Original Research Paper Medical Science

A STUDY ON CORRELATION BETWEEN BODY WEIGHT, BODY MASS INDEX AND BONE MINERAL DENSITY

Dr.Thasneen K Ahammed Junior Resident, Dept. of PMR, Govt. Medical College, Thiruvananthapuram.

Dr.Selvan.P Assistant Professor, Dept. of PMR, Govt. Medical College, Thiruvananthapuram.

Dr.Abdul Gafoor.S Professor and HOD, Dept. of PMR, Govt. Medical College, Thiruvananthapuram.

ABSTRACT Obesity and osteoporosis are the emerging public health concerns both in the developing and developed nations. Many a studies have been considering body mass index (BMI) as its core axis on which the study revolves around. Studies with focus on weight, BMI and Bone mineral density (BMD) is a rarity. In our study we envisages our parameters on weight, BMI in particular & BMD.

A cross sectional study was conducted among patients attended BMD camps in Dept. of PMR, Govt. Medical College, Thiruvananthapuram. Participants were categorized to underweight, normal, overweight and obese taking into consideration, the body weight and the body mass index and was contrasted with their respective BMD. The results demonstrated that the BMI was found to be in direct relation with BMD status of the individual in the study population. Osteoporosis is seen more in underweight people than among overweight persons

KEYWORDS : Body weight, Body Mass Index, Bone mineral density.

INTRODUCTION

Obesity and osteoporosis are two important and growing public health problems worldwide , and osteoporotic fractures are among the main concerns of elderly population. Low bone mineral density (BMD) is a major risk factor for osteoporosis and its related fractures . Relationship between body mass index (BMI), weight, height, and BMD was reported for many populations . Body weight or BMI has been found to be inversely related to the risk of osteoporotic fracture . BMD appears to be reduced in lean postmenopausal women in most but not all studies; in some studies BMD was reduced, whereas in other studies BMD was increased. Thus, the role of obesity as a risk factor for low BMD, osteoporosis, and its related fractures remains unsettled. While there have been abundant epidemiological studies in general, few studies have examined the relationship between BMI, weight, and BMD in south Indian population. However, from clinical and public health point of view, it is important to clarify the role of BMI and weight in association with BMD. Our study contributes to this issue by examining the relationship between BMI, weight, and BMD, among patients who attended BMD camps, ultrasound densitometry measurement in PMR OPD, Medical College, Thiruvananthapuram. Our hypothesis is that BMI and weight contribute to the etiology of low BMD.

OBJECTIVE

— To find the correlation between Body Mass Index and Bone Mineral Density among the patients attending BMD camps conducted in PMR OPD, Govt.Medical College, Thiruvananthapuram.

METHODOLOGY

— STUDY DESIGN

Hospital based Cross Sectional study

— STUDY SETTING

Bone Mineral Density camps conducted in PMR OPD, Govt. Medical College, Thiruvananthapuram

STUDY SUBJECTS

INCLUSION CRITERIA :

- Those patients above the age of 20

EXCLUSION CRITERIA :

Patient with known case of osteoporosis or on treatment for osteoporosis

Those patients with metabolic disorder / history of fractures / prolonged immobilization / serious illnesses etc

SAMPLING METHOD

— Randomly selected 50 patients among those who underwent BMD measurement in the camp conducted in PMR OPD, based on inclusion and exclusion criteria.

DATA COLLECTION

— Pre tested structured questionnaire
— Details of patients collected, weight and height measured. BMI calculated.
— Calcaneal bone mineral density is measured using hologic sahara bone sonometer. Diagnosis of osteoporosis/osteopenia was done according to T- Score values.
— Upto -1.1 is normal,
— b/w -1.1 &-2.4 is osteopenia,
— -2.5 or more is osteoporotic

DATA ANALYSIS

— Data entered into excel sheet
— Chi square test and pearson correlation method are used for analysis

OBSERVATIONS

Table No.1

Age in years	T- SCORE						Total	
	< -1.1		-1.1 to -2.4		≥ -2.5			
	N	%	N	%	N	%	N	%
20-29	10	45.5	2	9.1	0	0.0	12	24.0
30-39	4	18.2	3	13.6	0	0.0	7	14.0
40-49	6	27.3	9	40.9	2	33.3	17	34.0
50-59	2	9.1	4	18.2	0	0.0	6	12.0
60-69	0	0.0	4	18.2	2	33.3	6	12.0
70-79	0	0.0	0	0.0	2	33.3	2	4.0
Total	22	100.0	22	100.0	6	100.0	50	100.0

