

## Association Between Body Mass Index and Bone Mineral Density Among Rural and Urban Post Menopausal Women

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### ABSTRACT

**Introduction:** Osteoporosis is a growing health problem recognized in both developed and developing countries. The increasing prevalence of osteoporosis will lead to increased socioeconomic burdens because of the high cost of treatment. Weight and, body mass index (BMI) have been recognized as good predictors among the anthropometric parameters, for the evaluation of osteoporosis and osteoporotic fracture risk. Several retrospective and prospective studies also showed relatively consistent association between anthropometric characteristics and bone mass and fractures (Adami S et al 2004.,)<sup>1</sup> **Aim:** To study the association between body mass index and bone mineral density among rural and urban post menopausal women. **Setting and Participants:** In this comparative study 500 postmenopausal women in the age group of 45-60 years were randomly selected from rural and urban area (250 in each group) of Tamil Nadu, India. Rural subjects were selected from Somangalam region which is located in Kancheepuram district. Urban subjects were selected from Perambur region, Chennai. The height and weight of all the subjects were recorded and BMI was calculated. BMD was measured in calcaneus (heel bone) using Furuno's CM-200 light ultrasound bone densitometer. **Results:** The correlations between the variables were calculated by Pearson correlation test. P value < 0.05 was considered significant. Positive correlation was observed between BMI and BMD among urban samples whereas negative correlation was observed between BMI and BMD among rural samples BMI was found to be significantly associated with BMD in both rural and urban postmenopausal women. **Conclusions:** Body Mass Index (BMI) was found to be significantly associated with BMD. BMI is an important determinant of BMD in Indian females.

**Keywords:** Bone mineral Density; Body Mass Index, Osteoporosis, Rural and Urban Postmenopausal women

### INTRODUCTION

Osteoporosis is a public health problem worldwide and is a common disease in the older population, especially in the postmenopausal women (Srivastava M et al.,2002)<sup>2</sup>. This disease is characterized by low bone mass and destruction of bone tissue, leading to increased fracture risk. Prospective studies by Ravn et al.,1999<sup>3</sup> and Bjarnason and Christiansen.,2000<sup>4</sup> indicates that early postmenopausal women who have low BMI lose more bone compared to those with higher BMI tertiles. Measurement of body mass index is an inexpensive and valuable technique to guide public health policy, clinical decisions, and evaluation of nutritional status (Mahan LK et al.,2012)<sup>5</sup>. Bone mineral density (BMD) test measures the density of minerals present in the bones using a special scan. Quantitative ultrasound (QUS) measurement could be an ideal tool to screen for osteoporosis at the community level (Kim KI et al.,2001)<sup>6</sup>. A study conducted by Iqbal et al.,2005<sup>7</sup> found that low BMI is a good indicator for referral of women less than 60 yr for measurements of BMD. The present study was conducted to assess the association between BMI and status of BMD among rural and urban postmenopausal women.

### MATERIALS AND METHODS

Quantitative approach was adopted for this Comparative study. The study was conducted in rural Somangalam village in Kanchipuram district. Somangalam is a Village in Kunnattur Taluk in Kanchipuram District of Tamil Nadu State, India. Around six villages are nearby Somangalam. Urban Perambur is a locality in the northern region of the metropolitan city of Chennai in Tamilnadu state, India. Free medical camps for women were organized in both the areas on Saturdays and Sundays for a period of one month in each area. About 398 women in rural area and 431 women in urban area attended the camp among them 500 postmenopausal women age between 45-60 years were selected from rural and urban area (250 from each group) by random sampling method. The independent variables included rural and urban postmenopausal women, and the dependent variable included height, weight, bone mineral density. Inclusion criteria for the sample selection comprises of postmenopausal women age between 45-60 years. With the brief introduction of the study, informed consent was obtained from all the study participants. BMD was measured in calcaneus (heel bone) using Furuno's CM-200 light ultrasound bone densitometer. A single technician

Table 1: Correlation Coefficient between Bone mineral density and body mass index among Rural and Urban Postmenopausal Women.

S.no	Correlation between variables		Obtained “r”	Required “r”
1	Urban BMI	Urban BMD	0.076	0.073
2	Rural BMI	Rural BMD	-0.089	0.073

\*significant at 0.05 level of confidence.

Table 2: Number and Percentage of Type of Activity Pattern among Rural and Urban Postmenopausal Women (Scores in %)

S. No	Activity pattern	Rural women		Urban women	
		Number	Percentage	Number	Percentage
1	Sedentary	221	88.4	187	74.8
2	Moderate	29	11.6	63	25.2
3	Heavy	-	-	-	-

performed all QUS measurement to minimize subjective error. BMD values were measured in terms of QUS device specific T-score criteria which is similar to WHO’s criteria. (Kanis JA et al.,1994)<sup>8</sup>. T- score is the number of standard deviation relative to the standard speed of sound (SOS) value of the young age group. • Normal is a T-score of -1.0 or higher • Osteopenia is defined as between -1.0 and -2.5 • Osteoporosis is defined as -2.5 or lower. Weights and heights of patients were measured without shoes in light indoor clothing by the use of well calibrated digital weight and height scale measuring device, BMI was calculated by dividing weight in kilograms by the square of the height in meters as in the equation : weight (kilograms)/height (meters)<sup>2</sup> ( Sahu, m.t. et al 2007)<sup>9</sup>. The standard categorisation of BMI by Centre for disease control indicates less than 18.5 as Underweight, 18.5–24.9 as Normal, 25.0–29.9 as overweight, and 30.0 and above as obese.

