

A Gender Based Study on Life Style, Diet and Senile Osteoporosis

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ABSTRACT An attempt was made to study the role of diet and lifestyle pattern in the pathogenesis of osteoporosis. Twenty-five male and twenty-five female elderly osteoporotic patients diagnosed by Singh's Index were assessed for background profile, lifestyle pattern and nutrient adequacy. The mean dietary intake of protein, calcium and vitamin C in male subjects was 48.97±0.89 g, 688.26±29.58 mg and 15.55±2.93 mg while it was 37.86±0.80 g, 663.49±31.91 mg and 24.84±4.74 mg respectively in female subjects. Results of the study revealed that nutrient intake by all the subjects were deficient as compared to the allowances suggested for elderly. However, in comparison to male subjects, percentage intake of calcium was slightly higher among female osteoporotic patients. On comparing the plasma ascorbic acid level of the subjects, it was found that female subjects had comparatively higher level (0.60±0.06 mg/dl) than the male counterparts (0.39±0.07 mg/dl). Significant positive correlation was found between the ascorbic acid intake and plasma ascorbic acid level. Thus it can be concluded that among females, factors other than diet may also play an important role in the development of osteoporosis.

INTRODUCTION

Osteoporosis is a disease characterized by reduction in the bone mass and disruption of bone architecture leading to impaired skeletal strength and an increased susceptibility of fractures (Lane 2006). It is a major public health problem associated with substantial morbidity and socio-economic burden worldwide (Johnell and Kanis 2004). Moreover, the proportion of elderly population is rapidly increasing in the developed as well as the developing world, which increases concern among aging population and public health workers regarding disability, dependence, associated economic and social problems that are caused by osteoporosis.

Osteoporosis does not have a dramatic clinical presentation except when fractures result. As age advances, the incidence of osteopenia and osteoporosis, the silent disease increases (Atik et al. 2006). Osteoporotic fractures, particularly those of the hip, result in significant disability, medical care costs and reduction in quality of life. The number of hip fractures is projected to quadruple by 2050, and the effects of osteoporosis will become an increasing hu-

man and healthcare burden (Adrianne et al. 2005). The lifetime risk of osteoporotic fractures in women is 30-50 per cent and in men, the risk is 15-30 per cent (Cooper et al. 1992). The menopausal reduction in estrogen levels and the resultant decrease in bone density are well established.

Osteoporosis is a nutrition related disease. Protein deficiency may be a predisposing factor in osteoporosis (Ecker and Sikerski 1984; Einhorn 1990). A diet low in calcium can accelerate the osteoporosis process by as much as 70 per cent or more, making nutrition the single most important factor in the development and progression of the disease (Whiting 2005). An inadequate anabolic drive due to insufficient dietary protein (Heaney and Layman 2008) may decrease bone strength through adverse changes in bone micro-architecture (Bonjour 2005). This indicates a need for adequate protein intakes for elderly to help optimize bone health. Vitamin C is known to enhance collagen synthesis, a precursor of bone matrix mineralization, to stimulate the overall process of osteoblast differentiation and to increase the rate of osteoclast formation and increase the life span of osteoclasts and their precursors (Ragab et al. 1998). It suggests a potentially beneficial role for vitamin C in the prevention of osteoporosis. Besides diet, there are many other factors which are known to be associated with the osteoporosis viz. lack of stimulating exercise, hormones, alcohol consumption, smoking etc. and each of these factors carry an increased fracture risk and needs to be studied.

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In view of the above facts, the present study was conducted to study the life style factors and role of diet in the pathogenesis of osteoporosis among male and female elderly.

MATERIAL AND METHODS

The present study was conducted in the orthopedic ward of the Maharana Bhupal Government Hospital, Udaipur (Rajasthan) on a group of 25 male and 25 female subjects over the age of 50 years having osteoporotic fractures diagnosed by Singh's Trabecular criteria (Singh et al. 1995). Purposive sampling technique was used for the selection of samples.

To collect the information, structured interview schedule was framed. The proforma consisted of background information about the patient including age, sex, religion, residential and educational status, activity pattern, food habits and in case of females, the age of menopause. Information about the site of fracture was noted down for each patient in terms of whether it was fracture neck femur, intertrochantric fracture, fracture spine or pelvis etc. Nutritional status of the subjects was assessed through dietary survey and plasma ascorbic acid level. A 24-hour dietary recall method for three consecutive days was adopted to find out the intake of various foods consumed by the subjects. Consumption of cooked food was recorded in standard volumetric measures and in numbers. These were then converted to raw weight of food in grams and the nutrient content of these diets (that is, protein, calcium and ascorbic acid) was calculated by using food composition tables (Rao et al. 2007). Food and nutrient intake was then compared with the values suggested by Pasricha and Thimmayamma (1992) for the elderly.

