Int J Biol Med Res. 2012; 3(3): 1899-1901

BioMedSciDirect Publications

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International Journal of Biological & Medical Research

Journal homepage: www.biomedscidirect.com

Original Article

The Effect of Body Mass Index on Bone Mineral Density in preand post menopausal women of Western Rajasthan Population

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ARTICLE INFO

Keywords:
Body mass index (BMI)
Bone mineral density (BMD)
Osteoporosis
Waist circumference

ABSTRACT

Osteoporosis is a common disorder in the elderly population and presents one of the most significant public Health problems in the world, predisposing to fracture with minimal or no antecedent trauma. Bone mineral density (BMD) is the major measurable determinant of the risk for osteoporotic fractures. Several studies showed that the BMI and Body weight are associated with BMD. Aims & objective: The aim of present study was to find out the effect of body mass index on bone mineral density through anthropometric parameters. Material and method: The present study was performed on 100 women (50 pre and 50 post menopausal) 25 to 65 years age group. BMI, Waist circumference, Waist to hip ratio were measured. BMD was measured by clinical bone sonometer. Results: Observation showed a significant relationship between the BMI and BMD of underweight, normal and overweight pre and post menopausal women while it is non significant for the obese women of both groups.

1. Introduction

Osteoporosis is a systemic disorder characterized by decrease bone mass and micro architectural deterioration of bone tissue leading to bone Fragility and increased susceptibility to fracture [1]. Bone is a highly vascular mineralized connective tissue consisting of cells and dense intercellular organic matrix impregnated with inorganic salts. Bone mineral density (BMD) refers to the amount of mineral per unit of space or mass per volume of the bones. BMD decreases as people age, particularly for women. Bones naturally become thinner as people grow older because existing bone is broken down faster than the new bone made. 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. Therefore, thicker bones take longer time to get osteoporosis. Although osteoporosis can occur in men, it is most common in women older than 65 years of age [2]. Body mass index (BMI) or obesity index is a key index for relating a person's body weight to their height. In various past studies it was found that there was an association between body weight and BMI with BMD.

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The study done by Maghraoui AE et al, found that obese postmenopausal women had higher BMD than compared to normal and overweight postmenopausal women3. On the other hand Hafeez F et al obtained a statistically non significant relationship between BMI and BMD of pre and post menopausal women4. Fawzy T et al observed a statistically significant relationship between BMI and BMD [2]. It is seen that BMI is an important anthropometric parameter which affects the BMD in pre and postmenopausal women.

Thus, the primary object of this study is to delineate the influence of BMI on BMD in pre and postmenopausal women of Western Rajasthan Population.

2. Material and Methods

The present study was carried out in the Department of Orthopedics, Dr. S. N. Medical College and its associated group of hospitals, Jodhpur. A total of 100 female subjects between 25-65 years of age included for the study.

The subjects were divided into following 2 groups according to their menstrual history:

I. Pre-menopausal women: Women having normal menstrual cycle were included in this group.

II. Post-menopausal women: Women having more than 12 constitute months of amenorrhea were included in this group.

Above groups were further subdivided into following groups according to their BMI:

Table 1: Estimated Population of AMC in 2007

Group	BMI (Kg/m^2)
Underweigh	<18.5
Normal	18.5-24.99
Overweight	25-29.99
Obese	>30

[WHO, 2009]

Various anthropometric parameters were measured:

I.Body mass index(BMI) (Kg/m^2):

Weight calculated by weighing machine and height by measuring tape. BMI was calculated by following given by Garrow JS & Websler J, 1985.

BMI (kg/m^2) = Weight (kg)/ Height (m^2)

I.Waist circumference (WC) (cm):

WC was measured at most lateral contour of the abdomen by a measuring tape.

I.Waist to hip ratio (W/H):

Waist to hip ratio was calculated by dividing waist circumference by hip circumference.

Bone mineral density (BMD) (gm/cm^2):

BMD was recorded by the clinical bone Sonometer (Fig. no 1 & 2) with the help of an orthopedician. The BMD was recorded at the lower end of Tibia.

Arithmetic mean and standard deviation were calculated for all parameters studied.

3. Results and Discussion:

The following observations were performed:

Table No. 1 Shows mean Waist circumference in the four groups.

Group	Pre menopausal	Post menopausal	t value	p value
Underweigh	58.12±12.75	61.8±5.40	0.6044	0.5578 (NS)
Normal	79.13±4.22	79.08±10.00	0.01757	0.9861 (NS)
Overweight	85.29±7.99	93.86±11.66	2.45	0.0203 (S)
Obese	100.7±9.23	105.4±10.58	1.176	0.2502 (NS)

*NS=Non Significant
*S=Significant
*HS=Highly Significant

Table No. 2 Shows mean Waist to hip ratio in the four groups.

Group	Pre menopausal	Post menopausal	t value	p value
Underweigh	0.64 ±0.13	0.71 ±0.07	1.097	0.2962 (NS)
Normal	0.79 ±0.02	0.81 ±0.03	2.074	0.0485 (S)
Overweight	0.79 ±0.03	0.79 ±0.05	0	>0.9999 (NS)
Obese	0.85 ±0.02	0.89 ±0.04	6.325	<0.0001 (HS)

*NS=Non Significant
*S=Significant
*HS=Highly Significant

Table No. 3 Shows mean Bone mineral density in the four groups.

