Original Article

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Effect of Body Mass Index on Bone Mineral Density in Obese Person

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Abstract

The present study was done in the dept. of Anatomy with collaboration of dept.of Orthopedics The aim of study was to compare the effect body mass index on bone mineral density in obese persons.

- Obesity is condition of excvssive body fat that causes several public health problems Body mass index is calculated by height and weight

Body Mass Index = *Weight in Kg/Height in M*^{2}

- Obesity and osteoporosis are two common complex diseases with multifactorial etiology. Strong positive association between body mass index and bone mineral density is well defined in postmenopausal women but not in men. (Tooth e et al 2005)
- The present study was conducted on 200 subjects of age above 20 years. The weight and height of each subject was measured with the help of weighing machine and body mass index was calculated by above formula Bone mineral density was obtained with ultra sonographic bone densitometer. The distal end of radius and mid shaft of tibia were the sites used for measuring B.M. D.

The present study concluded that there is no co- relation between body mass index and bone mineral density and it is statistically significant.

Keywords: Body Mass Index; Bone Mineral Density.

Introduction

Obesity and osteoporosis are two common complex diseases. Both having multifactorial etiologies, including genetic, environmental components with potential interaction between them.

Body mass index is widely used as an index of degree of obesity, primarily as it is easy to measure. Body mass index is calculated by height and weight,height in meters and weight in kilograms [1].

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BMI = weight in kilograms / height in meter^2.

Obesity is defined as body mass index >24 and is categorized as mild, moderate and severe as follows.

Body mass index >25 - mild,
>30 - moderate ,
>35 - severe

Extensive epidemiological data shows that high body weight or BMI is correlated with high bone mass and reduction in weight may cause reduction in bone mass [2].

Toth E. et al. reported that ,there is association between body mass index and bone mineral density and this is observed in postmenopausal women but not in men [2].

Bone density is highly correlated with bone strength and fracture risk .A 1 standard deviation decrease in BMD is associated with 1.5 to 3 times increase in risk of future fracture depending on site of measurement.

Bone mineral density is measured by various techniques. The choice of technique to use in measuring bone density is based on availability ,cost, accuracy,precision diagnostic sensitivity and experience with various methods [3].

The World Health Organization standards for characterizing patients as normal (with 1sd of peak bone mass),osteopinea (1to 2.5sd below peak bone mass)and osteoporotic >2.5sd below peak bone mass are based on central DXA measurements [3].

Detailed quantitative knowledge about bone mineral density in obese people is necessary for prediction of fracture risk. Hence this study was undertaken to investigate if there is any association or effect of body mass index on bone mineral density in obese patients [4].