For the estimation of plasma ascorbic acid level, blood samples of osteoporotic patients selected for the study (15 males and 15 females) was collected and the ascorbic acid level was analyzed in the laboratory by Colorimetric method using 2,4 dinitrophenyl hydrazine reagent (Tietz 1986). The data were statistically analyzed as per the objectives.

RESULTS AND DISCUSSION

Background Information

General profile of the subjects presented in Table 1 shows age, residential status, educational

status, activity pattern and dietary life style. Data revealed that more than half of the subjects (64 per cent) were in the age group of 50 to 70 years, followed by 34 per cent who were in between 70 to 90 years. Being one of the major Government hospitals in Udaipur division of Rajasthan, patients not only from urban areas but nearby rural and tribal areas of the region come to M. B. Government Hospital, Udaipur for treatment. Data also showed that half of the subjects belonged to rural areas, 16 per cent were from tribal background and only 34 per cent belonged to urban areas. Literacy level was found comparatively better among males (44%) than female subjects (28%).

Table 1: General profile of the osteoporotic subjects

Characteristics	Male (n = 25) Number (%)	Female (n = 25) Number (%)	Total (n = 50) Number (%)
<i>Age (years)</i>			
50 -70	17 (68)	15 (60)	32 (64)
70 - 90	8 (32)	9 (36)	17 (34)
> 90	-	1 (4)	1 (2)
<i>Residential Status</i>			
Urban	4 (16)	13 (52)	17 (34)
Rural	16 (64)	9 (36)	25 (50)
Tribal	5 (20)	3 (12)	8 (16)
<i>Educational Status</i>			
Literate	11 (44)	7 (28)	18 (36)
Illiterate	14 (56)	18 (72)	32 (64)
<i>Activity Pattern</i>			
Sedentary	10 (40)	15 (60)	25 (50)
Moderate	7 (28)	10 (40)	17 (34)
Heavy	8 (32)	-	8 (16)
<i>Dietary Life Style</i>			
Vegetarian	15 (60)	13 (52)	28 (56)
Non-vegetarian	9 (36)	10 (40)	19 (38)
Ovo-vegetarian	1 (4.0)	2 (8.0)	3 (6.0)
Smoking	18 (72)	11 (44)	29 (58)
Tobacco	20 (80)	11 (44)	31 (62)
Alcohol	18 (72)	10 (40)	28 (56)
Betel leaves	20 (80)	14 (56)	34 (68)
Tea	22 (88)	23 (92)	45 (90)

Physical activity may also contribute to an increase in bone mass or density (Karlson 2004). Data on activity pattern shows that 60 per cent females and 40 per cent males were leading sedentary life style. Lau et al. (2001) reported that Asian women who migrate to urban areas and change their lifestyles from more agrarian to less active one also have increased risk of hip fractures.

Enquiry about food habits revealed that 56 per cent subjects were vegetarian, 38 per cent

