Research Paper

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Association of Bone Mineral Density with Age, Body Mass Index And Diet : An Observational Study in a Health Camp of Guwahati, Assam, India

Medical Science

KEYWORDS : Bone Mineral Density, Body mass index, age, diet.

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ABSTRACT

Background- The purpose of this study was to investigate the incidences of osteopenia and osteoporosis and their relation with BMI, age and diet.

Method- A cross-sectional study was conducted in 100 healthy women of Guwahati city aged 25-70 years. BMD was measured by peripheral dual X- ray absorptiometry (DEXA) scan. Body mass index of the individuals were calculated and results were analyzed.

Result- The result of this analysis showed that the association of BMI with BMD is highly significant ($p < 0.0003$). On comparing age groups, women after the age of 60 years had more incidence of osteopenia and osteoporosis and it was found that the age and BMD association is significant with $p < 0.001$. It is also seen that vegetarians tend to have low BMD.

Conclusion- Result of the study highlights that advancing age , lower BMI and vegetarian diet increases the risk for osteoporosis.

INTRODUCTION

Osteoporosis and obesity are two public health problems that are growing worldwide. Osteoporosis does not have a dramatic clinical presentation except when fractures result. It is therefore, called a 'silent epidemic [1-4]. Bone is normally mineralized but there may be deficient in quantity, quality and structural integrity of bone. Bone mineral density (BMD) test measures the density of minerals present in the bones using a special scan. This can be used to assess the strength of bones. [5]

There are many factors influencing bone mineral density which include heredity, age, gender, weight, body length, smoking, calcium intake, caffeine, alcohol etc. Among them, body weight and body mass index (BMI) are considered as strong predictors of osteoporotic fractures [6]. Several studies have shown that body weight or body mass index is positively correlated with bone mineral density (BMD) .Overweight and obesity have been considered protective to bone health, while higher BMI levels to be associated with higher BMD score [7-12].

Bones naturally become thinner as we grow older as existing bone broken down faster than the new bone formed. As a result of this, calcium and other minerals decrease in the bones and they become light in weight, less dense, and more fragile. The bones might break if it goes thinner and weaker. Osteoporotic fractures are among the main concerns of elderly population. Body weight or BMI has been found to be inversely related to the risk of osteoporotic fracture [13,14]. Some studies shows that people who take mixed diet have less chance of osteopenia and osteoporosis than who take vegetarian diet as mix diet contain more calcium. Thus, the role of obesity and age as risk factors for low BMD, osteoporosis, and its related fractures remains unsettled. In this study, we have tried to find the incidences of osteopenia and osteoporosis and their relation with age,body mass index and dietary habit.

MATERIALS AND METHODS

Present study is a cross- sectional, observational study which included 100 healthy women between the age group of 25 -70 yrs, who attended a Bone Mineral Density (BMD) camp in the periphery of Guwahati, Assam , India.

Inclusion criteria:- The participating women were non smokers and non alcoholics who were screened with a careful history taking and a written questionnaire. All the cases in our study had voluntarily opted for the test and study.

Exclusion criteria:- Women with history of taking oral contraceptive pill or any drugs which affect BMD were excluded. Also subjects having conditions like malignant tumours, thyroid and parathyroid disorders, autoimmune diseases, haematological diseases and malabsorption syndromes were excluded.

BMD was calculated using the peripheral DEXA (Dual energy X ray Absorptiometry) scan. Distal radius was selected as the site for the scan. Three readings were taken and the average was taken. The results were expressed as T- score which means the number of standard deviations from the mean of normal young adults. The result of BMD is expressed as follows :- [15]

T score ≥ -1.0 : normal
-2.5 < T score < -1.0 : osteopenic
T score ≤ -2.5 : osteoporosis

Body Mass Index (BMI) was calculated using the formula WEIGHT(kg)/ [HEIGHT](metre)^2. The study population was divided into 3 categories according to their BMI. :- i) normal when BMI is between 18.5-24.9 , ii) overweight when BMI is in the range 25- 29.9, iii) obese when BMI ≥ 30.[16]

Also the subjects were divided into 2 broad categories depending on their food habit :-

i)Vegetarian , ii) Non –vegetarian

The statistical analysis was done using Chi Square test. *P≤ 0.05* was considered to be statistically significant.

RESULTS:-

The study population consisted of 100 healthy women between the age group of 25- 70 yrs . A detailed description of the variables along with the distribution of subjects is given in table 1.

