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CORRELATION OF BODY MASS INDEX WITH BONE MINERAL DENSITY IN POST MENOPAUSAL WOMEN

B. Shobana[1], G. Sasi krishnan[2], Milind V. Bhutkar[3]

ABSTRACT

Background: Fractures in postmenopausal women are an important cause of morbidity and mortality. Osteoporosis is a silent and invisible disease characterized by a decrease in bone mineral density often seen in postmenopausal women. **Aims and Objectives:** Aim of the study is to correlate the body mass index (BMI) with bone mineral density (BMD) in postmenopausal women. The objective is to assess osteoporotic changes in postmenopausal women. **Materials and Methods:** Eighty postmenopausal women were included in the study. They were grouped into 40 women with BMI >30 and 40 women with <30 were included for this study osteoporotic changes (bone density) were assessed by using bone densitometry. Unpaired Student's *t*-test was used for statistical analysis. **Result:** There was significant ($P \leq 0.001$) correlation of BMI with BMD and there was decreased BMD value in subjects with BMI <30 when compared to BMI >30. **Conclusion:** This study suggest that increase BMI increases BMD leads to decreased risk of osteoporosis and decreased BMI decreases BMD leads to increased risk of osteoporosis.

Key words: Bone mineral density, Osteoporosis, densitometry, Post menopausal women

INTRODUCTION

Osteoporosis is a silent and invisible disease which is characterized by a decrease in bone mineral density (BMD) which is often seen in postmenopausal women.[1] Fractures most commonly associated with osteoporosis are those of the hip, the vertebrae, the femoral neck and the wrist, and these are responsible for morbidity and excess mortality. Many clinical guide lines recommend risk factor assessment and measurement of BMD to identify individuals at high risk of fracture.[2-4] Risk factors like osteoporosis and osteoporotic fractures are more common in postmenopausal women.

Body weight is positively associated with BMD, from the childhood through adulthood.[3] This relationship is stronger in older women in whose body weight and body mass index (BMI) have been to explain an larger proportion of the variance in BMD (8.9-19.8% of total variance).[5,6]

Low weight and low BMI are also related to an increased fracture risk. De Laet *et al*. documented that the age – adjusted risk of a hip fracture was increased two fold in older individuals with a BMI of 30.[8] Prospective study by Ravn *et al*.[9] and Bjarnason and Christian sen[10] explained that early postmenopausal women who have lower BMI lose more bone compared to those with higher BMI tertiles.

The purpose of this study was to assess the BMI and to correlate the BMI with BMD in postmenopausal women to guide clinicians in the evaluation of fracture risk in this population.

MATERIALS AND METHODS

It is a cross sectional study and the subjects were selected from the outpatient department in the Department of Radiology in Vinayaka Mission's Kirupananda Variyar Medical College. In this study 80 postmenopausal women were involved and they were grouped into Group A and Group B. Group A comprised of 40 women with BMI <30 and Group B comprised of 40 women with BMI >30.[6] After a detailed history women whose age >45 and she missed her periods of more than one year were included in this study. Women with bone secondary, steroid intake, cushings disease, hypothyroidism (metabolic disorder), Diabetes mellitus were excluded from this study.

Institutional ethical clearance was obtained and the informed consent was taken from the subject.

Body weight measurement

BMI was calculated as weight in Kg divided by height square in meters. Although weight is used in many osteoporosis risk assessment strategies, We also evaluated BMI as it has been selected by World Health Organization (WHO) of T-score as one of the several

[1]Post Graduate Student, Department of Physiology, Vinayaka Mission's KV Medical College, [2]Post graduate Student, Department of anatomy Stanely Medical College, Chennai, [3]Professor and Head, Department of Physiology, Vinayaka Mission's KV Medical College, Salem, Tamil Nadu, India

risk fracture assessment parameters for inclusion in a absolute fracture risk prediction tool.[8]

According to WHO classification of BMI:

