Bone Mineral Density in healthy Iranian population: A Cross sectional study

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Abstract

Introduction: Osteoporosis is a major problem and is a hidden epidemic disease in the world. Early diagnosis by measurement of Bone Mineral Density (BMD) and treatment can prevent and reduce disease complications, especially fractures. As there is no comprehensive study in Iran, this study designed to assess BMD discrepancy in 20-69 yr Tehran population as well as prevalence of osteoporosis and osteopenia.

Methods: 553 people (34% men, 66% women) from 50 clusters in Tehran randomly selected. The assessment of BMD in spine and femur region performed through DXA method. All subjects clinically examined and their BMIs determined.

Results: The average spinal BMD score in men were more than in women. The peak bone mass of spine bone in both men and women occurred during 20-29yr and reduction began from the age of 40. At the age of 60 to 69, loose of bone density was 19.6% in lumbar spine and 18.5% in femur of women and also 7.9% in lumbar spine and 14.6% in femur of men. Prevalence of osteoporosis in this age group in lumbar spine and femur was 32.4% and 5.9% in women and 9.4% and 3.1% in men respectively.

Conclusions: In all age groups, peak bone mass was lower than European or American population, whereas the rate of bone loss was as much as the some population and actually this process justifies the prevalence of osteoporosis and osteopenia in Tehran population.

Keyword: Bone Mineral Density, Osteoporosis, Osteopenia, Calcium, Vitamin D
Introduction

The importance of evaluation of BMD is in diagnosis of osteoporosis and prevention of bone fractures and its consequent disability (1, 2). Osteoporosis is the most common metabolic disease of bone which is known by deficit in bone mineral density and skeletal micro destruction that increases risk of bone fracture (1-3). According to BMD assay, people categorize to 3 groups. Normal imputed to someone whose BMD is less than one standard deviation, osteopenia less than 1 to 2.5 and osteoporosis less than 2.5.

This study, of course, suggests that the assessment of BMD in each region of human skeleton predict the fracture chance of the same region (4). Density of bones depends on age, disease, genetic, mechanical factors, nutrition, and the body hormones effects. Decrease of bone mass starts in women before ending of menstruation and in men from the third and fifth decades of life. With starting menopause in women, rate of bone loss, increases several fold that during the first 5 to 10 years of menopause, women lose 25% to 30% of trabecular bone mass and 10% to 15% of their cortical bone mass (4). Osteoporosis is a common problem and also a hidden epidemy. Appraisals show that about 75 million persons in Europe, Japan, and America are afflicted from osteoporosis. 30% of American women after the menopause have osteoporosis. Studies in Australia showed that the prevalence of osteoporosis at the ages 40 to 44 is 0.9%, but at the age of over 70, it increases to 87% (5-6). In Thailand's over 70yr women, prevalence of disease was 50% (6). In the UK, 1/3 of women and 1/12 of men affected form osteoporosis (7).

The importance of osteoporosis is the increase in fracture risk. Most fractures of osteoporosis are in pelvic, vertebra and distal radius (1). The most important fracture that increases mortality rate is femur neck fracture. The mortality rate after that,
during the life of a woman, is the same as breast cancer and it is almost four folds of uterus cancer mortality (2).

The number of pelvic fractures estimated almost 1.7 million in 1990, and concerning the population growth and the increase of life expectancy, it seems it will be 6 million in 2050. In addition, the investigations show that in the next 50 years, considering the population growth in the old people in Asia, South America and Africa, it is expected almost 75% of these fractures occur in progressing countries (1). Early diagnosis of osteoporosis by assessment of bone density can prevent its complications, especially fractures. Bone density relates to many items like race, genetic, sex, environmental factors and nutrition. This study designed to assess the variation of bone mineral density at lumbar vertebras and neck of femur in normal Tehran population.

