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Comparison of the Bone Mineral Density and Bone Mineral Content between Pre and Post-Menopausal Women

[1]Anmar Ahmed Qasem, [2]Muthanna Abdul Razaq, [3*]Khalid Ghanim Majeed

[1]FICMS Orthopedic Surgeon, AL- jamhory Teaching Hospital, Mosul, Iraq.

[2]FICMS Orthopedic Surgeon, Orthopedic Department, College of Medicine, University of Mosul, Mosul, Iraq.

[3]Medical Physics, Department of Medical Physiology, College of Medicine, Ninevah University, Mosul, Iraq.

Corresponding author: Khalid Ghanim Majeed, khalid.majeed@uoninevah.edu.iq

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Abstract

Background/Objectives: The aim of the study is to estimate the differences in bone mineral content, bone mineral density, T-score, Z score, and fracture risk before and after menopause.

Methods/Statistical analysis: A total of 100 female including 45 pre menopause (PM) and 55 post menopause(PoM) are participated in the study. BMDs of the lumbar vertebrae were assessed using the DXA technique. The mean age of the PM group is (40 ± 7.21) years, while the mean age of the (PoM) is 63 ± 7.24 years.

Findings: The bone mineral content (BMC) values for the (PM) group in the lumbar spine were 11.25, 13.89, 16.48, 18.86, and 60.47 g. Among (PoM) group, it was 10.71, 13.25, 16.05, 17.51, and 57.51 g respectively. And the BMD values of the lumbar spine were 0.94±0.12 g/cm2 vs. 0.88±0.20 g/cm2, 1.05±0.24 g/cm2 vs. 1.02±0.18 g/cm2, 1.15±0.22 vs. 1.10±0.21 g/cm2, 1.18±0.21 vs. 1.13±0.21 g/cm2 and 1.09±0.21 vs. 1.04±0.17 g/cm2 for L1, L2, L3, L4, and total L1-L4.

Key Words: DEXA, Bone mineral density, T & Z score

Introduction

Osteoporosis is characterized as a systemic skeletal disease that worsens over time, increasing bone fragility and fracture susceptibility [1] Varahra A 2018). Osteoporosis is a significant issue for the provision of health care in both developed and developing nations. [2] (Lim PS 2005)

One prevalent and serious health risk is osteoporosis. Bone strength and bone mineral density (BMD) are gradually declining. Even with minor physical strain, it leads to a serious fracture.

However, osteoporosis does not manifest in patients until a fracture occurs. [2] (Lim PS 2005)

Patients frequently utilize BMD measurements to diagnose osteoporosis and assess its severity. Low BMD is a significant risk factor for diagnosis, the requirement to evaluate the strength of bones, and its associated bone fractures. [3] (Aida 2014

The lumbar spine, femur, forearm, and the whole body can be measured using dual energy X-ray absorptiometry (DXA) or densitometry devices, which are extensively used and can distinguish between different body structures. [4] Nana A, 2011

The most effective approach for determining osteoporosis and tracking changes in BMD are using DXA. These findings can be used to estimate the risk of osteoporotic fractures, as well as to select best course of treatment for this condition. Low radiation doses, accuracy, and precision are all achieved while utilizing DXA. [5] Nalda E 2011

DXA provides the advantage of measuring a variety of body components, such as (fat mass, fat-free mass, and bone mineral mass) with a high degree of accuracy while exposing patients to the smallest amount of radiation possible [5] Nalda E 2011 . DXA is the most accurate tool for detecting osteoporosis and tracking BMD changes during the menopause period. [6] Siddapur PR 2015

DXA evaluations should be performed on all postmenopausal women over the age of menopause who have a history of fractures[7] Majeed KG, 2019, (8) [8] Faiq, I 2013 . As estrogen levels decline and are linked to an increased risk of osteoporosis. [7] Majeed KG, 2019

While fractures can happen anywhere, including the legs, ankles, and hands, the femur has been the subject of numerous research. [8] Jaganjac, A. 2017 This necessitates the research we are doing to determine which other parts of the human body are susceptible to a decline in bone density.

More than 46 million Americans have been diagnosed with osteoporosis, which impacts the role of medical services and assistance for the injured. This accounts for 50% of the population over the age of. Additionally, 30% of US women over the age of menopause have osteoporosis [9] Vestergaard P 2007, [10] Xu J, 2016.

