



Review Article

Nutritional Implications of Osteoporosis among Post Menopausal Women in India

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ABSTRACT

Objective: To review the evidence on diet and nutrition relating to osteoporosis along with other factors like physical activity and early onset of menopause among post menopausal women in India.

Approach: Firstly, to review the definition and prevalence of osteoporosis in India, Secondly, to provide an overview of the scientific data, interpreting studies linking diet, nutrition, physical activity and early menopause to osteoporosis. The following were considered: Protein, vitamin D, calcium, physical activity and early menopause.

Conclusions: There is insufficient knowledge linking bone protein status, growth rates or bone turnover among post menopausal to evaluate its benefits in overcoming fracture risks. The evidence of a link between intakes of any dietary component and fracture risk is not sufficiently secure to make firm recommendations, with the exception of calcium and vitamin D. For physical activity aspect, studies have proved that being physically active can not only reduce risk of fractures but can also help in increasing the BMD, however lack of compliance is often seen among elders. Studies have shown that there is an inverse correlation between number of years since menopause and BMD in India. So early menopause in Indian women may assume significance in causation of PMO in Indian context

KEY WORDS: BMD, PMO, Osteoporosis.

INTRODUCTION

Osteoporosis is a disease that affects many millions of people around the world. It is characterised by low bone mass and micro-architectural deterioration of bone tissue, leading to enhanced bone fragility and consequent increase in fracture risk. Fragility fractures are most common at the wrist, spinal vertebrae and hip, although they can occur throughout the skeleton. The incidence of vertebral and hip fractures increases exponentially with advancing age

while that of wrist fractures levels off after the age of 60 years. ⁽¹⁻³⁾

World-wide variation in the incidence and prevalence of osteoporosis is difficult to determine because of problems with definition and diagnosis. The WHO definition of osteoporosis is a bone mineral content (BMC) or bone mineral density (BMD), measured by techniques such as dual-energy X-ray absorptiometry, that is more than -2.5 SD below the young adult mean for the population. ⁽⁴⁾

Good nutrition is as important for bone health as it is for general health. Although the adequate nutrient intakes of calcium, vitamin D and proteins are critical for bone health, certain trace minerals are also involved in bone health. Besides, our skeleton is sensitive to mechanical loading, and bone mineral density can be improved by weight-bearing physical activity in addition to improving nutritional needs. Among the other predisposing factors to osteoporosis, premature menopause is common in Indian scenario.

Prevalence in India

The population of India is expected to increase to 1,367 million by 2020 and 1,613 million by 2050; of which 9.8% (134 million) and 19.6% (315 million), respectively, will be adults over 60 years (WPP 2010). Conservative estimates in a study suggest that 20% of women and about 10-15% of men are osteoporotic in India. ⁽⁵⁾

The Preliminary data from India (published and unpublished) indicates a high prevalence rate of PMO (post menopausal osteoporosis) making it a major public health problem, making also need for population-based studies for prevalence, and incidence of new hip fractures and related mortality. Though the prevalence of PMO in population above the age of 50 years varies widely across the globe 5.8-50.1%, the limited data from India reveal the prevalence to be ranging from 25.8 to 62. Further, stratification of the risk based on age shows that the prevalence of low bone mass is more than 40% from the age of 40 years and increases to more than 62% by age 60 and 80% by the age of 65 years. ⁽⁶⁻⁹⁾

Community-based epidemiological data on fractures are lacking. Hospital-based studies show that hip fractures are more common in women and with an average age between 60 years and 70 years. A longitudinal follow-up study of urban women (n = 450) over a 3 year period

revealed that 7 women who had sustained an a traumatic fracture had osteoporosis at either the hip or the spine. ⁽¹⁰⁾

High prevalence of PMO (post menopausal osteoporosis) in Indian women may be due to inadequate nutrition, i.e., protein, vitamin D3, and calcium, sedentary life-style, and early menopause. There is wide prevalence of low dietary calcium intake in Indians of all age groups with the majority of post-menopausal women consuming < 400 mg/day. This extends to all the other age groups (infancy, adult hood, post-menopausal women, pregnancy, and lactation). Studies on bone mineral health from different parts of India indicate wide prevalence of vitamin D deficiency in all age groups, including neonates, infants, school children, pregnant/lactating women, adults, and post-menopausal women. ⁽¹¹⁻¹⁷⁾