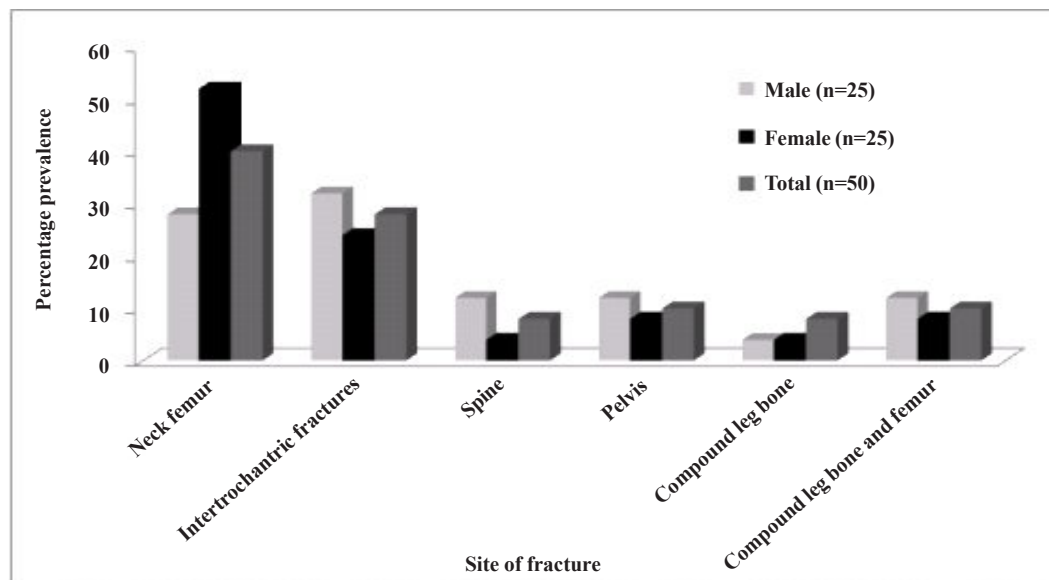


Fig. 1. Percent distribution of subjects as per site of fracture

were consuming non- vegetarian foods while 6 per cent were ovo- vegetarian. Frequency of smoking and consumption of tobacco, alcohol and betel leaves were more among male than female counterparts. Cigarette smoking is one of the risk factor for osteoporosis. Beck and Shoemaker (2000) reported that cigarette smoking negatively affects bone by decreased production and increased degradation of circulating estrogen and by decreasing dietary calcium absorption. Similarly alcohol directly impedes osteoblastic function and may also increase osteoclastic activities. In case of female subjects, mean age of menopause was 47.5 ± 6.36 years and it corresponded with Sharma et al. (2007).

The site of fracture of the subjects is presented in Figure 1. It was found that fracture neck femur was most common (40%) followed by intertrochantric fractures (28%). On comparing the two sex groups, it was found that fracture neck femur was more common among females (52%) while in case of males, intertrochantric fractures (32%) were more prevalent.

Dietary Intake

The information gathered through dietary history revealed that prior to the diagnosis of disease, dietary pattern varied with the residential status. The diet of all the subjects was found

to be inadequate in milk, fruits and vegetables. Cereal was predominant in their diet. Urban subjects included more varieties in their diet along with more number of meals. The consumption of vegetables was affected by the seasonal availability and cost among rural subjects.

Dietary survey conducted during study period (Fig. 2) revealed that as compared to balanced diet (Pasricha and Thimmayamma 1992) mean intake of cereals, pulses, roots and tubers, other vegetables, fruits, milk and milk products, sugar and jaggery was low while that of green leafy vegetables was found satisfactory in both male and female subjects. This may be due to the fact that after admission in the hospital for treatment they were advised by the doctors for inclusion of milk, fruits and green vegetables in their diet. Milk and fruits being costlier were not affordable by majority of the rural subjects whereas green leafy vegetables being cheaper were included in the diets. The intake of fats and oils was found to be adequate only in case of male subjects.

Nutrient Adequacy

The mean intake of protein was 48.97 ± 0.89 g/d and 37.86 ± 0.80 g/d in males and females respectively (Table 2) which represented 75 per cent of the suggested values. Deepti et al. (2006)

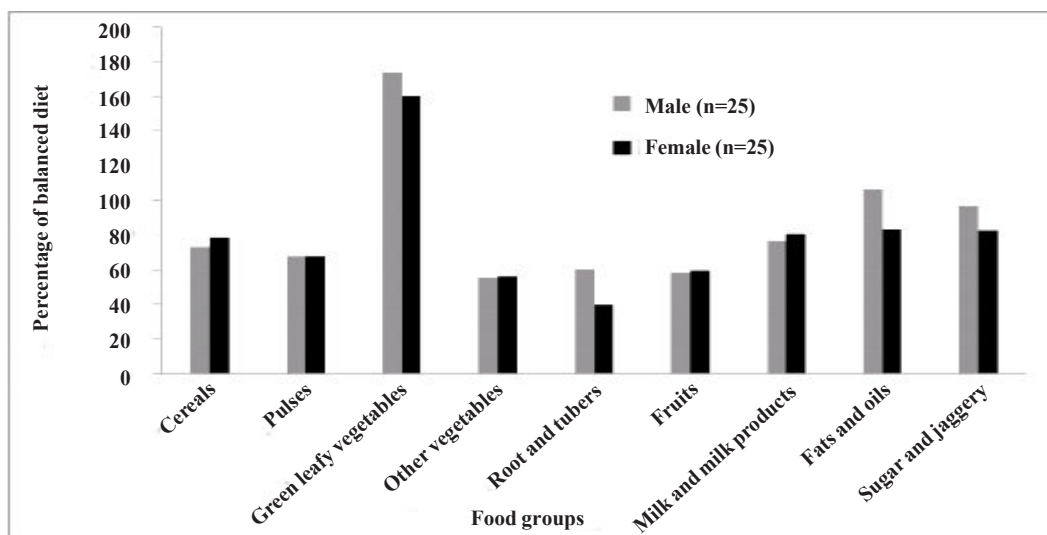


Fig. 2. Percent food intake of osteoporotic male and female subjects

also reported that mean consumption of protein in osteoporotic women was 81.5 per cent of the protein requirement.