As time goes on, it is anticipated that the financial toll of osteoporosis and its complications will rise. For elderly who are at high risk of fracture, increasing economic burden may have an impact on access to healthcare. [10] Xu J, 2016

The prevalence of osteoporosis among the people of Iraq has increased, and the proportion of the aged in the population is rising as a result. This presents a major challenge to the Iraqi government and society [7] Majeed KG, 2019

The aim of the study is to estimate the differences in bone mineral content, bone mineral density, T-score, Z score, and fracture risk before and after menopause.

MATERIALS AND METHODS

Hundred women (45 pre-menopause and 55 post-menopause) range in age from 35 -75 years recruited from DEXA unit-department of physiology in Ninevah medical college from August 1 to 30 December, 2022. Eligible subjects who sign the consent were examined by researcher regarding anthropometric measurements, such as height, weight, and body mass index . Later, assessment of bone mineral content, bone mineral density, T-score, Z score of lumber spine were performed by DEXA (40 - 70 keV x-ray, using STRATOS densitometer, DMS-France). [11] Majeed KG, Sulayman S-A A 2019

Descriptive statistics like frequencies, mean and SD were used to summarize the results . Independent two sample student t-test was used to assess the significance of difference of continuous variable between the two study groups (i.e., pre-menopause and post-menopause). $P < 0.05$ level was deemed significant.

Results

Table 1 summarizes the subjects' anthropometric measurements. The average age of-menopause was 40 ± 7.21 years while the age of post-menopause women were 63 ± 7.24 years. Although, pre menopause were significantly taller than post-menopausal women (p=0.004), but when height was used to calculate BMI, the difference were minimized and become not-significant (p=0.1). Since it is 1.60 ± 0.05 m vs. 1.56 ± 0.06 m respectively. The mean weight in pre-menopause is 81.85 ± 16.49 kg, while in post menopause it is 81.01 ± 15.34 kg. Finally, the BMI for pre menopause is31.74 ± 6.45 Kg/m2, while post-menopause has a BMI of 33.12 ± 5.60 Kg/m2.

Table. 1 Descriptive characteristic among participants (N= 100)

Variables	**Pre menopause N= 45**	**Post menopause N= 55**	**Minimum**	**Maximum**
Age (Yr.)	40 ± 7.21	63 ± 7.24	35	75
Height (m.)	1.60 ± 0.05	1.56 ± 0.06	1.40	1.76
Weight (kg)	81.85 ± 16.49	81.01 ± 15.34	42	123
BMI (kg/m^2)	31.74 ± 6.45	33.12 ± 5.60	16.20	52.50

The BMD L1-L4 data for both groups can be arranged and compared as indicated in table 2.

Table 2: The comparison of the lumbar spine between the two groups using DEXA technique.

Regions	Pre menopause Mean ± SD	Post menopause Mean ± SD	p- value	95% CI of the difference
BMC(L1-L4) (g)	60.47 ± 11.68	57.51 ± 11.51	0.1	- 0.21 – 1.70
BMD (L1-L4)(g/cm2)	1.09 ± 0.21	1.04 ± 0.17	0.05	-0.001 – 0.12
T- score	0.11 ± 2.06	-1.72 ± 2.88	0.001	- 6.30 – 4.95
Z- score	0.28 ± 2.10	0.20 ± 2.45	0.80	- 4.40 – 4.95

The BMD of different segments of the body revealed that maximum density is seen in L4 and the minimum density is seen in L1 regardless to the study group.

The BMC of the lumbar spine (L1–L4) is depicted in Figure (1) for the two groups. The results indicate that the BMC values for pre menopausal group were 11.25, 13.89, 16.48, 18.86, and 60.47 g. Among post-menopausal group, it was 10.71, 13.25, 16.05, 17.51, and 57.51 g. According to the figure below, pre menopause group have higher BMC values comparing with post menopause group(P> 0.1), not significant

The BMD values of the lumbar spine (L1-L4) were 0.94±0.12 g/cm2 vs. 0.88±0.20 g/cm2, 1.05±0.24 g/cm2 vs. 1.02±0.18 g/cm2, 1.15±0.22 vs. 1.10±0.21 g/cm2, 1.18±0.21 vs. 1.13±0.21 g/cm2 and 1.09±0.21 vs. 1.04±0.17

g/cm2 for each lumbar spine L1, L2, L3, L4, and total L1-L4 where ($p < 0.05$)is significant as shown in figure (2).