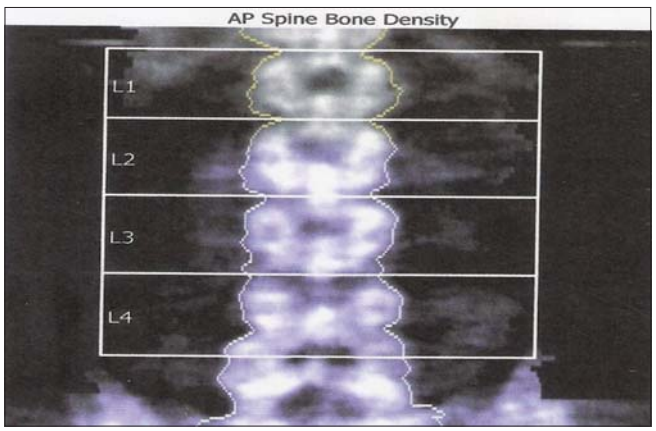
Normal	19-24.9
Over weight	25-29.9
Obese	
Mild	30-34.9
Moderate	35-39.9
Severe	40-44.9

Bone density measurement

The BMD or osteoporotic changes were measured by dual energy X-ray absorptiometry (DEXA) or densitometry. Densitometry is a gold standard technique for diagnosing osteoporosis. Densitometry was used as a diagnostic tool due to significant sensitivity and specificity for predicting the risk of the bone fractures.[11] A certified technician measured BMD at the femoral neck and the lumbar spine (L2-L4) using DEXA densitometer. WHO criteria used for categorizing the respondents based on DEXA results.[12,13]

WHO classification of BMD by T-score value

- Normal: T-score at or above −1 SD
- Osteopenia: T-score between −1 and −2.5 SD
- Osteoporosis: T-score at or below −2.5 SD
- Established osteoposis: T-score at or below −2.5 SD plus fragility fracture.



Statistical analysis

Since the two Groups A and B were comprised of different subjects Student's unpaired *t*-test with Pearson correlation was used for statistical analysis.

RESULT

Table 1 shows the positive correlation of BMI with BMD in Group A.

Scatter diagram

Figures 1 and 2 shows correlation between BMI and BMD in Group A and B.

DISCUSSION

Adipose tissue expresses and secretes a variety of biologically active molecules, such as estrogen, resistin, leptin, adiponectin, and interleukin-6. These molecules affect human energy homeostasis and may be involved in bone metabolism, which may contribute to the complex relationship between fat mass and bone.[20] Leptin, a bone active hormone produced mainly by adipocytes, has multiple target organs and functions related to bone mass, body weight, and reproduction.[14,15] It acts centrally to control body

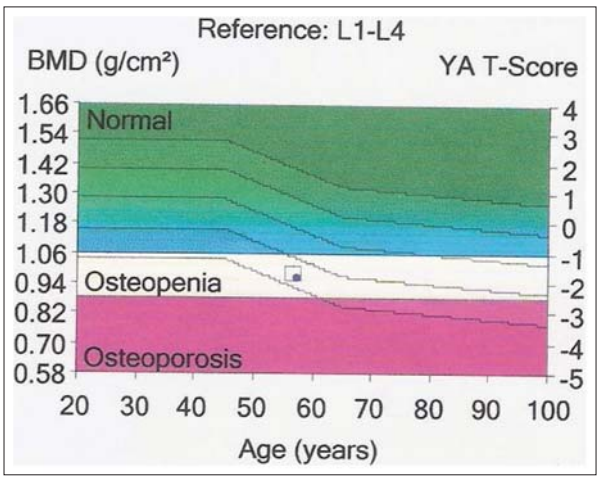


Table 1: Mean values of BMI and BMD (T-score value) in postmenopausal women

Group	BMI (kg/m²)	T-score (BMD [g/cm²])	*R* value
Group A	BMI<30	>−3 (g/cm²)	5.7±1.26
Group B	BMI>30	<−2 (g/cm²)	9.3±2.4