Recent data indicate that Indians have lower bone density than their North American and European counterparts. It is reported that osteoporotic fractures occur 10-20 years earlier in Indians compared to Caucasians. The probable reasons cited are genetic, environmental, and nutritional. ⁽¹⁸⁻²⁰⁾

Nutritional factors related to osteoporosis

Nutritional factors probably play a major role as shown in the ICMR (Indian Council of Medical Research) studies on three socio-economic groups at the National Institute of Nutrition. They showed that after the age of 50 years, osteoporosis of the spine was only 16% in the high income group (with calcium intake of 1000 mg) compared to the low income group with 65% osteoporosis (calcium intake around 400 mg). The major limitation of this study was it was confined only to four major cities in India and only up to Hyderabad (latitude 17°22'N) (latitudinal extent of India 8°4'N to 37°6'N). India has a vast cultural, ethnic, dietary, and dress code variations and it is imperative to include all sections of the

population in length and breadth of the country. ⁽²⁰⁾

Proteins and osteoporosis: Protein is a building block for strong bones and muscles. Similar to calcium and vitamin D, insufficient protein intake is detrimental to bone development and bone mass maintenance later in life. As with vitamin D, protein intake has a dual benefit on bone disease prevention, as it helps build stronger bones and muscles. One of the mechanisms by which a higher protein intake may have a positive influence on bone and muscle health is via an increase in blood levels of Insulin-like Growth Factor -1 (IGF-1). Regular daily milk intake results in a measurable increase in IGF-1 blood levels in children. This may also be achieved with protein supplements as demonstrated in one study among senior hip fracture patients. IGF-1, produced by the liver, promotes bone and muscle formation, and supports the conversion of vitamin D into its active form (1,25-dihydroxyvitamin D). ^(21,22)

A study carried out among 289 women (41% postmenopausal and premenopausal) from the low socio economic group with mean age at menopause was 40.8. Their mean height, weight and body mass index (BMI), which are important indicators of the nutritional status, were 149.1, 49.2kg and 22.1 respectively. They subsisted on a cereal based diet with little protective foods like milk, fruits, vegetables, meat, fish etc. They had deficient intakes of all nutrients such as calories proteins; vitamins and minerals. These women belonged to labor class. This study highlights the serious consequences of under nutrition defined in terms of weight, height, BMI, low calcium intakes with multiple nutrient deficiencies on the bone health of women from the poor socio economic group. Osteoporosis and bone thinning sets in by the age of 40+ itself

which may explain the early onset of fractures. ⁽²³⁾

To study effect of soy protein supplementation for postmenopausal therapy, a double blind, placebo controlled trial was conducted on hundred healthy postmenopausal women not taking Hormone Replacement Therapy. Supplementation containing phytoestrogens significantly decreased total and low density cholesterol and improved menopausal symptoms as compared to placebo. Significantly higher number of cases reported improvement in hot-flashes, joint-pains and vaginal-dryness on soy treatment ($p < .05$). Soy group showed 7.7% decrease in total cholesterol and 14% decrease in LDL-cholesterol (significantly different from control group $p < .05$) while no effect was seen on HDL cholesterol, Blood pressure, sex hormones, vaginal cytology, uterine endometrium & bone densitometry. ⁽²⁴⁾

Importance of Vitamin D: Vitamin D is obtained either from the diet or by synthesis in the skin under the action of sunlight. Older people tend to have reduced endogenous production of the vitamin for a variety of reasons, and they become more dependent on dietary sources to maintain adequate vitamin D status. Associations have been reported between plasma 25-hydroxyvitamin D and BMD in middle-aged and older women. However, vitamin D intervention trials of older people with either bone loss or fracture as outcome have given inconsistent results. ⁽²⁵⁻²⁷⁾

One study from North India reported requirement of 60,000-120,000 IU per month to achieve Vitamin D level > 30 ng/ml. This is the level at which calcium absorption from the gut is maximum. ⁽²⁸⁾

One more study has reported correction of Vitamin D level to normal after 8 weeks of supplementation with weekly dose of 60,000 IU. Both these studies highlight the need of regular

supplementation of at least 2000 IU/day of Vitamin D supplementation to maintain normal Vitamin D levels. ⁽²⁹⁾

