T-scores: r = 0.666 (QUS versus T-score total femur), r = 0.631 (QUS versus T-score femur neck) and r = 0.485 (QUS versus T-score lumbar spine). All correlations were statistically significant (p = 0.01). Therefore it was concluded that QUS showed a strong correlation with DXA and proved to be a feasible measuring method in a population (Bonnick *et al*., 2013). In a study from Njeh *et al*. (Bonnick, 2013), in which the precision of six different calcaneal QUS devices was determined, the short-term precision for SOS, expressed as the root-mean square percent coefficient of variation (RMS-%CV), ranged from 0.11 to 0.42. For BUA, the RMS-%CV ranged from 1.39 to 6.30. Typically, better precision values are seen for SOS than for BUA.

In theory, the speed with which sound passes through bone is related not only to the density of the bone but to the quality of the bone as well. Both bone density and bone quality determine a bone's resistance to fracture. Therefore, the speed of sound through bone can be related to the risk of fracture. When ultrasound passes through a material, the velocity of the sound wave is also related to the elastic modulus and density of the material and it becomes clear that the velocity of ultrasound through bone is directly related to the square root of the product of bone density and bone quality. The velocity with which ultrasound passes through normal bone is quite fast and varies depending upon whether the bone is cortical or trabecular. Speeds of 3,000–3,600 m/s are typical in cortical bone with speeds of 1,650–2,300 m/s typical of trabecular bone. Therefore in present study Tibial QUS method was selected for purpose of studying bone health in Caucasian males & females of Indian origin from pitampura delhi.

MATERIALS AND METHODS

In the present study 160 subjects were encountered out of which 141 subjects consented for study with the age group ranging from 20 - 80 years. Prior to testing subjects were enquired about their medical history and present condition by a MD physician and 138 subjects with stable clinical conditions were selected for the purpose of study. In the moths of June and July 2017, 148 subjects with no pain in spine or lower limbs were studied. 12 subjects were excluded of which 3 males were found clinically unstable for having a history of acute trauma and current arthroscopic replacement treatment 9 subjects refused to provide their medical data. None of the patients who were included in the study was undergoing corticosteroid injections, oral corticosteroid medication, or alcohol abuse rehabilitation. All 138 subjects were examined by use of quantitative ultrasonography (QUS) method to

evaluate their bone mineral density (BMD) at right calcaneus. In order to calculate velocity, ultrasound densitometers. Higher values of SOS indicate greater values of bone density. A second ultrasound parameter is broadband ultrasound attenuation (BUA). This parameter is reported in decibels per megahertz (dB/MHz). Like SOS, higher BUA values indicate greater bone density. Most devices report both SOS and BUA. SOS method was used in present study & BMD at the calcaneus is assessed with QUS, but devices exist that can be applied to the radius, finger, and tibia. As coupling medium between the transducers and the bone ultrasound gel was used for measurements at the calcaneal site (Bonnick *et al*., 2013).

RESULTS

Table 1. Demographic data of 148 subjects with 57 female & 91 males with mean age and standard deviation

Data parameters		Mean	S.D. (±)
Age	Females (57)	50.75	11.97
	Males (91)	51.81	14.61
BMD	Females (57)	-1.22	0.27
	Males (91)	-1.22	0.41
Systolic Blood Pressure (SBP)	Females (57)	129.89	13.30
	Males (91)	126.75	21.80
Diastolic Blood Pressure (DBP)	Females (57)	79.75	7.57
	Males (91)	77.60	13.02

The statistical analysis was performed using SPSS 14 and prevalence was calculated by following formula.

$$\text{Prevalence of Osteopenia} = \frac{\text{Number of Osteopenic subjects}}{\text{Total number of subjects}} \times 100$$