In the present study, the mean intake of calcium by males was 688.26 ± 29.58 mg/d which was 68.82 per cent of the suggested value. In case of females it was 663.49 ± 31.91 mg/d indicating 73.72 per cent of the suggested intake. This corroborates with previous findings, such as the one by Lee et al. (2007) who reported that male patients had a mean daily calcium intake of 599 mg/d and female patients had a mean daily calcium intake of 665 mg/d. In comparison to male subjects, percentage intake of calcium was slightly higher among female osteoporotic patients which indicated that among females, factors other than diet may also play an important role in the development of osteoporosis.

Similarly, though the patients of both the sexes had insufficient intake (Table 2) of ascorbic acid, females showed better picture (15.55 ± 2.93 mg/d by males and 24.84 ± 4.74 mg/d by females). In view of the recommended

quantity (ICMR 2010) it represents only 38.87 per cent and 62.1 per cent respectively. The major reason for these inadequacies might be due to the fact that the consumption of vitamin C rich foods was very less.

Nutritional and Biochemical Profile of Selected Subjects

Plasma ascorbic acid estimation is an important indicator for osteoporosis. Mean intake of ascorbic acid by the males was 14.33 ± 4.03 mg/d and in case of the females it was 27.93 ± 6.64 mg/d and mean serum ascorbic acid level were 0.39 ± 0.07 mg/dl and 0.60 ± 0.06 mg/dl respectively (Table 3). This shows that plasma level of ascorbic acid increased with increasing intake. It was also found that the plasma ascorbic acid level of female subjects was much higher in comparison to their male counterparts. In order to find out the correlation between the intake and plasma level of ascorbic acid of the subjects, the data were statistically analyzed and results indicate that intake of ascorbic acid was

Table 2: Mean nutrient intake of osteoporotic male and female subjects

Nutrients	Male (n=25)	SNI*	Intake as % of SNI	Female (n=25)	SNI*	Intake as % of SNI
*Protein (g)	48.97± 0.89	65	75.35	37.86± 0.80	50	75.72
*Calcium (mg)	688.26±29.58	1000	68.82	663.49±31.91	900	73.72
**Ascorbic acid (mg)	15.55± 2.93	40	38.87	24.84± 4.74	40	62.1

Values are Mean±SE *Suggested Nutrient Intake by Pasricha 1992, **ICMR 2010.

significantly correlated (1 per cent level) to the plasma ascorbic acid level in both the male ($r=0.81$) and female ($r=0.87$) subjects.

Table 3: Mean ascorbic acid intake and plasma levels of osteoporotic male and female subjects

Details	Male (n=15)	Female (n=15)
Ascorbic acid intake (mg/d)	14.33±4.03	27.93±6.64
Plasma ascorbic acid level (mg/dl)	0.39±0.07	0.60±0.06
Correlation value (r)	0.81**	0.87**

** = Highly significant

In the present study, classification of plasma ascorbic acid level of selected osteoporotic subjects based on recommendations of Goodhart and Shills (1980) revealed that 26.7 per cent of subjects were well nourished, about 43 per cent had adequate level of ascorbic acid and 30 per cent were under the category of having low level (Table 4). About half of the male subjects (53.3%) had low plasma level of ascorbic acid whereas in case of female subjects only 6.7 per cent had low level. Studies conducted in different parts of the country revealed that the prevalence of vitamin C deficiency was 73.9 per cent and 45.7 per cent in North and South India respectively (Ravilla et al. 2011). It was also reported that only 10 per cent of those in the North and a quarter of those in the South met the criteria for adequate levels.

Table 4: Percentage distribution of male and female osteoporotic subjects by the plasma ascorbic acid level

Details	Male (n=15)	Female (n=15)	Total (n=30)
Well nourished (0.60 mg/dl)	2 (13.3)	6 (40.0)	8 (26.7)
Adequate (0.40-0.50 mg/dl)	5 (33.3)	8 (53.3)	13 (43.3)
Low (0.10-0.39 mg/dl)	8 (53.3)	1 (6.7)	9 (30.0)
Deficient (Below 0.10 mg/dl)	0	0	0

Values in parentheses indicate percentage of subjects
n = Number of subjects

CONCLUSION

Osteoporosis is one of the major public health problems among elderly population and therefore cannot be neglected. The present study of subjects having osteoporotic fractures showed that consumption of protein, calcium and vitamin C was low in both male and female sub-

jects. Significant positive correlation was found between the ascorbic acid intake and plasma ascorbic acid level among the osteoporotic subjects. Furthermore, the study reveals that osteoporosis is a multi-factorial disease and various factors including sex, lifestyle and dietary inadequacy might play an important role in development of this disease.

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