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Association of Bone Mineral Density and Lifestyle in Men

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Abstract

Background: Recently, osteoporosis is an increasingly important public health problem in men. The aim of this study was to investigate relationship between life style and bone mineral density in men.

Methods: Among the 20-76 year-old men of Tehran, 325 persons were selected randomly from 50 clusters. The persons suffering from rheumatoid arthritis, thyroid diseases, fractures or other conditions which effect bone metabolism were excluded. All participants underwent clinical examinations and lumbar and spinal densitometry using DXA method.

Results: In lumbar spine, peak bone density was seen between ages 25 and 40 yr and in hip, between 20 and 30. In men older than 50 yr, prevalence of osteoporosis and osteopenia, were 3.9% and 50%, respectively. Bone mineral density was significantly correlated to calcium and vitamin D intake, physical activity and smoking.

Conclusion: Nutritional intake and physical activity are important factors in maintaining bone mineral density. Peak bone density in 20-40 year-old population and its relation to life style could be useful in policy-making for the prevention of osteoporosis.

Keywords: *Bone mineral density, Life style, Nutrition, Osteoporosis*

Introduction

Osteoporosis is a common problem of health care systems and in other words it is a hidden epidemy of today world. Osteoporosis is associated with bone loss and increase in bone fragility. Bone Mineral densitometry (BMD) has an essential role in the evaluation of osteoporosis and fracture risk (1). BMD is the most important risk factor for fracture and is believed that bone mineral density acts as an intermediary variable on the biological path way, linking endocrine hormones, lifestyle and dietary risk factors with fractures (2).

Health care promotion in recent decades has been associated with increase in life span and life expectancy, but industrialization and changes in life style and environmental factors have changed burden of disease patterns (3). In this regard, WHO in 2002 reported that 60% of mortality and 49% of burden of diseases is related to chronic diseases, which in 79% of cases occurs in developing countries. Changes in dietary habits, decreased physical activity and smoking are essential risk factors of these diseases. It has been reported that 20%- 50% of bone mass changes are related to life style, especially nutrition. Nutrition has the essential role in maintaining peak bone density in growth period (4). Appropriate diet, with provision of vitamin D and calcium, has an effective role in bone metabolism. Supplying enough calcium for maintaining peak bone mass in growth period and for protection against bone loss in adolescence is essential (4-6).

Osteoporosis prevention based on increasing peak bone mass and delay in the beginning of bone loss age, has been more noticed recently. These prevention programs have been designed based on individual characteristic and effective factors indicative of osteoporosis and its following fractures (7). Especial variables of lifestyle which affect bone mass are physical activity (8), smoking (9), alcohol drinking (10) and calcium and vitamin D intake (4-6).

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The aim of this study was to investigate the relationship between life style and bone mineral density in men.

Materials and Methods

In this cross sectional study, 20- 76 year old males of Tehran (capital of Iran) population were assessed. Subjects were selected by random cluster sampling. Persons with rheumatoid arthritis, thyroid, parathyroid and adrenal dysfunction, diabetes mellitus, renal failure, severe liver failure, cancer, smoking more than 10 cigarettes per day, alcohol drinking for more than 5 year, and one glass per day, addiction, professional sporting, vertebral fracture, fracture due to simple falling, vertebral column deformity, hospital admission in last 2 wk due to a disease, and complete bed rest were excluded from the study. The study protocol was approved in research ethic committee of the Endocrinology & Metabolism Research Center (EMRC).

Selected subjects were invited to hospital for bone mineral densitometry. After obtaining informed consent, special questionnaires were completed. The physical examination for bone deformity, muscle tenderness and vertebral column deformity was performed, and weight and height were measured. For the subjects who had received radioactive material, radio opaque or calcium supplements, BMD assessment was postponed to at least five days later.

Bone mineral density was measured by dual x-ray absorptiometry (DXA), using a Lunar DPXMD densitometer (Lunar, 7164, USA) which was calibrated daily, using appropriate fantoms. BMD was assessed in lumbar vertebrae (L_2-L_4) and femur (neck, ward and trochanter) in gr/cm^2.

