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The Comparison of Bone Mineral Density with Body Mass Index in Postmenopausal Women

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The aim of this study was to determine whether there is any relationship between bone mineral density (BMD) and body mass index (BMI) in postmenopausal women. For this reason, 180 women who referred to Diyarbakır Bilim Medicine Center, for measuring bone mineral density, were taken into the study. Bone mineral density was assessed by Dual Energy X-ray Absorptiometey (DEXA) from femur and lumbar 2-4 vertebra areas. In addition, age, weight and height of all cases were reported. The mean age of all cases was 57.95 ± 6.38 years. The average height was 159.60 ± 3.59 cm. The average weight was 71.86 ± 10.91 kg. Body mass index was calculated for each case. The average body mass index and standard deviation was 28.28 ± 4.04.

At the end of the study, a significant relation was found between body mass index and bone mineral density at femur and lumbar 2-4 vertebra areas. A significant reverse correlation was found between age decades and bone mineral density in all areas. Also a significant reverse correlation was found between age decades and body mass index.

Key words: Body mass index, Bone mineral density.

Introduction

Osteoporosis is a major health problem, which affects millions of postmenopausal women worldwide. Reduction of bone characterizes osteoporosis, which results in the disruption of the bony architecture. Osteoporosis affects more than 75 million in the USA, Europe and Japan alone, and the morbidity and mortality of osteoporosis related fractures is so enormous that it is causing major economic concerns [2, 10]. Body weight is considered a strong predictor of bone mineral density (BMD). This study was designed to estimate one of the determinants of bone mineral density, the body mass index (BMI). Body weight can be related to height by calculating the index (BMI, kg/ m^2) which serves to distinguish overweight from normal body weight and between normal body weight and energy deficiency. It has been suggested that the optimum BMI range for women ranges between 18.7 and 23.8 [8] and a bone scan is recommended if BMI found 19 [7]. Regardless of body weight women tend to be concerned with their weight which in turn influences eating habits, dieting and physical activity [6].

Among many factors which are implicated in the development of osteoporosis female population is hypovitaminosis D, multiparity and prolonged lactation. The

identification of factors that influence bone mass has important implications for the design of appropriate strategies to prevent or treat osteoporosis in elderly males and females. The diagnosis of osteoporosis is currently based on measurement of BMD using dual energy X-ray absorptiometry(DEXA). The aim of this study was to determine the relation between BMD and BMI.

Materials and Methods

This was a randomized study carried out in Diyarbakır Bilim Medical Center. The participants were 180 postmenopausal women between ages 45-70. Bone mineral density (BMD) scans were performed with DEXA scanner. Bone mineral density was measured from the femur neck and lumbar spine L2-L4 using DEXA and was expressed in g/cm^2 in assessment of results currently two different scores. Z-score is the ratio of the difference between the assessed BMD and the average BMD of this age, and the standard deviation of the population. T-score is the ratio of the difference between the assessed BMD and the average BMD of the young adult population, and the standard deviation of young adult population. The scores were also expressed in g/cm^2. For T-score we accept the range between (—1 and 1) as normal results, (—1 and —2.5) as osteopeni and the values under (—2.5) as osteoporosis. We measured the weight and height of the patients anthropometrically BMI was calculated according to the Formula weight (g)/height (cm^2). The participants divided in four groups according to their age decades. The groups of ages were 45-49, 50-59, 60-69, 70. We compared body mass index with the bone mineral density of femur and lumbar spine. The data were assessed by the descriptive statistical tests, Posthoc test and Pearson correlation tests in SPSS for Windows programme.

Results

The youngest parcipitant was 45, the oldest was 70 years old. The average age was 57.95 and its standard deviation was 6.38. The highest was 176 cm, the shortest was 150 cm. The average height was 159.60 cm with 3.59 standard deviation. The heaviest was 98 kg and the lightest was 48 kg. The average weight and its standard deviation was 71.86±10.91 kg. The greatest body mass index was 39.83, the lowest was 19.58. The average BMI was 28.28 ± 4.04. In comparison of variables body mass index and lumbar spine bone mineral density, we found the results $r = 0.381$.

The increase in body mass index was found in correlation with the increase in lumbar spine bone mineral density.

Bone mineral density of femur neck another weight bearing site similarly shows positive correlation with body mass index ($r = 0.454$)

Our results support there is a strong positive correlation between bone mineral density and body mass index (Table 1).

Discussion

Osteoporosis is the most common bone metabolism disease. Advanced age is one of the most important determinants of the disease and the mean lifespan gets longer and elderly population will increase nearly 40 % in recent years. The fractures, the most common complication of the disease makes it a common public health prob-

T a b l e 1. The comparison of body mass index and bone mineral density of lumbar spine and femur neck according to the age groups

Ages	BMI	Lumbar spine BMD	Femur neck BMD	*p*
45-49	28.94±4.36	1.107±0.17	1.047±0.13	>0.05
50-59	28.84±3.98	1.061±0.19	0.948±0.13	>0.05
60-69	27.42±4.02	0.930±0.15	0.837±0.13	>0.05
70	26.57±4.03	0.856±0.17	0.860±0.13	>0.05

lem [4]. Age, gender, height, weight, body mass index, physical activity, the geographic position are important factors for the prevalence of the disease [3]. Body size had a major influence on the magnitude of the areal BMD difference between elderly males and females at the femoral neck but also at other sites (e.g., at hip and spine), and found that the magnitude of sex difference, likewise, was reduced after adjustment for weight [11]. BMD distribution with ageing differs at different skeletal sites in both males and females. Elderly people of both sexes experiencing different levels of bone loss at various skeletal sites with ageing may account for the different BMD distribution [1]. The risk for males and females is very similar about 50 years but between 50 and 75 years females have two times much more risk. The bone loss after menopause period is the major risk factor [9]. In our study we found ageing as a risk factor for postmenopausal women. The results suggest that the strong effect of weight on bone mineral density is due to load on weight bearing bones. The sex difference is unexplained but may be due to adipose tissue production of estrogen in women after menopause [5]. Underweight women have less subcutaneous fat compared to normal and overweight women and since it is assumed that inactive vitamin D and estrogen are stored in subcutaneous fat, it serves as a minor energy reserve as well as a storage place for vitamin D. As vitamin D is fat soluble, lack of fat may lead to insufficient levels of vitamin D for bone formation during a particular period. Salamone et al. determined positive correlation between bone mineral density and lean body mass not with fatty mass in perimenopausal women [13]. R e i d et al. found fatty mass as a determinant of bone mineral density in only women not in men [12]. Ageing females experience two phases of bone loss whereas ageing males experience only one. An accelerated phase of predominantly cancellous bone loss initiated by menopause is the result of the loss of the direct restraining effect of estrogen on bone turnover [9].

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