Most importantly, the results of the total T-Score as shown in Table (2) , which is an index for bone health status calculated on basis of a younger healthy population. For the lumbar spine, the post menopause women group was highly significantly lower than that for the pre menopause group (i.e., - 1.72 ± 2.88 vs. 0.11 ±2.06) respectively; $P < 0.001$).as soon as the Z-score of the pre menopause group was higher than post menopause group (i.e., 0.28 ± 2.10 vs. 0.20 ± 2.45) and the results are not significant.

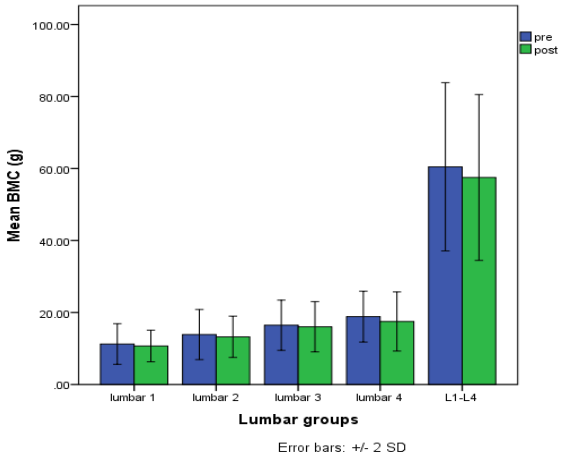

Figure 1. The bone mineral content of the lumbar spine for both the two groups.

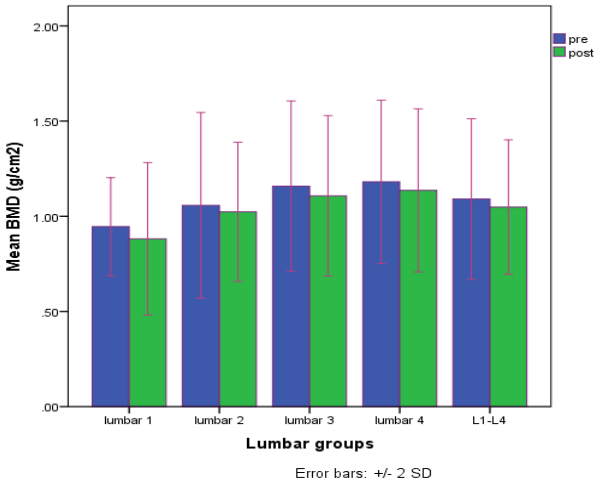

Figure 2 . The measurements of BMD of the lumbar spine for the two groups.

Due to the importance of the measurements that are made on examining the lumbar vertebrae, we found that it is necessary to measure the abdomen fat % effect on body weight and thus its effect on the shape of the vertebrae. The results show that the abdomen fat % for post menopause group was higher than pre menopause group (i.e., 36.28 ± 6.72 vs. 30.48 ± 6.12) as shown in figure (3).

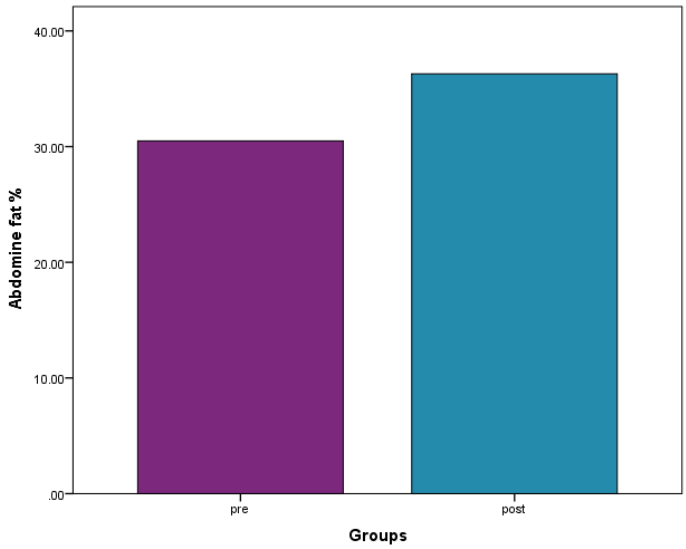

Figure (3). The abdominal fat % for both two groups

Further assessment is done is by measuring the fracture risk factors percentage for both groups. The risk results show that (0.54 ± 0.10 vs. 2.67 ± 0.85)for both pre & post menopause with a higher value in post group. At the same time the tissue thickness in the trunk is (23.76 ± 1.24 vs. 25.90 ± 1.95) cm for the two groups as shown in table 4. Since the mean value is higher in post menopause group. This clearly reflects the effect of advancing age and childbirth, as well as the lack of daily exercise, which affects the increase of the fat tissue in the body.

