

CORRELATION OF BODY MASS INDEX & PHYSICAL ACTIVITY WITH BONE MINERAL DENSITY IN POSTMENOPAUSAL WOMEN

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Abstracts: Background & objectives: Bone Mineral Density (BMD) estimates strength of bones. There is an increasing incidence and prevalence of osteoporosis with about 200 million women having osteoporosis worldwide. In India it is emerging as a major health problem in elderly women. It is proved that exercise protects osteoporosis. Many studies has been reported a positive correlation between Body Mass Index, physical activity & BMD. But only in postmenopausal women studies are less hence this study is planned to find correlation of BMI and physical activity with BMD. **Methods:** In 131 postmenopausal women BMD was estimated by Dual Energy X- ray Absorptiometry (DEXA) for spine and femur in gm/cm². BMI and physical activity was also found out. Data was analysed using correlation coefficient. **Results:** There was positive correlation between BMI and BMD. (p≤ 0.05) Also, there was positive correlation between Physical activity and BMD, though the correlation was not statistically significant. **Interpretation & conclusion:** Body mass index and physical activity are positively correlated with bone mineral density. BMD screening program for older adults should be encouraged for early detection of osteoporotic risk and to prevent further complications.

Key Words: Body Mass Index, Physical activity, Bone Mineral Density, Postmenopausal Women

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Introduction: As a woman advances towards menopause, risk of osteoporosis increases because estrogen promotes bone deposition and this advantage is compromised in postmenopausal women.¹ Estimation of bone mineral density (BMD) is one of the standard parameters to diagnose osteoporosis. It can be estimated by ultrasound or DEXA. Of these, DEXA is considered as a better tool for diagnosis of BMD.

Many studies have reported a positive correlation between Body Mass Index & BMD which is reasoned out to be due to increased mechanical loading². So, whether overweight (BMI>24.99 kg/m²) postmenopausal women are at an increased BMD advantage over postmenopausal women with normal BMI needs to be studied. Moreover, in many above mentioned studies, the study group has included all women (adolescent, premenopausal and postmenopausal women) all of whom are either preobese or obese. In order to avoid the resultant discrepancies in the results, the present study involved only postmenopausal women. This study also uses DEXA as the tool for measurement of BMD which is considered better than measurement by ultrasound.

So, the study was planned to explore if there is any correlation between BMI and BMD. As physical activity is observed to supplement the bone deposition effect of estrogen, the study also explored if there is any correlation between physical activity and BMD¹.

Material and Methods: Study was conducted in 131 postmenopausal women after obtaining institutional ethics committee approval. All participants were selected on the basis of inclusion and exclusion criteria as mentioned below.

Inclusion Criteria:-

1. Years since menopause 1-10years.
2. Physically active subjects walking for at least 30mins/day, for at least 4 days a week since one year at least.

Exclusion Criteria:-

1. History of smoking and alcohol as they are risk factors for osteoporosis.
2. History of hyperthyroidism, Diabetes mellitus, malignancy, kidney disease, bone disease, as they are risk factors for osteoporosis.
3. History of taking drugs like glucocorticoids, thyroxine, oral anticoagulants or

anticonvulsants as any of these is a risk factor for osteoporosis.

4. History of taking drugs like HRT (Hormone Replacement Therapy), SERMS(Selective Oestrogen Receptor Modulator), statins, thiazide diuretics or beta blockers as any of these can have an effect on Bone Mineral Density.
5. Nulliparous women as it is risk factor for osteoporosis.

Parameters:

- 1) **Bone Mineral Density (BMD) estimation:** After taking written consent and completion of proforma in all women, BMD was estimated by Dual Energy X- ray Absorptiometry (DEXA) for spine and femur in gm/cm².
- 2) **Body Mass Index (BMI):** Body weight was measured while the subject was minimally clothed and without shoes, standing motionless on a weighing scale and it was recorded to the nearest of 0.1kg. Height was measured to the nearest of 0.1 cm while the subject was standing in erect position with bare feet on flat floor against a vertical scale and with heels touching the wall and head straight. BMI^{3,4} was measured by weight in kilograms divided by square of height in meters (kg/m²).
- 3) **Physical activity:** Detailed history of Physical activity was taken from all the participants. It was noted in minutes per day.