BMI: Body mass index, BMD: Bone mineral density

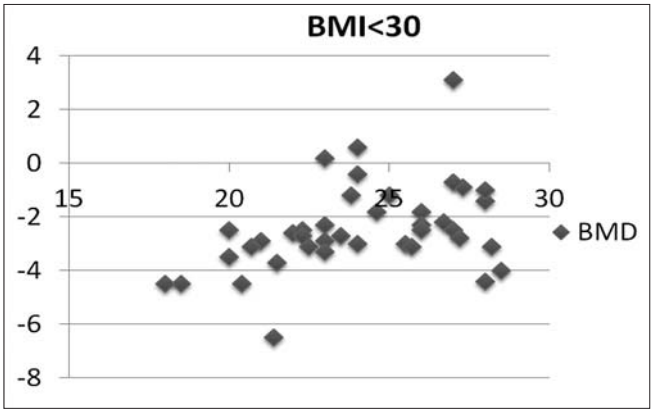


Figure 1: Correlation between BMI < 30 and BMD in Group A postmenopausal women

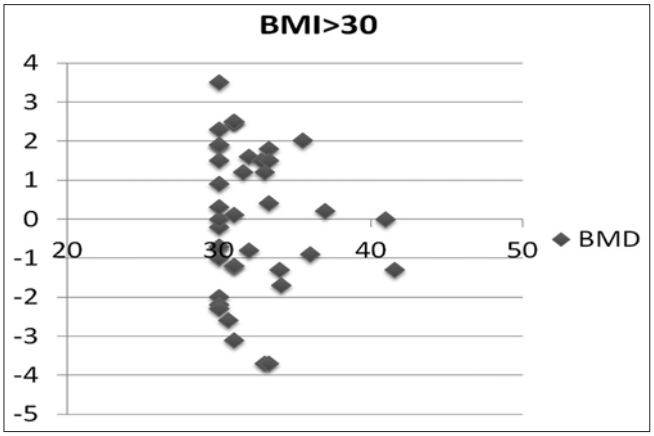


Figure 2: Correlation between BMI > 30 and BMD in Group B postmenopausal women

weight by mediating eating behaviour and modifying energy utilization through the complex neuronal pathway.[16] Leptin is also expressed in primary cultures of human osteoblasts; it promotes bone mineralization, regulates bone formation and inhibits osteoclast generation.[16,17] Interestingly, circulating leptin was found genetically correlated with both BMI and hand bone size and geometry,[18] and existing studies support the role of leptin as a link between fat and bone.[19] The secretion of bone-active hormones from the pancreas (including insulin, amylin, and preptin) may also explain part of the relationship between fat mass and bone mass. Estrogen is another bone active hormone increased in obesity. Fat tissue converts androstenedione to estrone by aromatization and this corresponds to the principal source of estrogen in the postmenopausal female, rather than ovarian or adrenal secretion. Cleland *et al*. showed that aromatase activity in adipose stromal cells increases as a function of age, being higher in postmenopausal than in premenopausal women. Thus, the increased estrogen production in obese postmenopausal women is due to a larger number of adipose cells and enhanced aromatase activity. These findings provide strong support for the view that increased synthesis of estrone in adipose tissue may be a contributing factor to bone mass in women passing through natural menopause. Nawata *et al*. demonstrated that the adrenal androgen DHEA is converted to estrone in osteoblasts by P450 aromatase, and this could also contribute to the maintenance of bone mass in the sixth to seventh decade of life.[21] Finally, adipocytes and osteoblasts originate from a common progenitor, the pluripotential mesenchymal stem cell.[22] So, in postmenopausal women with BMI <30 was having increased BMD and T-score value below −2.5 (g/cm^2); they are more prone for osteoporosis.

CONCLUSION

This study suggests that increase in BMI increases the BMD which leads to decreased risk of osteoporosis and decrease in BMI decreases the BMD which leads to increased risk of osteoporosis. Nevertheless menopausal women with BMI of more than 30 have a higher risk of cardio vascular diseases in general. Whether Osteopenia or osteoporosis, adequate treatment should be instituted, which includes modification of life style such as exercise, calcium intake, and vitamin D supplement and fall prevention.

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Corresponding Author: Dr. B. Shobana, Post Graduate Student, Department of Physiology, Vinayaka Mission's KV Medical College, Salem, Tamil Nadu, India.
E-mail: shobanasaki@gmail.com