Table (3). The measurements of the body using DEXA technique.

Pre menopause			
	Mean ± SD	Minimum	Maximum
Abdomine fat %	30.48 ± 6.12	22.10	47.60
Tissue Thickness in the trunk (cm)	23.76 ± 1.24	15.64	30.25
Fracture risk factors %	0.54 ± 0.10	0.06	1.30
Post menopause			
Abdomine fat %	36.28 ± 6.72	11.70	47.60
Tissue Thickness in the trunk (cm)	25.90 ± 1.95	14.60	35.16
Fracture risk factors %	2.67 ± 0.85	18.38	0.26

Discussion

This study showed a link between menopause symptoms and women with abnormal BMD. Some authors have reported studies on the BMD in pre- and postmenopausal women [12] Bączyk, G.,2012

This study give a new information about the difference in BMD between both pre & post menopause. Most of previous bone status used equipment's like traditional X- ray, quantitative ultrasound, and invasive computed tomography scan [13] Jaganjac, A. 2017, [14]. Aleem, M.K.2014. Our measurements are done using advanced DXA to analyze the strength of the lumber spine. DXA technique having dual energies with a minimum dose equal to 37.07 µGy of the X- ray used. [15] El-Desouki MI, 2003

There are many areas in the body that indicate osteoporosis, and the researchers includes the femur aria and another that included measuring the whole body . Our study focused on the lumbar vertebrae, since the human body depends physically on them. [13] Jaganjac, A. 2017, [14]. Aleem, M.K.2014, [15] El-Desouki MI, 2003 [ ]

The results of the current study's analysis of the total BMD and alternatively BMC, and T-Z score revealed that postmenopausal women's were significantly lower than those of pre-menopausal women, confirming that bone loss is a clear consequence of menopause [16] . Janiszewska M,.2016

The lower bone status indicators of post-menopausal women are generally consistent with earlier investigations that have been reported [16]. Janiszewska M,.2016). T-score found in the current study was close to the figure reported by Bączyk, G.,2012[12] . Our findings show that beyond midlife, bone mass declines by 0.5% year.

With regard to the measurements made on the BMC, it was found that there is a gradual increase in these values as the numbers of the lumbar vertebrae increase from L1 to L4 , and this corresponds completely with what the researcher presented [8] (Faiq, I.). The results are highly statically significant (p value= 0.0001). Likewise, BMD measurements proved that the density increased gradually, starting from the first to the fourth lumbar vertebrae , and this is consistent with the [15] (El-Desouki MI.) , and the results proved to be highly statistically significant (p= 0.0001).

Estrogen is crucial for the development and maturation of bone, as well as for controlling bone turnover in adult bone. Estrogen's main physiological impact is to prevent bone resorption

These results inverted to risk factor, which is reverted that it is high in post menopause comparing with pre menopause(2.67 ± 0.85 vs. 0.54 ± 0.10) as shown in table ( ), this figure was in line with El-Desouki MI et al [15] .

The decline in estrogen levels that occurs during menopause results in a number of symptoms that accelerate bone resorption and decrease BMD, Bączyk, G [12] .

This study demonstrated an association between menopause symptoms and reduced BMD in females, which is supported by other investigations. [10-12] Therefore, in postmenopausal women, symptoms may contribute as a BMD marker. It will be simple to apply these clinical signs in a clinical context. To confirm the link between menopause symptoms and BMD in women, more research with a bigger sample size is needed. The findings will help to reduce the risk of menopause-related fractures.

Conclusion:

analysis of the total BMD, BMC and T- and Z-scores revealed that postmenopausal, were lower than those of pre-menopausal women, confirming that bone loss is a clear consequence of menopause.

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