A questionnaire, including general information, medical history, drug history, duration of physical activity (h/wk), and period of sunlight exposure (min/d) was completed for each participant. Also food frequency questionnaire was used to estimate the amount of daily calcium (mg/d) and vitamin D intakes (IU/d).

The data analysis was done by SPSS software (version11), using paired t- test; Man-Whitney and variance analysis were used for mean comparison. Linear and Logistic regression were used for assessment of correlation between variables.

Results

Three hundred twenty five males, 20-76 yr old, enrolled in the study. Mean age and BMI of participants were 44.93±14.65 (yr) and 26.2± 4.18 (kg/m^2), respectively. Mean vitamin D and calcium intakes were 61.23 (54.05-68.42) (IU/day) and 678.69 (638.43-718.96) (mg/day), respectively. 7.1% of cases were smoker, 5.2% alcohol drinker, and 23.4% did some kind of sports 2- 3 times in a wk.

Daily sunlight exposure in 44.4% of cases were less than 45 min, in 25.9% less than 30 min and in 13.7%, less than 15 min.

Peak bone mass of lumbar spine and hip region occurred between ages 25-40 and 20-30 yr, respectively. Osteoporosis was diagnosed in 3.9% and osteopenia in 50% of men older than 50.

In linear regression, there was a significant correlation among bone mineral density in lumbar spine and hip region and age and BMI. In one way analysis of variance there was no significant difference in calcium intake between different age groups but vitamin D intake had significant difference in different age groups and its intake decreased as the age increased.

In cases with vitamin D intakes less than 100 (IU/day) and more than 100(IU/day), mean BMD of spine were 1.15±0.16 (gr/cm^2) and 1.22±0.14 (gr/cm^2), respectively. These measurements in hip region were 1±0.14 and 1.05±0.14 (gr/cm^2), respectively. The differences in both regions were significant between two groups. After age, BMI and vitamin D and calcium intake matching, BMD in hip and spine in 20- 40 yr old men, who exercised 2 or more times in a week was more than the others. Also in the same age group, lumbar spine BMD, in cases with calcium intake of more than 800 (mg/day), was higher than cases with intake of less than 800 (mg/day).

After age, BMI and vitamin D intake matching in 20-40 yr-old men who exercised less than 2 times a week, spine and hip BMD was higher in cases with more than 800 (mg/day) calcium intake (Fig. 1), but calcium had no effect on BMD in cases that exercised 2 or more times a week. Also sport had no effect on BMD in cases with less than 800 (mg/day) calcium intake but hip BMD was higher in cases with more than 800 (mg/day) calcium intake and exercising 2 or more times a week (Fig. 2). Overall hip BMD in cases that received more than 800 (mg/day) calcium and did some kind of sports 2 or more times in a week were higher than the others (Fig. 3).

After age, BMI and calcium and vitamin D intake matching in smokers, BMD in lumbar spine of subjects with older than 50 year was lower than non smokers (Fig. 4).

In osteoporosis risk assessment among older than 50 yr subjects, calcium and vitamin D intake and sunlight exposure were significantly different between osteoporotic and non osteoporotic cases (Table 1).

Table 1: Comparison of osteoporosis risk factors between normal and osteoporotic cases

Parameters	**Normal group**	**Osteoporotic group**	***P* value**
Age (year)	58.46±6.6	58.2 ±6.3	0.7
BMI (Kg/m^2)	28.34 ±3.7	24.99±6.57	0.05
Vitamin D intake (IU/d)	44.7 ±52.4	18.51±14.2	0.02
Calcium intake (mg/d)	623.5 ±378	413.4±447	0.04
Sunlight exposure (min/d)	77.41 ±71.6	28.2 ±17	0.02