**Methods**

553 subject were selected among the men and women of 20_69yr from 50 clusters of Tehran. The exclusion criteria were rheumatoid arthritis, hypothyroidism, hyperthyroidism, hypoparathyroidism, hyperparathyroidism, adrenal disorders, diabetes mellitus, renal insufficiency, chronic hepatic desease and any type of cancer. Disorder of menstruation after 18, permanent cease of menstruation either over the past 3 months in those who were under 40, or those who had menstruation less than 6 months over the past 1 year in those who were under 40, oophorectomy before menopausal age, infertility, pregnancy, breast-feeding during the study, smoking more than 10 cigarettes in a day, alcohol consumption of more than one glass for more than 5 years, drug abuse, professional sport, spinal column deformity or fracture or any other minor fractures, full bed-rest for three consecutive months, finally taking drugs such as estrogen, progesterone and primarine among women with menopause, taking
one calcium pill a day at least, taking multivitamin and vitamin D over the past two weeks and getting parental vitamin D3 over the past six months were all among the exclusion criteria.

The study protocol was approved by research ethic committee of Endocrinology and Metabolism Research Centre (EMRC) and the data gathered by cluster random sampling. The subjects with osteoporosis were referred to the EMRC osteoporosis clinic in the Shariati Hospital for treatment.

Having received the letters of consent, the related questioners were completed and clinical examinations such as height and weight were carried out. BMD was measured by DXA using Lunar DPX-MD device (Lunar Corporation, Madison, Wisconsin, 53713. USA). To assess BMD, second to forth lumbar spine and from the femur bone (neck, trochanter and the whole femur). Bone density was calculated based on gr/cm².

SPSS (ver 11.5) was used for data analysis. To compare the mean, the student T test was used and for comparing frequency of variable between groups Chi-square was used.

Results

553 subjects (34% men, 66% women) between 20 to 69 yr (mean ± SD, 44.07±12.68) participated in the study. Mean of their BMI was 27.19±4.97 kg/m². There was no significant difference in the spinal BMD of women between the age groups 20-29 and 30-39 (Table 1). But the spinal BMD among the men and women of over 40 showed a decrease in BMD in such a way that in the age group 40-49, there was a decrease of 4% among the women and a decrease of 1% among the men compared with the two former groups. Likewise, in the age group 50-59 there was a decrease of 11.6% in women and 6.8% in men. Finally, in the age group 60-69 there was a decrease of 4% among the women and with no decrease (0.24%) among the men. In the age group 30-
39 compared with the age group 29-29, there was an increase of 6.17% in the mean femur BMD of the women. In the age groups 40-49, 50-59 and finally 60-69 among the women, there was a decrease in the BMD respectively 5.3%, 5.2% and 8% within each decade. In the age decades after 30 among the men, compared with the former decade, there was a decrease of 5.1%, 3.2%, 4.2% and 2.1% respectively (Figure 1).

A significant relationship was found between age and BMD (P < 0.001 and P < 0.001). There was a significant relationship (P = 0.025) between BMD and BMI among the men but there was no relationship of this kind among the women. On the other hand, there was a significant relationship between BMI and femur BMD both among the women and the men (P < 0.001 and P < 0.001 respectively). There was no significant relationship between WHR (waist and hips relation) and BMD whereas this relationship was significant in spinal column (P < 0.001). The decrease of BMD among the women was accelerated after menopause so that during the first ten years after the menopause, there was almost an annual decrease of 1.16% in BMD of the spinal column and the BMD in femur bone decreased 2.2 times. In this study, the mean femur BMD among the women with menopause was 10.5% lower than the women without menopause (P < 0.001). The mean spinal BMD among the women with menopause was 16% lower than the women without menopause (P < 0.001). In total, 7.4% of all cases in lumbar spine and 2.4% in femur bone had osteoporosis and 30.4% in the spinal column and 23.9% in femur bone had osteopenia. Figure 2-5 show the prevalence of osteoporosis and osteopenia in both sexes and age groups.