Group	Pre menopausal	Post menopausal	t value	p value
Underweigh	0.405 ±0.10	0.263 ±0.06	2.844	0.0160 (S)
Normal	0.500 ±0.04	0.397 ±0.07	4.814	<0.0001(HS)
Overweight	0.512 ±0.05	0.431 ±0.07	3.8	0.0007 (HS)
Obese	0.561 ±0.08	0.522 ±0.06	1.463	0.1555 (NS)

*NS=Non Significant
*S=Significant
*HS=Highly Significant

Osteoporosis is a common metabolic bone disorder in the elderly Population and presents one of the most significant Public Health problems in the world. Bone mineral density (BMD) is the major determinant of the risk for osteoporotic fracture [5]. Expert group peg the number of osteoporosis patients in India at approximately 26 million in 2003 with the number projected to increase 36 million by 2013.

BMD decreases with age particularly for women after menopause. The reason of bone loss after menopause is primarily estrogen deficiency. Estrogen inhibits the secretion of cytokines such as Interleukin-1 (IL-1), Interleukin-6 (IL-6) and Tumor necrosis factor (TNF) and these cytokines faster the development of osteoclasts. Estrogen also stimulates the apoptosis of osteoclasts this result in bone loss.

In several studies it was found that BMD was highly associated with BMI. There was an increase in BMD with an increase in BMI. Overweight may protect women against bone loss after menopause. This protective effect appears to be related to both mechanical support and increased estrogen synthesis in adipose tissue [6]. Thus, the BMI has an effect on BMD and BMI can be protective in bone loss by increasing the BMD. Therefore the present study was conducted on 100 females of various age group (25-65) comprising of 50 pre menopausal and 50 postmenopausal women.

In the present study there was a non significant relationship observed in Waist circumference of underweight, normal and obese females of both pre and post menopausal women while it was significant (t=2.45; p=0.02) for overweight pre and post menopausal women. Similarly, Perry et al, observed that the mean WC of postmenopausal women (114.50 ±15.2 cm) was higher than compared with pre menopausal women (104.57 ±16.3 cm) [7].

In this study the mean W/H ratio of postmenopausal women was higher than the pre menopausal women. The value of mean W/H ratio for the obese pre and post menopausal women were 0.85±0.02 and 0.89±0.04 respectively. A statistically significant relation (t=6.32; p< 0.001) was observed. Similarly Perry et al, observed that the mean W/H ratio of postmenopausal women (0.90 ±0.09) was significantly higher than pre menopausal women (0.85 ±0.08) [7].

In the present study mean BMD (in gm/cm^2) was 0.405 ±0.10 and 0.263 ±0.06 in underweight of pre menopausal and postmenopausal subjects respectively. A statistically significant relation (t=2.84; p=0.01) was observed in underweight subjects.

Mean BMD (in gm/cm^2) of the pre menopausal normal weight and postmenopausal normal weight subjects in the present study was 0.500 ±0.04 and 0.397 ±0.07, respectively. A statistically highly significant relation (t= 4.81; p <0.0001) was observed in normal weight subjects.

Mean BMD (in gm/cm^2) of the pre menopausal overweight and postmenopausal overweight subjects in the present study was 0.512 ±0.05 and 0.431 ±0.07, respectively. A statistically highly significant relation (t= 3.8; p=0.0007) was observed in overweight subjects.

Mean BMD (in gm/cm^2) of the pre menopausal obese and postmenopausal obese subjects in the present study was 0.561 ±0.08 and 0.522 ±0.06, respectively. A statistically non significant relation (t= 1.46; p =0.15) was observed in obese subjects. Baheiraei A et al, observed a significant positive correlation (p=0.333) between BMI and BMD in postmenopausal women [8]. Maghraoui AE et al, observed that obese postmenopausal women had higher BMD (0.947 ±0.1) than compared to overweight (0.891 ±0.1) and normal weight postmenopausal women (0.832 ±0.1)3. Hafeez F et al, found a statistically non significant relationship between BMI and BMD of pre and postmenopausal women [4].

Fig 1: Clinical BoneSonometer

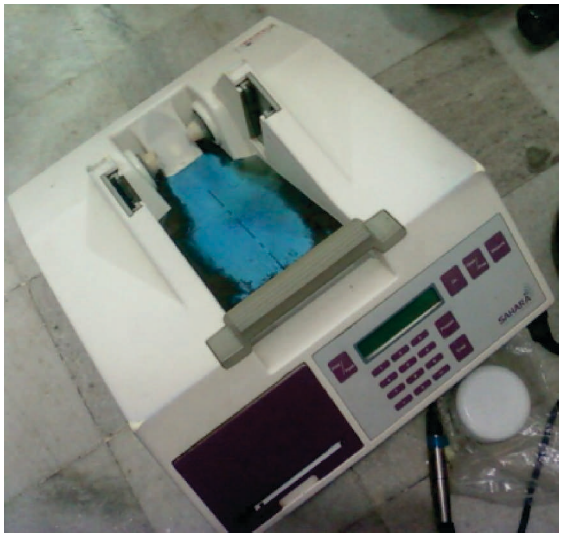

Fig 2: Measurement of Bone Mineral Density

4. Conclusion

Thus, a significant relationship was observed in BMD of underweight, normal and overweight pre and post menopausal women while it was not significant for obese subjects.

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