The Comparison of the Total Body Mass between Pre and Postmenopausal Women in Mosul City

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Abstract

In this research, we discussed bone density for women taking into consideration the method of research, we measure the total body mass of women in premenopausal and comparing it with postmenopausal, since the amount of the bone mineral content and bone mineral density, fat mass and lean mass.

A cross sectional study conducted at DXA laboratory, Physiology Department, College of Medicine, University of Ninevah, Mosul-Iraq from Jan. 1 - Dec. 31, 2013. Since 174 healthy women recruited from reviewing of college medical academic center. They were divided into two groups: pre menopause group (n = 42) and post menopause group (n= 130). Detailed anthropometric data were gathered from study subjects. The mean age $\square$ SD of pre-menopause group was (43.37 $\square\square$7.49) year while the mean age $\square$ SD postmenopausal group (63.63 $\square$ 9.23) years .The T-score, Z-score, Bone Mineral Density (BMD), Bone Mineral Content (BMC), Fat Mass and Lean Mass were measured in the supine position by the use of DXA bone densitometer scanner type (STRATOS) from (DMS) group, France.

Bone Mineral Content (BMC) was significantly lower in arm, rib, and thoracic spines. Bone Mineral Density (BMD) in arm, rib, leg and total were significantly low in postmenopausal women. Non-significant differences were noticed between both groups for lean mass. Postmenopausal women having more fat mass than pre menopause group. Both T-score and Z-score for pre menopause and post menopause groups were from class of osteopenia, but it was significantly lower in post menopause group (p-value =0.001, 0.008 respectively).

Postmenopausal women were at higher risk of osteoporosis due to lowered Bone Mineral Density , T & Z scores.

Keywords: Postmenopausal, Bone Mineral Density, Fat Mass, Bone Mineral Content, T- score .

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مقارنة كتلة الجسم الكلية للنساء لفترتي قبل وبعد سن اليأس في مدينة الموصل

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الخلاصة

هدف البحث الى مقارنة الكثافة المعدنية العظمية وكتل المحتوى العظمي والشحمي والعضلي بين السيدات قبل سن اليأس والسيدات بعد سن اليأس. اجري البحث كدراسة مقطعيه في مركز الخدمات الطبية والاستشارية لكلية الطب/جامعة نينوى في سنة 2013 . اذ تضمنت عينة الدراسة 174 سيدة من السليمات ظاهريا واللاتي راجعن المركز لأغراض اخرى, حيث تم تقسيم العينة الى مجموعتين , مجموعة السيدات قبل سن اليأس ضمت 42 سيدة كان معدل اعمارهن (7.49 🞎 43.37) سنه بينما ضمت مجموعة السيدات بعد سن اليأس 130 سيدة وان معدل اعمارهن (9.23 🞎 63.63) سنه. وقد اجري للمشتركات قياس الكثافة المعدنية العظمية وكتل المحتوى العظمي والشحمي والعضلي في الجسم فضلا عن قياس معاملي T,Z باستخدام جهاز قياس هشاشة العظام (الدكسا نوع STRATOS من شركه DMD Group الفرنسية) بوضع الاستلقاء على الظهر. النتائج: أظهرت انخفاض قيمة كتلة المحتوى العظمي لعظام مناطق الأطراف العليا والاضلاع والمنطقة الظهرية عند السيدات بعد سن اليأس بالمقارنة مع السيدات قبل سن اليأس وكان الفرق ذو دلالة معنوية. وكانت قيمة الكثافة المعدنية العظمية لمناطق الاطراف العليا والسفلى والأضلاع وعموم الجسم للسيدات بعد سن اليأس أدنى مستوى بالمقارنة مع مجموعة السيدات قبل سن اليأس والفرق إحصائيا ذو دلالة معنوية. ومن ناحية الكتلة العضلية كانت الفرق غير معنوي بين المجموعتين بينما الكتلة الشحمية كانت مرتفعة بصورة معنوية عند السيدات بعد سن اليأس. , اظهرت النتائج ان قيمة T, Z لكلتا المجموعتين كانا من صنف بداية هشاشة العظام إلا أن مستوياتهما كانت قيمة ادنى وبصورة معنوية لدى السيدات اللاتي جاوزن سن اليأس الخلاصة: تزايد خطر هشاشة العظام لدى السيدات في فترة سن اليأس نتيجة انخفاض الكثافة المعدنية العظمية وكتلة المحتوى العظمي ,وكذلك قياس مؤشري T,Z.

Introduction

Osteoporosis is a common salient health problem. It is gradual decline in bone mineral density (BMD) and bone strength. It leads to a serious fracture even after trivial physical strain.
However, osteoporosis having no symptoms until a fracture occurs in the patients[1].

Bone mineral density measurement is widely used in patients for the diagnosis of osteoporosis and determination of its severity[2].

Low BMD is an important risk factor in the diagnosis and the need to assess the strength of bones assessment and its related fractures in the bones[3].