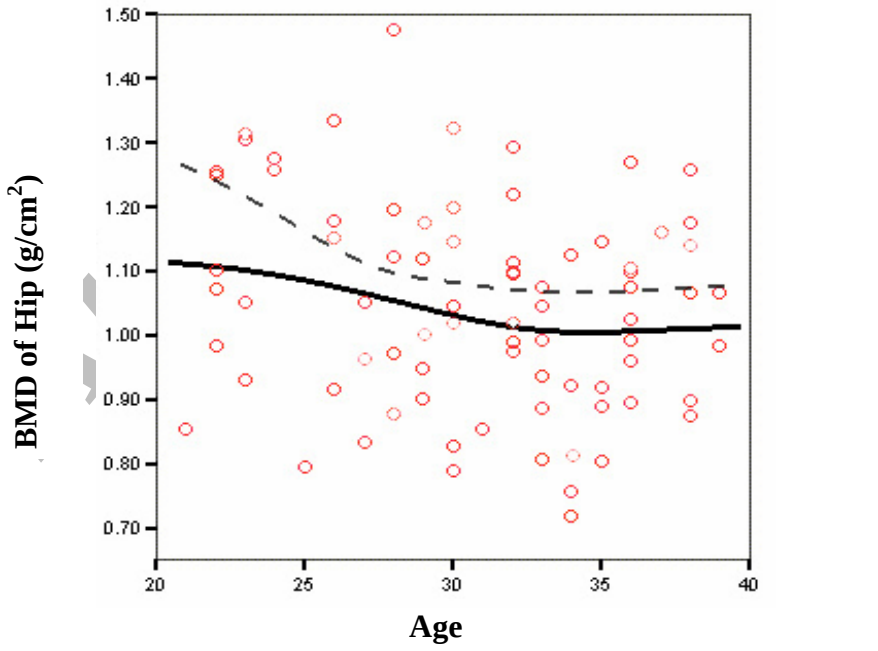

Fig. 1: BMD in hip region in 20-40 year-old according to daily calcium intake

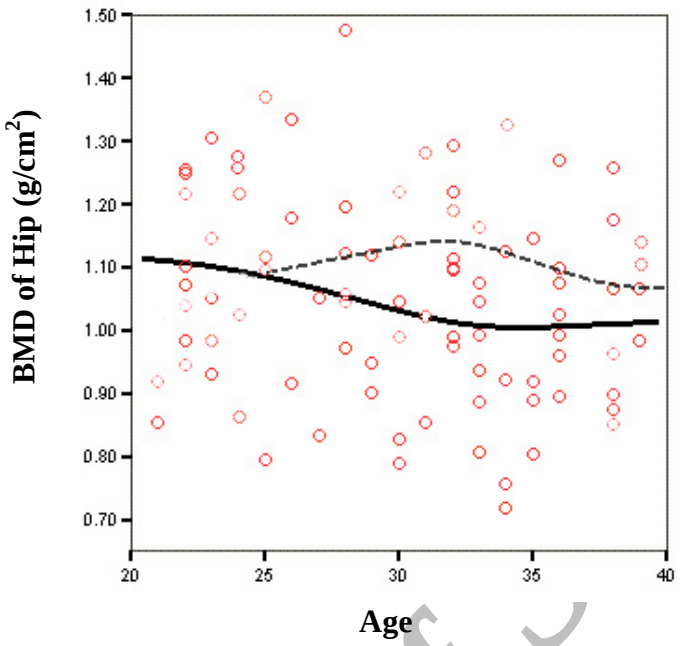

Fig. 2: BMD in hip region in 20-40 year-old according to the frequency of weekly exercise