Statistical Analysis:-

Statistical analysis was done by using correlation coefficient test. P value is calculated from r value and p value ≤ 0.05 was considered as statistically significant.

Result:

Table:1 Correlation of BMI with BMD

BMI (Kg/m ²) Mean ± SD	BMD (gm/cm ²) Mean ± SD	r value	p value
26.24 ± 4.14	0.85 ± 0.26 (Spine)	0.12	> 0.05
26.24 ± 4.14	0.79 ± 0.13 (Femur)	0.19	≤ 0.05*

*Statistically significant

Table 1 shows that there was positive correlation between BMI and BMD. There was statistically significant correlation between BMI and BMD at femur.

Table:2 Correlation of Physical activity with BMD

Physical activity (min/day) Mean ± SD	BMD (gm/cm ²) Mean ± SD	r value	p value
33.63 ± 17.54	0.85 ± 0.26 (Spine)	0.05	> 0.05
33.63 ± 17.54	0.79 ± 0.13 (Femur)	0.03	> 0.05

Table 2 shows that there was positive correlation between Physical activity and BMD, though the correlation is not statistically significant.

Discussion: In the present study, a positive correlation between BMI and BMD was observed. There was statistically significant correlation between BMI and BMD at femur. Similar findings were observed in a study conducted by Yusuf Serdar Gürlek et al⁵. They conducted study on 121 postmenopausal healthy women and found that higher BMI seems to have positive impact on bone density. They also considered waist circumference in their study and observed that women specifically with abdominal obesity should be evaluated for osteoporosis as higher waist circumference can negatively impact BMD.

Several studies have investigated the relationship between obesity and osteoporosis; however, there still is not a consensus regarding this subject. The generally accepted opinion suggests that obesity has a protective effect against osteoporosis and weight loss leads to decreased BMD levels.^{6,7,8}

In a review study by Abdulaziz F. Hariri et al it was found that a positive relationship exists between BMI and BMD levels.⁹

Another study conducted in Manipur women by Laishram Geetanjali et al suggested that lower BMI is an important risk factor for the occurrence of low BMD.¹⁰

The role of several adipokines secreted by adipose tissue seems to be important in bone remodeling via their effects on either bone formation or resorption. As bone cells express several specific

hormone receptors, the skeleton is considered as an endocrine target organ. There may exist a potential feedback mechanism between the skeleton and endocrine organs. Thus, the cross-talk between fat and bone likely constitutes a homeostatic feedback system. However, the mechanism(s) by which all these events occur remains unclear.¹⁰

Present study also shows positive correlation between Physical activity and BMD, though the correlation is not statistically significant. Similar findings were demonstrated by study in the elderly of Amirkola in northern Iran. Study was conducted on 1113 elderly individuals. They observed that bone mineral density in femur and lumbar areas was increased with an increase in physical activity in both genders. Less physical activity was found in elderly with osteoporosis.¹¹

Sharami et al, in their study on determining the risk factors for osteoporosis in women over 50 years of age identified significant associations between parameters including age (inverse association), education (positive association), career (positive association), physical activity (positive association), and BMI (positive association) and osteoporosis. They also reported a negative impact of lower BMI (BMI of less than 25¹²) on BMD.¹³

Physical activity can affect bone via multiple mechanisms including : muscle contraction forces, gravitational loading and endocrine or paracrine effects. During physical activity, bone is subjected to mechanical forces exerted by muscle contraction and gravitational loading. At the cellular level, bone cells (osteocytes) perceive these mechanical forces as cell deformation, changes in extracellular fluid shear stress, pressure gradients and electric fields.¹⁴ The osteocytes communicate with osteoblasts and osteoclasts to modulate bone formation and resorption thereby changing bone geometry and material properties.¹⁵ Because most modes of physical activity involve both muscle contraction and gravitational loading, it is difficult to determine their relative effects on bone.

In a nutshell higher BMI and regular physical activity can improve bone mineral density and prevent osteoporosis.

The current study had some limitations like, all the factors that can affect bone mineral density were not taken into account and small sample size.

Conclusion: Body mass index and physical activity are positively correlated with bone mineral density. BMD screening program for older adults should be encouraged for early detection of osteoporotic risk and to prevent further complications.

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