*Ethical Considerations*

Permission to carry out this study was obtained from local authorities of that respective area. With brief introduction of the study, informed consent was obtained from all the study participants.

*DATA ANALYSIS*

The results of the variables were statistically analysed and compared using percentile and Pearson’s Correlation coefficient. Data analysis and results are tabulated below.

**RESULTS**

Table –I shows the Correlation Coefficient between Bone mineral density and body mass index among Rural and Urban Postmenopausal Women. The above table shows the correlation coefficient (“r”) between Bone mineral density(BMD) and Body mass index(BMI) among rural and urban postmenopausal women. The Obtained r value between Bone mineral density and Body mass index among urban subjects was 0.076. This value was higher than the table value of 0.073 at 0.05 level of confidence, hence it was significant. Among rural subjects obtained r value between BMI and BMD was -0.089. This Obtained r value between BMI and BMD value was also higher (without considering – ve sign) than the required r value of 0.073 at 0.05 level of confidence, hence it was also significant. Positive correlation was observed

between BMI and BMD among urban postmenopausal women whereas rural subjects showed negative correlation. Table-II shows the Number and Percentage of Type of Activity Pattern among Rural and Urban Postmenopausal Women Among the 250 Rural postmenopausal women 221 (88.4%) were involved in sedentary activity and 29 (11.6%) were involved in moderate activity. In Urban postmenopausal women 187 respondents were involved in sedentary activity which was about 74.8 percent and 63 respondents were involved in moderate activity which was about 25.2 percent. No one was involved in heavy activity in both the groups.

**DISCUSSIONS**

In various epidemiological and clinical studies, bone quality, bone mineral density (BMD), as well as risk of falling have been associated with lifestyle and anthropometric/demographic characteristics. Studies conducted by Van der Voort et al.,2001<sup>10</sup> illustrates that thinness is related to both osteoporosis and increased fracture risk; hence, low BMI was included in the risk assessment tools for evaluation of osteoporosis and osteoporotic fracture risk as suggested by Eddy et al.,1998<sup>11</sup>and National Osteoporosis Foundation 1998<sup>12</sup> and Black et al. 2001<sup>13</sup>. The results of this study shows the association between Bone mineral density and Body mass index among rural and urban postmenopausal women. There was significant relationship between Bone mineral density and Body mass index among both rural and urban subjects. 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. (Ribot C et al 1994)<sup>14</sup>. The BMI has an effect on BMD and BMI can be protective in bone loss by increasing the BMD. A.Laria et al ., 2015<sup>15</sup> in their study concluded that the BMD seems to have a direct relationship with BMI for every BMI value in post menopausal women .The results of the study is consistent with Naseer J.H.et al ., 2014<sup>16</sup> evaluated the osteoporosis risk factors occurrence and its association with BMD in rural and urban women from the Lublin Region in Poland and found that BMI have a strong

positive association with BMD (g/cm<sup>2</sup>). The findings of this study goes in congruence with study of Biplob Chowdhury et al., 2014<sup>17</sup>. They investigated the associations between body weight, BMI, BMD and subsequent fracture risks in postmenopausal women aged 45 to 85 years and concluded that low BMI confers a risk of substantial importance for all fractures that is largely independent of age and sex, but dependent on BMD. The significance of BMI as a risk factor varies according to the level of BMI. Its validation on an international basis permits the use of this risk factor in case-finding strategies. Several studies in the UAE, India, Japan, Netherlands, the US and Morocco (Mehrdad Aghaei et al., 2013)<sup>18</sup> have considered a positive correlation between BMI and bone mineral density. In this present study Positive correlation was observed between BMI and BMD among urban postmenopausal women whereas rural subjects showed negative correlation. The reason for negative correlation in rural subjects may be because of sedentary activity pattern as shown in table 2 in which the number of sedentary subjects were greater in rural population than urban subjects. Physical activity has been proved to have a protective effect on BMD in epidemiological surveys (Filip RS et al 2005)<sup>19</sup>. The findings of the study is consistent with Pongchaiyakul C et al 2005<sup>20</sup>, study comparing bone mineral density (BMD) between rural and urban populations in Thailand, femoral neck BMD was found to be higher in males and females living in rural areas compared with urban dwellers from Bangkok, while little difference was observed at the lumbar spine. Previous studies also reported that individuals with low physical activity were susceptible to bone disorders including bone loss or osteoporotic fracture (Morin S et al., 2009)<sup>21</sup>. Study by Filip RS et al 2005 also concluded that Body Mass Index (BMI) was found to have strong positive association with BMD.

#### SUMMARY AND CONCLUSION

This Comparative study between body mass index and bone mineral density among rural and urban post menopausal women indicated Positive correlation between BMI and BMD among urban samples whereas negative correlation was observed between BMI and BMD among rural samples BMI was found to be significantly associated with BMD in both rural and urban postmenopausal women. It was concluded that BMD was influenced by BMI. The quality of life will be better in urban than the rural post menopausal women. The body mass index will be lower in rural than in urban postmenopausal women due to level of activities and nutritional habits (Kaur R et al., 2015)<sup>22</sup> BMI is an important predictors of BMD, affecting bone loss. Therefore, it is recommended to assess BMD and BMI with a larger number of patients.

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#### CONFLICT OF INTEREST

The authors have no conflict of interest to declare

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