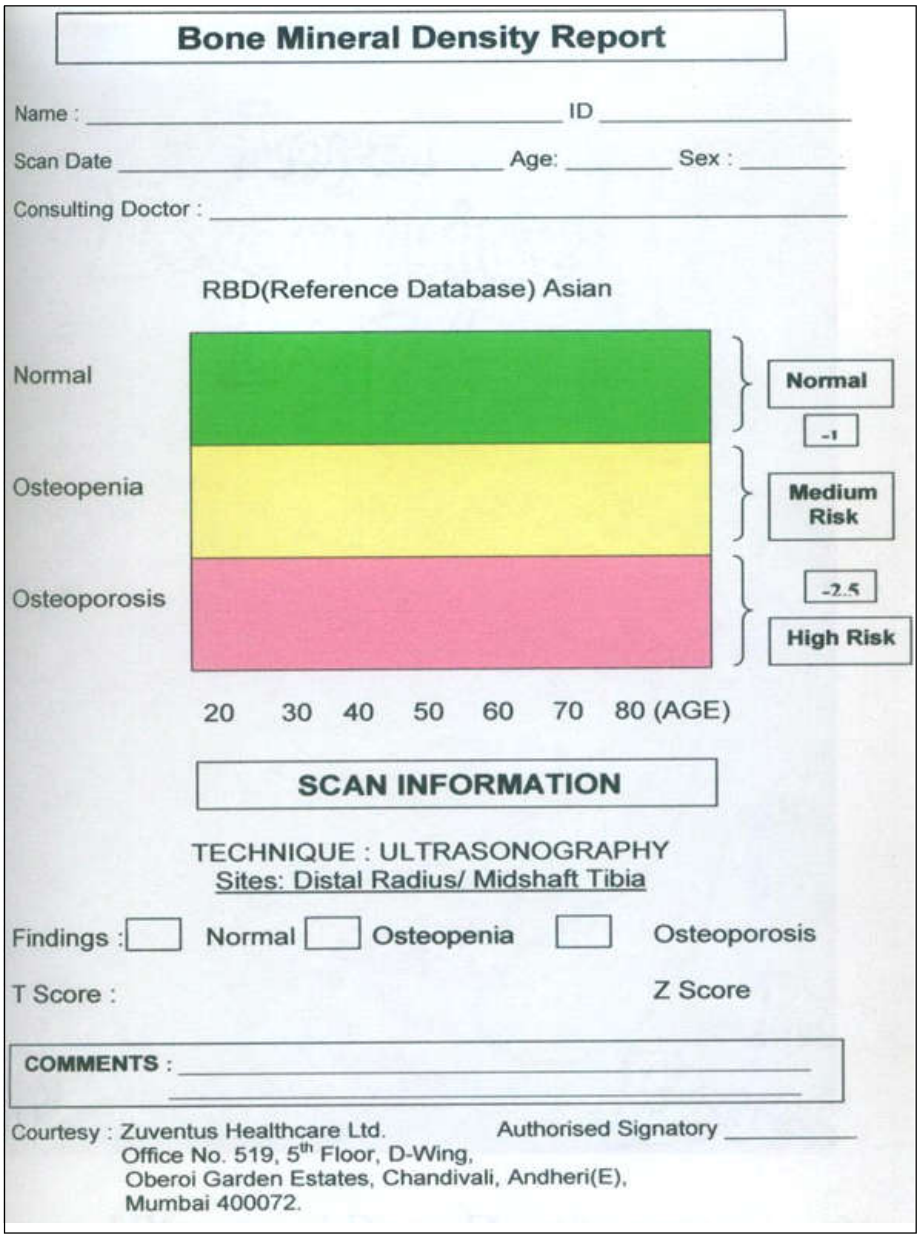
Material and Methods

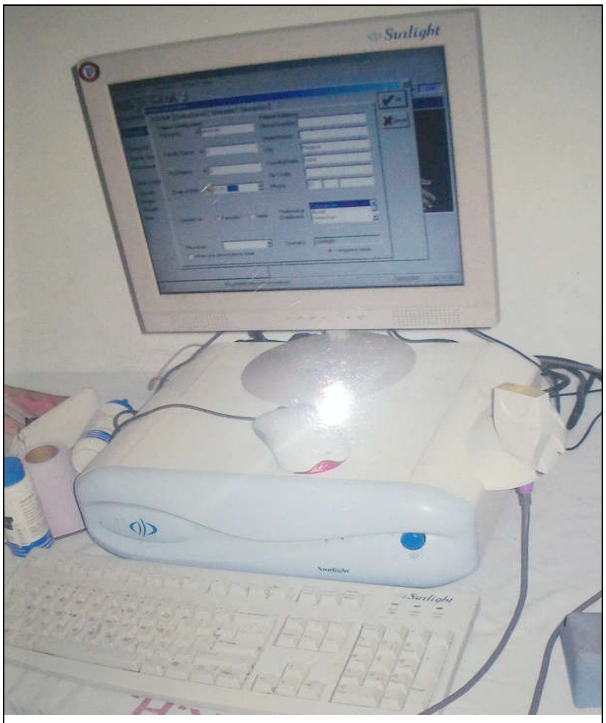
The study was designed to include normal weight and over weight subjects of both sexes, 100 each, total 200. The weight and height of each subject was measured with the help of weighing machine and measuring device.

Body Mass Index was obtained from formula.

BMI =weight in kg/height in m^2

Bone Mineral Density of each subject was obtained from ultrasonographic Bone Densitometer





Ultrasound Bone Densitometer

The distal radius or midshaft of Tibia were the sites for measuring Bone Mineral Density.

Observations

On screening wide range of literature regarding fracture risk it was found that measurement at any site with any of the different types of densitometry equipment provide information about fracture risk. Low bone densities of single site is still an indicator of increased risk of fracture even though other sites are normal [5].

The T-score compares patients bone density to that person who is 30 years old. This age was chosen since it is the time when you attain your peak bone mass. The scores are reported as standard deviation above or below peak bone mass .one standard deviation below is approximately equal to 10 to 15 percent decrease in bone density. The t score is given positive and negative number where a negative number represent the bone loss [6].

T- score interpretation	
Above = -1	Normal Bone Mass
Between= -1 and -2.5	Osteopinea (low Bone Mass)
Below = -2.5	Osteoporosis

Table 1: Distribution of subjects as per BMI

Group	Body Mass Index	Male	Female	Total	Percentage
Non obese	Normal (up to 24)	60	55	115	57.50
Obese	Mild (25-30)	25	28	53	26.50
	Moderate(31-35)	10	9	19	9.50
	Severe(>35)	5	8	13	6.50
	Total	100	100	200	100.00
	Z-Test		1.13		
	P-Value		0.006		
	Significance		Significant, p<0.05		

This table shows significant p value on distribution of subjects according body mass index.