$\chi^2 = 31.275 df = 10 p = 0.00$

Table No.2

Gender	T-SCORE						Total	
	< -1.1		-1.1 to -2.4		≥ -2.5			
	N	%	N	%	N	%	N	%
Male	11	50.0	4	18.2	2	33.3	17	34.0
Female	11	50.0	18	81.8	4	66.7	33	66.0
Total	22	100.0	22	100.0	6	100.0	50	100.0

$\chi^2 = 4.964 df = 2 p = 0.01$

Table No.3

Weight in Kg	T- SCORE						Total	
	< -1.1		-1.1 to -2.4		≥ -2.5			
	N	%	N	%	N	%	N	%
30-39	0	0.0	2	9.1	2	33.3	4	8.0
40-49	0	0.0	4	18.2	2	33.3	6	12.0
50-59	2	9.1	8	36.4	0	0.0	10	20.0
60-69	4	18.2	2	9.1	0	0.0	6	12.0
70-79	12	54.5	4	18.2	2	33.3	18	36.0
≥ 80	4	18.2	2	9.1	0	0.0	6	12.0
Total	22	100.0	22	100.0	6	100.0	50	100.0

χ^2=24.882df=10p=0.006

Table No.4

Height in cm	T- SCORE						Total	
	< -1.1		-1.1 to -2.4		≥ -2.5			
	N	%	N	%	N	%	N	%
<140	0	0.0	0	0.0	2	33.3	2	4.0
141-149	0	0.0	6	27.3	0	0.0	6	12.0
150-159	4	18.2	10	45.5	2	33.3	16	32.0
160-169	14	63.6	6	27.3	0	0.0	20	40.0
170-179	0	0.0	0	0.0	2	33.3	2	4.0
>180	4	18.2	0	0.0	0	0.0	4	8.0
Total	22	100.0	22	100.0	6	100.0	50	100.0

χ2 =50.985df=10p<0.001

Table No.5

BMI	T- SCORE						Total	
	< -1.1		-1.1 to -2.4		≥ -2.5			
	N	%	N	%	N	%	N	%
Under weight	0	0.0	2	9.1	4	66.7	6	12.0
Normality	8	36.4	10	45.5	0	0.0	18	36.0
Over weight	14	63.6	8	36.4	2	33.3	24	48.0
Obese	0	0.0	2	9.1	0	0.0	2	4.0
Total	22	100.0	22	100.0	6	100.0	50	100.0

χ2 =25.000df=6p<0.001

Table No.6

			T - SCORE		
		N	mean	sd	P
WEIGHT	30-39	4	-1.80	.94	.003
	40-49	6	-2.27	.61	
	50-59	10	-1.54	.47	
	60-69	6	-.75	.34	
	70-79	18	-.51	1.37	
	≥ 80	6	-.88	.53	
HEIGHT	<140	2	-2.50	.71	.001
	141-149	6	-1.87	.40	
	150-159	16	-1.53	.78	
	160-169	20	-.40	1.16	
	170-179	2	-1.95	.64	
	>180	4	-.63	.44	

Chart No.1

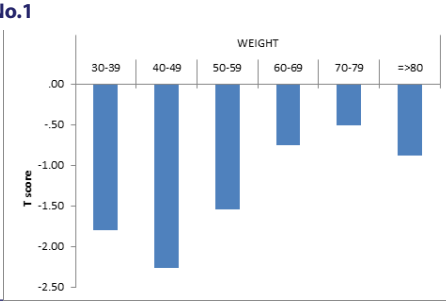


Chart No.2

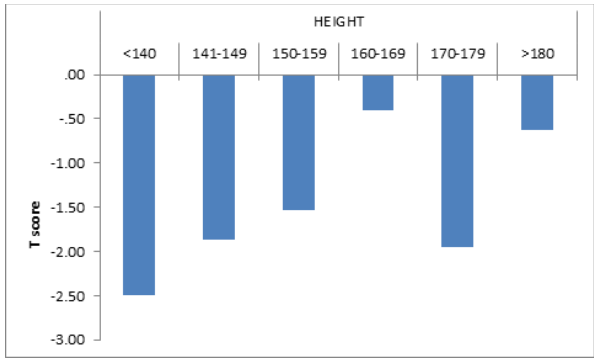
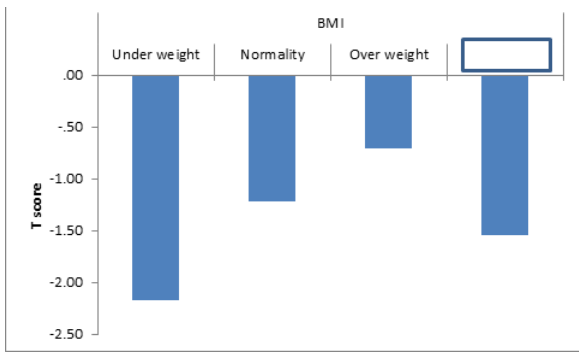