Discussion
In this study, the mean of BMD from spinal column and femur in all age groups of men were more than that of women. Most similar studies justify these results through comparing the fluctuations of androgen level with estrogen level, in men the level of androgen to estrogen dose not reduce compared with women. On the other hand, the bone mass, physical activities and maximum bone density in men were more than women (4, 8, 9). These results also indicate that the maximum density of bones were among women of 30-39 which is in accordance with other studies (4, 10). The mean of spinal column BMD among women 30-39, was 5.6% lower than the American women. Although this mean was 3.9% more than the Japanese women, there was no significant difference between these two groups because maximum BMD of Japanese occur in women of 40-49 (9). Many studies have demonstrated that alteration in BMD depends on type of the bone, different function, menstruation condition, environmental factors, genetics effects and age (11, 12). As the results achieved in other countries indicate different means and amounts, the information obtained through this study show a similar BMD pattern. The present study suggests that the maximum BMD of femur bone compared with spinal column occur later. This is justifiable considering the fact that the maximum BMD in cortical bone compared with trabecular bone occurs later (10, 11, 12). The amount of BMD of spinal column decreases 15.6% after ten years being 16.9% less than the Japanese women (13, 14). The maximum BMD of femur bone was 4.48% less than the American women and in the first decade after menopause, the decrease in BMD is in line with other studies (15). The pattern of bone loss, both in femur and lumbar, depends on the age. The pace of loss in bone mass up to menopause period, in the women in question, is similar to the Canadian, British and American women. Although after that period, it is
faster than the women of Belgium, United Kingdom, France and America whereas it is less than the Japanese women (13, 14).

On the other hand, the rate of bone loss compared with the other studies (Western Belgian and Japanese) is either the same or more (13, 16). This trend, therefore, caused an increase in incidence of osteoporosis and osteopenia. In men, the maximum of BMD in spinal column was 3.5% less than the American men while the decrease in this density among the oldest men in question was twice as much as the Finish and American men (7). The incidence of osteoporosis among women and men was 32.4% and 9.4% respectively, which is more than of UK, this is justifiable with regard to the above-mentioned explanations. Studies indicate that the peak bone mass plays an important role the incidence of osteoporosis which this peak bone mass depends on genetics, kind of diet, sport and the hormonal state. Genetics was the most important factor justifying low BMD in our study. As well, with respect to the deficiency of vitamin D in Iran, which is common among 80% of people in some areas, and also lack of enough activity, in particular, among young girls of 20-29 can cause the low level of bone mass (7).

There was no significant relation between BMI and BMD especially in women lumbar spinal columns, but in other studies there was such a relationship. This lack of relation seems to result from less activity in spinal column. In other studies, there is no justification for the relationship between lumbar spine bone density and body weight either (17).

**Conclusions**

It is notice-worthy that this paper represents the early results of the comprehensive plan for prevention, diagnosis and treatment of osteoporoses carried out in the EMRC
of Tehran University of Medical Sciences, which is still being conducted and is not finished yet. With completing the project and data gathering and studying all patients fully, the final results could be achieved and the relationships could be analytically discussed. Broadly speaking, the present study indicates the high incidence of osteoporosis and osteopenia among the Tehran population, which requires our proper attention and planning for prevention. Also, the low amount of peak bone mass in the ages 20-39 is helpful to adopt an adequate strategy in this respect. There are many factors involved in this maximum BMD including genetic factors, body activity and providing enough vitamin D and calcium.

Among the intervening factors, enough nutrition together with calcium and vitamin D could be enumerated. The results of this study indicate that there is an increase in bone mass in the first decade after menopause requiring a proper treatment during the years before and after menopause.

**Abbreviations**

EMRC: Endocrinology and Metabolism Research Center,
TUMS: Tehran University of Medical Sciences,
BMD: Bone Mineral Density
BMI: Body Mass Index
DXA: Dual X-ray Absorption
WHR: Waist and Hips Relation

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<td>1.098±0.15</td>
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<td>1.117±0.155</td>
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**Mean ±SD**
Figure Legends:

**Figure 1**: Rate of BMD decrease in femur and lumbar spine in variable sex and age group

**Figure 2**: Prevalence of osteoporosis in lumbar region according to the age and sex

**Figure 3**: Prevalence of osteoporosis in femur region according to the age and sex

**Figure 4**: Prevalence of osteopenia in lumbar spine according to the age and sex

**Figure 5**: Prevalence of osteopenia in femur bone according to the age and sex
Figure 1
Figure 2

Prevalence of osteoporosis (percent) vs. Age group
Figure 4