Table 2. Prevalence of osteoporosis in 148 subjects with 57 female & 91 males

Subjects	N	BMD < -1.0	Prevalence (%)
Total Females	57	37	64.91
Females Age group (70-80)	2	2	100
Females Age group (60-70)	13	6	46.15
Females Age group (50-60)	22	13	59.09
Females Age group (40-50)	9	9	100
Females Age group (30-40)	7	7	100
Females Age group (20-30)	4	0	0
Total Males	91	57	62.63
Males Age group (70-80)	11	6	54.54
Males Age group (60-70)	22	10	45.45
Males Age group (50-60)	29	21	72.41
Males Age group (40-50)	13	12	92.32
Males Age group (30-40)	12	8	66.67
Males Age group (20-30)	4	0	0
Grand Total	148	94	63.51

Subjects	Z-score	T-score	N	Significance
Females	0.5701	0.5602	N1=57	T value observed at 136
Males	0.5181		N2=91	df = 0.845 at p <0.05
Df (N1+N2-2)			136	

Z-test was used to identify whether the scores BMD of subjects were significantly different and male & female subjects were compared on the basis of unpaired t-test with unequal variance. The statistical analysis found significant variation in values of BMD score of 57 females and 91 males (Z – score Females =0.5701, $p < 0.05$ and Z – score Males = 0.9466, $p<0.05$). Hence the data reveled significant variation in the BMD scores of population of 148 subjects including male & female subjects. Comparison between male & females for BMD values were also obtained and no significant difference was obtained (t=0.5602 calculated for two tailed unequal variance, t value observed = 0.845 at df=136 for p value = 0.05). Hence all male & female subjects were found to have similar BMD scores with no significant difference in male & female scores. However from this data it can be interpreted that both males and females in general have high incidence of bone strength loss with average BMD value= -1.22 being osteopenic. Also in both males & females high prevalence of 60 – 90% between 30 to 60 years age group for decreased bone density < -1.0 was found which indicates towards immediate need of large scale detail evaluation of causative factors for loss of bone strength in adults & middle aged subjects to facilitate its prevention.

DISCUSSION

Osteoporosis is characterized by reduced bone mass and the disruption of bone architecture that results in increased risks of fragility fractures, which are the main consequences of the disease (Kanis *et al*., 2008). While data on prevalence of osteoporosis among women in India come from studies conducted in small groups spread across the country, estimates suggest that of the 230 million Indians expected to be over the age of 50 years in 2015, 20% are osteoporotic women. In Indian women, increasing longevity and risk factors, such as low calcium intakes, vitamin D deficiency, sex inequality, early menopause, genetic predisposition, lack of diagnostic facilities, and poor knowledge of bone health, have contributed toward the high prevalence of osteoporosis and fractures (Malhotra *et al*., 2008; Anuradha *et al*., 2015). The results of present study corroborates with the findings of the previous epidemiological studies however the rate of osteoporosis seems to be increasing in Indian females of north Delhi region pitampura as the present study data depicts a high prevalence of 64.91% in 57 females studied. This indicates towards the need of immediate steps that should be taken to conduct studies on Indian population with larger sample sizes are needed to identify and treat the probable risk factors associated with it. A high prevalence of bone strength decrease has been studied in survey conducted by SRL diagnostics in 2015 on Indian men while moderate decrease is found in study by Agrawal NK, Sharma B. with osteoporosis affecting 8.5 % of otherwise healthy males aged 50 years and above with Vitamin D deficiency common in such group and maybe responsible for osteoporosis. In the present study also 62.63% male subjects were found to have decreased bone strength. Therefore high risk of osteoporosis exists in Indian males also which needs more awareness against the common perception that bone weakness is more associated with post-menopausal or household females with less exposure to sunlight (Kadam *et al*., 2010).

Conclusion

Hence it can be concluded for the studied population in the present study that high prevalence of osteoporosis of 62.63% in males and 64.91% in females of Indian origin has been found with total prevalence of 63.51% indicating that there is immediate need of larger sample size studies to re-evaluate the status of Osteporosis disease in India.

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Conflict of Interest

No conflict of interest was found in the study.

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