Table 2: Correlation of BMI & Age

Age Groups	Non Obese Group Normal(upto 24)		Obese Group Mild (25-30)		Moderate (31-35)		Severe (>35)	
	Male	Female	Male	Female	Male	Female	Male	Female
21-30	11	25	6	4	4	0	0	0
31-41	11	12	8	13	1	2	1	2
>40	38	18	15	14	3	4	2	6
Total	60	55	29	31	8	6	3	8
X^2 – test	12.44		1.56		4.27		0.07	
P- Value	0.002		0.45		0.11		0.78	
Significance	Significant P<0.05		NS P>0.05		NS P>0.05		NS P>0.05	

This table shows comparison of subjects according body mass index and age.

Table 3: Sexwise distribution of BMD

Sex	Bone Mineral Density					
	Normal		Osteopenia		Osteoporosis	
	Non Obese	Obese	Non Obese	Obese	Non Obese	Obese
Male	20	18	20	14	20	8
Female	15	20	15	15	25	10
Total	35	38	35	29	45	18
Fishers Exact Test	0.48		0.61		1.00	
P-Value	NS, p>0.05		NS, p>0.05		NS, p>0.05	

This table shows sex wise. distribution of bone mineral density, with no significant p value

Table 4: Correlation of BMI &BMD

Group	Body Mass Index	Bone Mineral Density					
		Normal		Osteopenia		Osteoporosis	
		Male	Female	Male	Female	Male	Female
Non obese	Normal (up to 24)	20	15	20	15	20	25
Obese	Mild(25-30)	10	14	9	10	5	4
	Moderate(31-35)	4	3	5	2	2	4
	Severe(>35)	4	3	0	3	1	2
	Total	38	35	34	30	28	35
	X^2-test	16.55, p-value=0.01, Significant, p<0.05					

This table shows correlation of body mass index and bone mineral density, with significant p value

The results are given in numerical form and require physician interpretation. The results are given as to different scores the T-score and Z-score [6].

Discussion

Detailed quantitative knowledge about the effect of age and bone density on absolute risk of fracture is necessary to evaluate the potential benefit of interventions aimed exclusively at bone density .The association of low bone mass with an increased risk of hip fracture is well documented [7].

In our present study there is no correlation found between body mass index and bone mineral density.

Coin A.et al (2000) [8] reported the underweight state in the elderly is associated with malnutrition and osteoporosis, besides body composition changes ,such as protein deficiency could be involved in association between underweight and osteoporosis. In present study these factors were not include.

In the present study 30.43% subjects were having normal BMD, and 30.43% were having osteopenia and 39.13% were having osteoporosis. Whereas 44% subjects of obese group were having normal BMD, 34.11% subjects were having osteopenia and 21.17% subjects were having osteoporosis in correlates these obsarvations to Lan juan et al (2006) [1] reported that high body mass index may not have any effect on bone mineral density.

According to ICMR bulletin (1-4, april 2005) women with decreased bone density usually have no complaints or specific abnormal physical findings. Our findings correlate with their findings..

Tooth et al (2005) [9] found strong positive association between body mass index and bone mineral density in post menopausal females but not in males, in our study no such correlation was found in the subjects of either sex belonging to this age group. Felson D.T. (1993) reported the effect of weight and of weight change on bone mineral density was in general much less in males than in females. The strong effect of weight on bone mineral density is due to load on weight bearing bones in both sexes. In our study there is no such correlation of body mass index and bone mineral density of non obese as well as obese males and females.

In present study the maximum number of subjects i.e. 44% of age group 21-30 years where having normal BMD. Maximum no of subjects 97% of age group 40 and above where having osteopenia and osteoporosis . This results of our study correlate with the study of Stephan et al (1997) [10] who reported measurements at distal radius BMD strongly influenced by age.

Edelstein S.L., et al (1993) [11] suggested that bone mineral density was measured at midshaft and distal radius with a single photon absorptiometry in their study, all measures of body size were associated with BMD in both sexes and were better markers of bone mineral density in weight bearing site than in non weight bearing site implying a mechanical effect of weight on bone mineral density.

In present study the bone mineral density was measured at distal radius and tibia by ultrasonographic bone densitometer and there is no difference in bone mineral density of radius and midshaft tibia.

Kofi Asomaning et al (2006) [12] reported that women with low body mass index are at increased risk of osteoporosis. To help reduce the risk of osteoporosis, patient should be advice to maintain normal weight. In present study there was no such correlation of body mass index and bone mineral density was found on the contrary there was reverse correlation of body mass index and bone mineral density and subjects with low body mass index were not included in our study.

Conclusion

Bone density measurements are done in order to determine if low bone mass,to predict risk of future fracture, to determine which subject may need drug therapy.

As per our observation bone density testing should be recommended to all women and men above age group of 40years and for younger subjects who have clinical risk factors irrespective of obesity. Bone density measurement being very simple, noninvasive method, can be used for mass screening population at a large scale.

The present study concluded that there is no correlation of body mass index and bone mineral density and it is statistically significant.

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