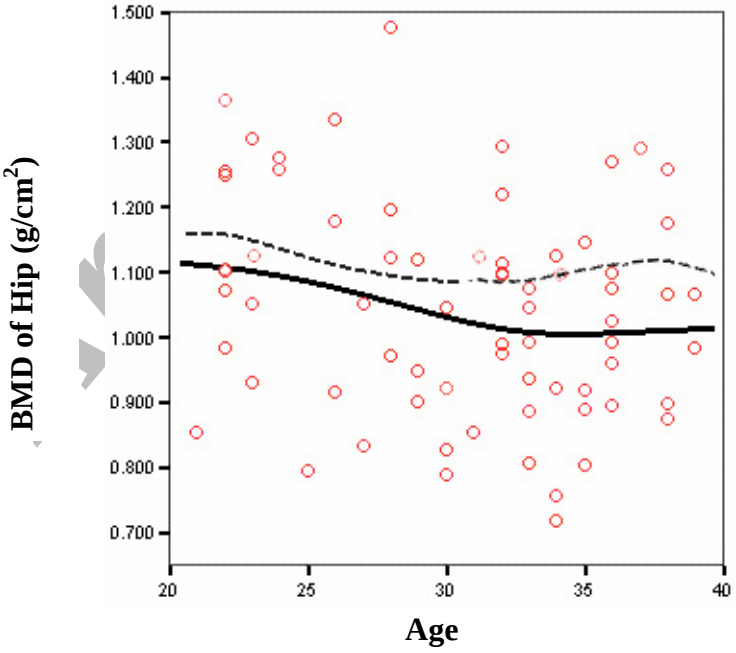

Fig. 3: BMD in hip region in 20-40 year-old according to the daily calcium intake and frequency of weekly exercise

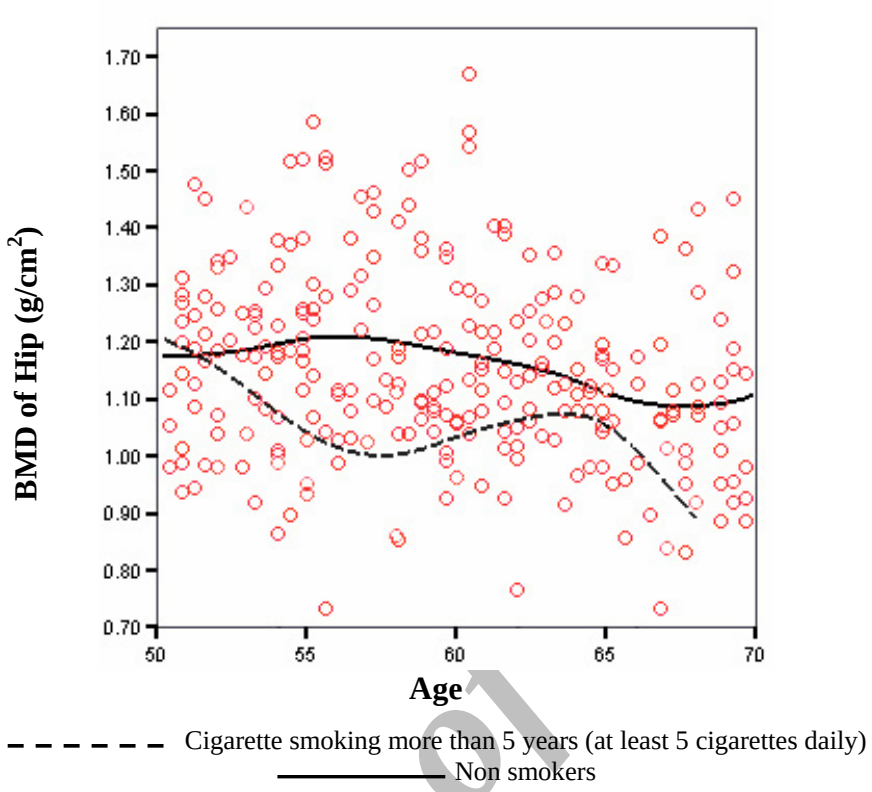

Fig. 4: BMD in hip region in 50-70 year-old in smokers and non smokers

Discussion

Some of the studies have shown that, prevalence of osteoporosis and osteopenia in men older than 50 yr is 4%-6% and 33%-47% respectively, which is in concordance with our study (11, 12). Daily calcium and vitamin D intake only provide 60% and 15% of what is recommended, respectively. Up to age of 40, calcium intake has an effect on bone mass changes but in older ages, it has no independent correlation with bone mass. Effectiveness of calcium intake in older ages is controversial. Some studies have shown that in males, calcium intake up to 1200 (mg/day) has no effect on bone loss pattern.

In other studies, it has been reported that calcium intake in older ages did not change bone mineral density significantly (13). Similar results have been reported about vitamin D. It should be mentioned that vitamin D intake was inadequate and this make analysis difficult.

Significant difference was found between osteoporotic and non osteoporotic cases in sunlight exposure. Because of little intake of vitamin D, skin synthesis is the only source of it. Therefore high prevalence of vitamin D deficiency shows that this endogenous vitamin D is not sufficient to provide daily requirement. Other studies in various countries confirm these results (14-17).