Dual energy X-ray absorptiometry (DXA) or densitometry instruments considered as a widely used, which can distinguish different body structures and have the capacity of many site measurements mainly of the lumbar spine, femur, forearm and the whole body[1].

DXA is the preferred very good method for the diagnosis of osteoporosis and monitoring BMD changes . These results can be using in prediction the risk of osteoporotic fractures, and also to know the appropriate treatments for this disease and follow the patient therapeutic. Accuracy and precision, and low radiation doses with using of DXA [2].

DXA has the advantage of measuring   many body components like (fat mass, fat-free mass and bone mineral mass) with a very well precision and minimal exposure of patients to radiation[3].
DXA is the more accurse equipment for the diagnosis of osteoporosis and monitoring the changes in BMD over the time of menopause period[4].

All postmenopausal women over the age of menopausal with a history of fractures should making DXA assessments[2].

Reducing in bone density during menopause are dependent on decreasing of estrogens levels association with the risk of osteoporosis[3].

Many studies have dealt with the fractures that occur in the area of the lumbar and femur, while fractures may occur in many places such as legs, ankles, hands and wrists. This requires us to conduct this research to find out other areas of the human body that are exposed to reducing in bone density [4-6].

Low-energy trauma fractures may occur at any time in sites like the ribs, wrist, tibia, pelvis, and knee[4, 5]. As soon as traditional fracture sites include femur, spine, and forearm.
Estimates and European studies in this period indicate that fractures have reached 3.79 million and that over 300 million people are already suffering from osteoporosis [7] .

Other studies indicate that there are more than 44 million Americans diagnosed with osteoporosis in the United States, accounting for 55% of the population over the age of 52, which affects the role of medical services and support for the injured. And 30 % percent of US women who are over menopause suffer from osteoporosis [7-9].

It is expected that the economic burden of osteoporosis and its complications will increase in the future, as life continues, as for older people who are at high risk of fracture, a growing burden may be effect on access to health care. Sources; hence, further assessment and greater research into health care associated with different types of fractures is needed[10,11].

An osteoporosis in the Peoples of Iraq was increased and has become large in population and an increasing proportion of elderly people as osteoporosis has become a big serious challenge to the Iraqi government, society[12].

In this research we discussed the subject of bone density for women taking into consideration the method of research, we measure the total body mass of women in premenopausal and comparing it with postmenopausal. Furthermore the amount of the bone mineral content and bone mineral density, fat mass and lean mass.

Material and methods

The research sample conducted as a cross-sectional study at Medical physics unite, DXA laboratory-Ninevah Medical college during the whole calendar was 2013. Ethical clearance and permission were obtained from the scientific section of medical college-Ninevah University. The subjects of the study were selected from the companion of patients who attend to the medical center of Ninevah medical college. The eligible healthy subjects who fulfill inclusion & exclusion criteria were asked voluntarily to participate in the current study. The following were excluded from the study: receiving hormonal replacement therapy in the last year before participation in the study; having history of hyperthyroidism and / or using corticosteroid therapy in the last 6 month; Having chronic kidney and liver diseases. A consent form was signed by each participant before they were enrolled in the study. The study population sample consisted of 172 women. They were divided into two groups: pre menopause group (n = 42) and post menopause group (n= 130). The mean age $\pm$ SD of pre-menopause group was (43.37 $\pm$ 7.49) year while the mean age $\pm$ SD postmenopausal group (63.63 $\pm$ 9.23) years.

An anthropometric data like weight, height, and body mass index (BMI) were gathered from study subjects. The body weight (kg) was measured by using a sensitive digital scale . Where the height (m) was measured by using a stadiometer. The body mass index (BMI) was expressed as Weight/(Height)^2 (kg/m^2).

The bone mineral density (BMD), bone mineral content (BMC), fat mass and lean mass were measured in the supine position by the use of DXA type Stratos Bone Densitometer scanner (Stratos from (DMS) group ,France). The DXA scanner will provide data about whole body & its segment (head, ribs, spine, pelvis, upper and lower extremities). The T –score and Z-score will be classified to: normal (bigger than -1.0), osteopenia (-1.0 and -2.5), and osteoporosis (-2.5 or below).

The T –score and Z-score can be calculated as [13]:

$$\text{T- Score} = \frac{\text{BMD(patient)} - \text{BMD (young adult)}}{\text{Standard Deviation}} \qquad \text{………} \quad (1)$$

$$\text{Z- Score} = \frac{\text{BMD(patient)} - \text{BMD (peers)}}{\text{Standard Deviation}} \qquad \text{………} \quad (2)$$

A patient's BMD is compared to the mean BMD of young normal of the same sex and to the mean BMD of their peers for both age and sex-matched.

All the data has been entered and processed by the use of statistical package SPSS ver. 18 (Chicago Inc., Ill).Descriptive statistical methods were used to summarize and tabulate the data. Two independent sample(t-test) was used to assess the significance of differences in mean between pre & post menopause groups. A p-value ≤0.05 was considered statistically significant.