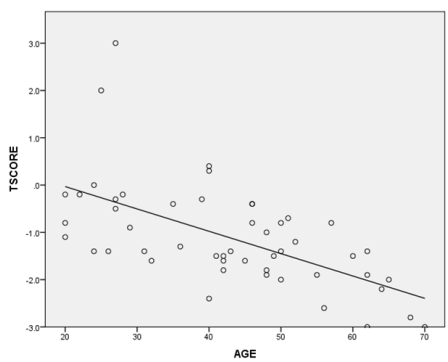
Table No.7

		T SCORE		
BMI	N	mean	sd	p
Under weight	6	-2.17	.92	.023
Normality	18	-1.22	.60	
Over weight	24	-.71	1.29	
Obese	2	-1.55	.07	

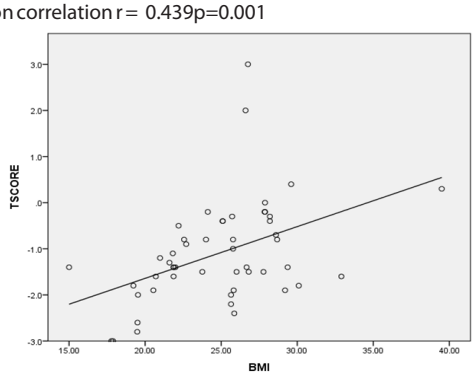
Chart No.3



Correlation between Age and T score
Pearson correlation r = - 0.598 p<0.001



Correlation between BMI and and T score
Pearson correlation r = 0.439p=0.001



RESULTS

- The study population was 50, out of which 33 were females age ranged from 20- 80 yrs
- In this study, 44% falls in normal range of BMD.(upto -1.1)
  44% in category of osteopenia.(-1.1 to -2.4)
  12% under osteoporosis.(≥ -2.5)
- As age increases BMD value is seen decreasing.
- Significant correlation is seen with weight, BMI and BMD. Lean body mass people are prone to develop osteoporosis when compared to overweight.
- Significant correlation of BMD with height is also noted in the study, BMD value shows less in short individual and found increasing in tall individuals.