Different results have been reported about the role of alcohol in BMD changes (10). In our study there was no correlation between BMD and Alcohol drinking which can be justified by our culture, religious beliefs and lower prevalence of drinking alcohol.

Considering the results, smoking and its duration have an effect on BMD, which has been reported in other studies (8, 9).

Although osteoporosis in men is primarily associated with age and genetic factors, most studies have shown that in 30%- 60% of cases, it is associated at least with one risk factor (12, 13, 18). According to the results, paying more attention to lifestyle improvement in young age may increase the peak bone mass, and decrease the

rate of bone loss in old age. In this regard, enough vitamin D and calcium intake, exercise and physical activity are the most important factors which should be considered in policy making.

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References

1. Brown JP, Josse RG (2002). Clinical practice guidelines for the diagnosis and management of osteoporosis in Canada. *CMAJ*, 167: S_1- S_{34}.
2. McGuigan FE, Murray L, Gallagher A, Davey-Smith G, Neville CE, Van't Hof R, et al. (2002). Genetic and Environmental Determinants of Peak Bone Mass in Young Men and Women. *J Bone Miner Res*, 17: 1273–79.
3. WHO. (2003). *Increasing fruit and vegetable consumption to prevent chronic disease has profound implications for global food production*. WHO Press Release 10 January. available from: http://www.who.int/dietphysicalactivity/publications/releases/en/index.html
4. Sarah L, Morgan MD (2001). Calcium and vitamin D in osteoporosis. *Rheum Dis Clin North Am*, 27: 101- 30.
5. Renner E, Hermes M, Stracke H (1998). Bone mineral density of adolescents as affected by calcium intake through milk and milk products. *Int Diary J*, 8: 759- 64.
6. Fujita T (1996). Calcium intake, calcium absorption, and osteoporosis. *Calcif Tissue Int*, 58: 215.
7. Oria E (2003). Preventive and nutritional factors of osteoporosis. *An Sist Sanit Navar*, 26 Suppl 3:81-90.
8. Murphy NM, Carroll P (2003). The effect of physical activity and its interaction with nutrition on bone health. *Proc Nutr Soc*, 62: 829-38.
9. Daniell HW (1976). Osteoporosis of the slender smoker. Vertebral compression fractures and loss of metacarpal cortex in relation to postmenopausal cigarette smoking and lack of obesity. *Arch Intern Med*, 136:298-304.
10. Law MR, Hackshaw AK (1997). A meta-analysis of cigarette smoking, bone mineral density and risk of hip fracture: recognition of a major effect. *BMJ*, 315: 841- 6.
11. Looker AC, Orwoll ES, Johnston CC Jr, Lindsay RL, Wahner HW, et al. (1997). Prevalence of low femoral bone density in older U.S. adults from NHANES III. *J Bone Miner Res*, 12: 1769-71.
12. Amin S, Felson DT (2001). Osteoporosis in men. *Rheum Dis Clin North Am*, 27:19-47.
13. Orwoll ES, Oviatt SK, McClung MR, Deftos LJ, Sexton G (1990). The rate of bone mineral loss in normal men and the effects of calcium and cholecalciferol supplementation. *Am Intern Med*, 112: 29-34.
14. Fonseca V, Tongia R, el-Hasmi M, Abu-Aisha H (1984). Exposure to sunlight and vitamin D deficiency in Saudi Arabian women. *Postgrad Med J*, 60: 589-91.
15. Maclaughin J, Holick MF (1985). Aging decreases the capacity of human skin to produce vitamin D3. *J Clin Invest*, 76: 1536-8.
16. Keane EM, Healy M, O'Moore R, Coakley D, Walsh JB (1998). Vitamin D-Fortified Liquid Milk: Benefits for the Elderly Community-Based Population. *Calcif Tissue Int*, 62: 300-2.
17. Alagol F, Shihadeh Y, Boztepe H, Tanakol R, Yarman S, et al. (2000). Sunlight exposure and vitamin D in Turkish women. *J Endocrinol Invest*, 23: 173-7.
18. De Laet CE, van Hout BA, Burger H, Hofman A, Pols HA (1997). Bone density and risk of hip fracture in men and women: Cross sectional analysis. *BMJ*, 26; 315: 221-5.