A study of 25(OH)D and BMD in women of reproductive (WR) age group and post menopausal women (PMW) in South India. They have reported Vitamin D deficiency in 76% in WR, 70% in PMW, insufficiency in 16.5% in WR and 23% in PMW. Vitamin D deficiency is considered to be present when serum 25(OH) D levels are < 20ng/ml; insufficiency between 20-30ng/ml and sufficient when > 30ng/ml. 14-16. In this study there is Vitamin D deficiency which coexists with low BMD. They have recommended daily calcium intake of 1-1.5 gm and Vitamin D supplementation as part of therapy in the study population to maintain Vitamin D levels > 30ng/ml. ⁽³⁰⁾

The result of Indian multi-centric study in middle aged health-care professional found that 79% of subjects were vitamin D deficient, 15% had insufficient levels of 25-hydroxy vitamin D (25(OH) D), and just 6% of health professionals were adequate in vitamin D status. The mean concentration of 25(OH) D was 14.65 ± 10.32 ng/mL (median 11.93 ng/mL). This study confirms the results from a single center smaller study carried out earlier amongst the health professionals in India. A review of the global vitamin D status by the IOF in 2009 underscores the fact that South Asia may be one of the worst affected regions in the world. ^(31, 32)

Calcium intake and osteoporosis. A large body of literature, including epidemiological evidence, randomized clinical trials, and metabolic balance studies, indicates that dietary calcium is a determinant of skeletal, i.e. calcium, accretion. This is a logical consequence of calcium being the dominant mineral of the skeleton, existing as hydroxyapatite. While calcium supplements

in later life have shown a small benefit on bone mineral density, calcium supplements in vitamin D deficient individuals have not been shown to reduce the risk of fracture. Also, calcium supplementation without vitamin D supplementation may contribute to an increased risk of hip fracture. ^(33, 34)

Inadequate calcium intake was proposed as an additional factor contributing to the low BMD. This was shown in a study on Indian women from low income groups who consume diets that have inadequate calcium coupled with too few calories, proteins and micronutrients. BMD and T scores at all the skeletal sites were much lower than the values from the developed countries and were indicative of a high prevalence of osteopenia and osteoporosis. Body weight, age, menopause and calcium intake were found to be important determinants of BMD. ⁽²³⁾

In a multicenter interview-based study conducted in selected hospitals and health centers from urban areas in Iran and India, postmenopausal osteoporotic women were included. Calcium supplementation (0.6) and HRT (0.4) were shown as protective factors and steroid therapy (3.3) was found as a risk factor in Iran. Calcium supplementation more than 1 year (0.3) was shown as a protective factor in India. Pure vegetarianism (2.2) and Red meat consumption more than 4 times per week (1.4) was shown as a risk factor in Indian and Iranian subjects respectively. Regular consumption of Soya (0.3), almond (0.5), fish (0.5), fruits (0.4) and milk tea 4 cups per day and more (0.4) appeared to be significant protective factors in India. Regular consumption of cheese (0.5), milk (0.5), chicken (0.4), egg (0.6), fruit (0.4), tea 7 cups per day and more (0.3) were found to be significant protective factors in Iran. Exercises were shown as protective factor in Iran (0.4) and India (0.4). ⁽³⁵⁾

Prevalence of low dietary calcium intake is common in India among all age-groups, with majority of postmenopausal women consuming < 400mg/day. Parallel to a decrease in the calcium intake, bone densities are also lower with a decreasing income. Those above 50 years suffer from much worse bone densities than those less than 50 years in the same group. The fracture rate at the neck of the femur occurs 12-15 years earlier in women from low income group as compared to that in high income group. ⁽¹⁰⁾

Physical activity and osteoporosis

Several observational studies support a beneficial association between a greater lifetime physical activity and preservation of BMD, as well as a lower risk of hip, humerus and vertebral fracture, at older age. It was also suggested that exercising prior to age 40 is associated with a lower risk of falling in seniors. Thus, we get rewarded for being active when we were young even much later in life. ⁽³⁶⁾

In a study involving 200 pre- and postmenopausal women to determine the prevalence of osteoporosis were divided in two groups with respect to parity, education, socio-economic status, family history of osteoporosis, hormone replacement therapy, and thyroid disorders. The prevalence of low BMD was found in more than half of this population (53%). The mean age in group I (normal BMD) was found to be 50.56 ± 5.74 years as compared to 52.50 ± 5.94 in group II with low BMD ($P=0.02$). About 46.8% of the women in group I and 33% of the women in group II had low physical activity and there was no statistically significant difference in sunlight exposure between the groups. Lack of exercise and low calcium diet were significantly associated with low BMD. Multiple logistic regression analysis showed that age, exercise, menopause, and low calcium diet acted as significant predictors of low bone density. ⁽³⁷⁾