DISCUSSION

- In a previous study conducted by Tarek Fawzy et al, BMD was low in 82.4% of people with normal BMI, 78.1% among overweight and 44.2% among obese. Age wise variation showed 33.3% in age group 25-39 yrs, 60.9% in 40-59 yrs of age and 88.2% of those aged 60yrs and above had low BMD.
- A hospital based study conducted in elderly males by paniagua et. al. found out that overweight and obese men were more likely to have osteoporosis and osteopenia.
- In this study, both BMI and weight were associated with BMD, and obesity significantly decreased the risk for osteoporosis in men. The relationship between BMD and weight was stronger than between BMI and BMD. These results are consistent with most previous studies, particularly in postmenopausal women, which indicated that lower BMI and weight were associated with lower BMD. Prospective studies found that the early postmenopausal women who have low BMI lose more bones compared to those with higher BMI tertiles . In other cross-sectional studies, however, thinness is related to both osteoporosis and increased fracture risk . Iqbal et al. found that low BMI is a good indicator for referral of women less than 60 years old for measurements of BMD. Similar studies also reported a consistent finding that lower BMI was associated with lower BMD . In a study similar to ours, those with lower BMI were at higher risk of low BMD. The Studies of National Osteoporosis Foundation and others suggested that low BMI should be included in the risk assessment tools for evaluation of osteoporosis and osteoporotic fracture risk . In contrast to our study, Steinschneider et al. in a cross-sectional study reported that the correlation between BMD at the femoral neck and BMI was highly positive among postmenopausal women. A hospital-based study conducted in elderly men reported that overweight and obese men were more likely to have osteoporosis and osteopenia. The possible explanation for the discrepancies between these results might be related to populations, research designs, sampling methods, and methodological differences.
- The mechanisms whereby adipose tissue exerts positive effects on BMD status are not entirely clear. The putative mechanism relevance of adipose tissue for skeletal integrity probably resides in the role of several adipokines in bone remodeling through effect on both formation and resorption. Recently, bone has been considered an endocrine organ affecting body weight control and glucose homoeostasis through the actions of bone-derived factors such as osteocalcin and osteopontin. The putative crosstalk between fat and the skeleton constitutes a homoeostatic feedback system in which adipokines and molecules secreted by osteoblasts and osteoclasts represent the link of an active bone-adipose axis . Obesity is also associated with BMD because of the conversion of androgen to estrogen , which improves bone mass in both men and women and maintains healthy plasma levels of insulin and regulating factors including insulin-like growth factor-1, leptin, and adiponectin . In addition, obesity provides cushioning for the hip in the event of a fall . However, the mechanisms by which all these events occur remain unclear.
- Although this study had several findings relevant to the better understanding of the relationship between weight, BMI, and BMD , it has some limitations. One potential source of bias in the present study is residual confounding due to the risk factors that we were unable to account for in our analysis (socioeconomic status, educational level, level of physical activity, smoking, alcohol consumption, vitamin D status, sex hormone levels, and nutrition). Moreover, unknown confounders cannot be adjusted for. Thus, the observed decreased risk of osteoporosis associated with BMI may reflect confounding by these risk factors. The study was clinic-, rather than population-, based and so may not contain a clinical spectrum . Clinic-based estimates of the prevalence of low bone mass are most likely to be affected by referral patterns. Selection bias is less likely to affect associations between BMI, and BMD as investigated in this study. As a cross-sectional study, the present analysis is limited in its ability to elucidate causal relationships between weight, BMI and BMD

CONCLUSION

- The result of this study suggest that advancing age and lower BMI are important risk factor for the occurrence of low BMD. Therefore investigation for osteoporosis has to be done in suspected individual and thereby prevention of fractures by proper care and advice. However further studies are required to investigate the effect of other factors like exposure to sunlight, calcium intake, vitamin D supplementation and other habits like smoking, diet and so forth.

LIMITATION OF STUDY

- Smaller sample size.
- Specificity of ultrasound densitometry for calculation of BMD is less.
- Only calcaneal BMD is assessed in our study.
- This study does not taken into consideration factors like nutrition, calcium intake, vitamin D status, addictions, etc

REFERENCES

1. Relationship between weight,BMI and BMD in men…muhammed reza salamat et al,journal of osteoporosis,vol 2013,Article ID 205963.doi 10.1155/2013
2. Association between BMI and BMD in patients referred for DEXA scan in Ajman…tarek fawzy et al,journal of osteoporosis,vol 2011,article ID 876309,doi10.4061/2011
3. BMD of spine in normal japanese subjects using DEXA: effect of obesity and menopausal status..kokai kin et al,calcified tissue international,march 1991,doi 10.1007/BF02565129
4. J. Porthouse, Y. F. Birks, D. J. Torgerson, S. Cockayne, S. Puffer, and I. Watt, "Risk factors for fracture in a UK population: a prospective cohort study," QJM, vol. 97, no. 9, pp. 569–574, 2004.
5. N. H. Bjarnason and C. Christiansen, "The influence of thinness and smoking on bone loss and response to hormone replacement therapy in early postmenopausal women," Journal of Clinical Endocrinology and Metabolism, vol. 85, no. 2, pp. 590–596, 2000.
6. S. I. Iqbal, L. S. Mørch, M. Rosenzweig, and F. Dela, "The outcome of bone mineral density measurements on patients referred from general practice," Journal of Clinical Densitometry, vol. 8, no. 2, pp. 178–182, 2005.
7. D. J. M. van der Voort, S. Brandon, G. J. Dinant, and J. W. J. Van Wersch, "Screening for osteoporosis using easily obtainable biometrical data: diagnostic accuracy of measured, self-reported and recalled BMI, and related costs of bone mineral density measurements," Osteoporosis International, vol. 11, no. 3, pp. 233–239, 2000.
8. D. J. M. van der Voort, P. P. Geusens, and G. J. Dinant, "Risk factors for osteoporosis related to their outcome: fractures," Osteoporosis International, vol. 12, no. 8, pp. 630–638, 2001.