TABLE 1 :- Distribution of subjects according to age , BMI and diet

Variable	Group	Number of subjects	Percentage
Age	25-39yrs 40-59 yrs 60+ yrs	25 60 15	25 60 15
BMI	normal Overweight Obese	20 36 44	20 36 44
Diet	vegetarian Non-vegetarian	38 62	38 62

The results of the peripheral DEXA scan showed that 36% had normal T score, 34 % were osteopenic and 30% were osteoporotic. Of the normal BMI individuals 40% are osteopenic and 45% are osteoporotic. In the overweight category the normal, osteopenic and osteoporotic percentage are 22.2%, 38.9% and 38.9% respectively. However in the obese category it has been seen that 56.8% of the women have normal T score , 27.3% are osteopenic and only 15.9% are osteoporotic. In our study none of the subjects in the age group of 25-39 yrs had osteoporosis whereas the maximum number of osteoporotic cases was seen in the age group of 60+yrs (60%). Of the subjects taking vegetarian food 18.4% had normal BMD and 50% had the T score of osteoporosis. In the non vegetarian category 46.7% subjects had normal BMD and only 17.8% were osteoporotic. The details of the p-DEXA scan is given in table 2.

TABLE 2 :- Distribution of bone mineral density according to the variables

Variables	Bone Mineral Density						
	Normal		osteopenic		osteoporosis		
	No.	%	No.	%	No.	%	Total
AGE 25-39yrs	15	60	10	40	-	-	25
40-59 yrs	19	31.6	20	33.3	21	35.1	60
60 + yrs	2	13.3	4	26.7	9	60	15
BMI normal	3	15	8	40	9	45	20
Overweight	8	22.2	14	38.9	14	38.9	36
Obese	25	56.8	12	27.3	7	15.9	44
DIET vegetarian	3	7.9	13	34.2	22	57.9	38
Non-vegetarian	33	53.2	21	33.9	8	12.9	62
TOTAL	36		34		30		100

To see the association between the different independent variables and BMD the study group has been divided into normal and low bone mineral density according to the p-DEXA scan results in table 3.There were 36 subjects with normal BMD and 64% with low BMD. BMD was low in 85% with normal BMI, 77.8% among overweight and 43.2% among the obese group. The association between BMD and BMI is found to be statistically significant(p< 0.0003). In the age category 40% 0f 25-39 yrs age group, 68.3% of 40-59yrs age group and 86.7% of 60+yrs age group had low BMD.There was a statistically significant association between age and BMI (p< 0.001). The subjects taking vegetarian diet showed that 92.1% had low BMD. Of the non vegetarian subjects 53.2% had normal BMD and 46.8% had low BMD.

Table 3 :- Association of BMD with the different variables

Variables	Bone Mineral Density					
	Normal		Low			
	No.	%	No.	%	Total	p value
AGE 25-39yrs	15	60	10	40	25	P<0.001
40-59 yrs	19	31.7	41	68.3	60	
60 + yrs	2	13.3	13	86.7	15	
BMI normal	3	15	17	85	20	P < 0.0003
Overweight	8	22.2	28	77.8	36	
obese	25	56.8	19	43.2	44	
DIET vegetarian	3	7.9	35	92.1	38	P< 0.0001
Non-vegetarian	33	53.2	29	46.8	62	
TOTAL	36		64		100	

DISCUSSION:-

Osteoporosis is a major public health problem all over the world. As the life expectancy is increasing even in the developing countries, by the year 2035, the maximum number of osteoporosis cases in the world will be in India and China[17]. In our study all the variables, viz, BMI, age and diet were associated with BMD. Obese women had a decreased risk of osteoporosis as compared to the normal BMI women. With the advancing age , the risk of osteoporosis has increased. Also in our study we have found that diet plays an important role and vegetarian women were more prone to osteoporosis. These results are consistent with most previous studies.

In case of women, with the increase in age starting from her fourth decade , there is a gradual loss of BMD. This is in support of our study where we have found that there is no osteoporotic woman between the age group of 25-39. But with the increasing age the osteoporotic population has increased from 35% to 60% in the age group of 40-59 yrs and 60+yrs respectively. The previous studies of Baheiraei et al.,[18] and Nguyen et al.[19] indicated that advancing age was associated with low BMD.

In the study only 15.9% of obese women had osteoporosis whereas 45% of normal BMI had osteoporosis. Similar study by Felson et al. [20] also reported the consistent finding that lower BMI was associated with lower BMD.

In our study 92% of vegetarian have a low BMD whereas only 46.8% of non-vegetarian have low BMD. This is so because vegetarian diet has a lower calcium content.[21]

In conclusion our study indicates that advancing age, lower BMI and vegetarian diet are important risk factors for low BMD. The use of central DEXA scan is more favourable and accurate in determination of bone mineral density. Further studies are required to understand the effect of other factors like gender, exercise, calcium intake and other personal habits like smoking and drinking on BMD. Also more detailed study into the role of adipose tissue on BMD is desired.

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