A study was conducted to evaluate the impact of life-style on BMD and osteoporosis in Indian Jawans and Indian sportswomen. It was highlighted that good nutrition, better bone biochemical parameters, adequate sun exposure, and physical activity from younger age helped to attain better peak bone mass (PBM) when compared to their age matched sedentary controls. ⁽³⁸⁾

A Comparative Effectiveness Research (CER) study comparing changes in bone mineral density in healthy women over-40 with above-average compliance when following one of three bone health plans incorporating the SG's three components (i.e. improved nutrition, increased health literacy, and increased physical activity) was conducted. About 414 females were tested, 176 of whom agreed to participate and follow one of three different bone-health programs. One plan contained a bone-health supplement with 1,000 IUs of vitamin D3 and 750 mg of a plant-sourced form of calcium for one year. The other two plans contained the same plant form of calcium, but with differing amounts of vitamin D3 and other added bone health ingredients along with components designed to increase physical activity and health literacy. The increases in BMD found was in all three treatment groups but the group following the most nutritionally comprehensive plan along with recommended physical activity outperformed the other two groups. The increases in BMD found in all three treatment groups in this CER stand in marked contrast to previous studies reporting that interventions with calcium and vitamin D3 reduce age-related losses of BMD, but do not increase BMD. ⁽³⁹⁾

Early menopause

The estimated mean age of menopause is 46 years in India, and is lower than that of the Caucasians. From the

available Indian data, it is hypothesized that an early age of menopause predisposes a woman to chronic health disorders a decade earlier than a Caucasian woman. It is reported that osteoporotic fractures occur 10-20 years earlier in Indians compared to Caucasians.

A study was conducted to estimate age at natural menopause among rural and urban Punjabi Brahmin females. Cross-sectional data based on 870 Brahmin females (rural=450, urban=420), ranging in age from 40 to 70 years. Mean and median age at menopause of rural females is 48.22±2.47 years and 48.98±1.12 years respectively, while among urban females it is 49.30±2.80 years and 50.12±1.15 years, respectively. These findings indicate that urban Brahmin females experience menopause at a later age as compared to their rural counterparts. The mean age at menopause of rural as well as urban females is found to be earlier than their median ages at menopause. ⁽⁴⁰⁾

In another study to assess the average age at menopause, to evaluate the influence of certain bio-social factors on menopause, and to find the menopausal symptoms experienced by Punjabi women, a cross-sectional study was conducted on 564 Punjabi women of Chandigarh, ranging in age between 40-60 years. Out of these, 288 women who had attained natural menopause form the subject of present investigation. The mean age at natural menopause was found to be 47.91(± 3.16) years. The mean ages at menopause among early and late menopausal groups were 41.04 and 51.05 years, respectively. ⁽⁴¹⁾

In a research to ascertain the average age of menopause and its symptomatology, to study the prevalence of chronic diseases, and to understand the health status, health behavior and health needs of Indian women was done. A total of 1132 (64.14%) of the 1765 women had a

natural menopause and 486 (27.54%) had a surgical menopause; 147 (12.99%) women (mean age 35.89 ± 3.02 years) were considered to have premature menopause. The average age of menopause in the sample studied is 46 years. Chronic diseases are on the rise and osteoporosis presents a decade earlier than in Caucasians. ⁽¹⁶⁾

Early menopause in Indian women in comparison with their Caucasian counterparts may assume significance in causation of PMO in Indian context since there is an inverse correlation between and number of years since menopause and BMD. This brings to attention the urgent need for the Government and Non-Government Organizations to promote community and school-based educational programs on nutrition, physical, and outdoor activities, to tackle these modifiable risk factors for osteoporosis.

CONCLUSIONS

Several studies related to osteoporosis and its nutritional aspects were reviewed in order to get an insight of the relationship that exists between diet and osteoporosis and several conclusions were drawn, which are:

There is insufficient knowledge linking bone protein status, growth rates or bone turnover among post menopausal to evaluate its benefits in overcoming fracture risks. The evidence of a link between intakes of any dietary component and fracture risk is not sufficiently secure to make firm recommendations, with the exception of calcium and vitamin D. For physical activity aspect, studies have proved that being physically active can not only reduce risk of fractures but can also help in increasing the BMD, however lack of compliance is often seen among elders. Studies have shown that there exists an inverse correlation between and number of years since menopause and BMD in India, so early menopause in Indian

women may assume significance in causation of PMO in Indian context.

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