Results

One hundred seventy two women participated in the current research consisting of (42) pre menopause and (130) post menopause women. The mean age □ SD of pre-menopause group was (43.37 □□7.49) year while the mean age □ SD postmenopausal group (63.63 □ 9.23) years. Table-1 shows no significant differences between groups regarding weight, height, and body mass index (BMI). Comparison of other anthropometric and body composition variables revealed the following: non-significant differences regarding lean mass; postmenopausal group were having more fat mass than pre menopause group (p=0.0001), T-score of both groups are from class of osteopenia, but it was significantly lower in post menopause group (p=0.001); Finally, Z-score is significantly lowered in post menopause group compared to pre menopause group (p=0.01).

Table 1- Comparison of anthropometric and body composition between pre menopause and post menopause women.

Variables	Pre-menopause N=42 Mean± SD	Post-menopause N=130 Mean± SD	P-value
Age (year)	43.37± 7.49	63.63 ± 9.23	0.0001
Weight(kg)	78.75 ±13.93	82.47 ±14.88	0.2
Height(m)	1.55 ±0.09	1.53±0.05	0.09
BMI(kg/m^2)	31.43 ±5.93	33.86 ± 6.08	0.5
Lean Mass (kg)	37.37±5.31	38.12±5.55	0.4
Fat Mass (kg)	32.79±9.64	40.14±10.19	0.0001
T-Score	-1.12±0.84	-1.52±0.84	0.001
Z-Score	-0.19±0.77	-0.76±0.84	0.01

Table- 2 and Figure -1 show the distribution of different segmental and total bone mineral content (BMC) measured by kg between pre and postmenopausal women. The results showed a significantly lower BMC of arm, rib, and thoracic spines (p=0.001, 0.01, and 0.05 respectively). The differences in the rest of segments were statistically not significant.

Table 2- Comparison of segmental and total Bone Mineral Content BMC measured for pre and post menopause women groups.

| Variables	Pre menopause N=42 Mean± SD	Post menopause N=130 Mean± SD	95% CI of Difference N=172 Min-max	P-value
Head BMC, Kg	0.38±0.07	0.37±0.15	-0.04 -0 .05	0.1
Arm BMC, Kg	0.26±0.08	0.22±0.04	0.01-0.05	0.001
Rib BMC, Kg	0.33±0.17	0.28±0.07	0.01-0.09	0.01
Thoracic BMC, Kg	0.15±0.19	0.10±0.02	0.01-0.08	0.005
Lumbar BMC, Kg	0.04±0.01	0.04±0.01	0.00-0.01	0.1
Pelvis BMC, Kg	0.28±0.06	0.27±0.05	-0.01-0.02	0.5
Leg BMC, Kg	0.72±0.12	0.69±0.10	-0.00-0.07	0.1
Total BMC, Kg	1.72±0.31	1.63±0.29	-0.01- -0.19	0.1

Error bars: +/- 2 SD
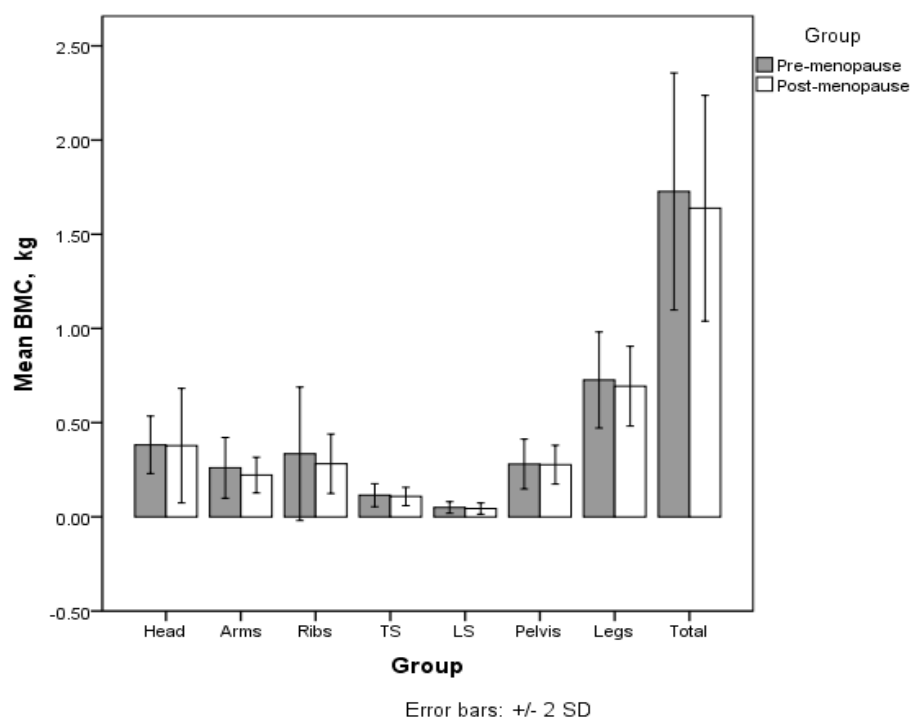
Figure 1- Graphical plot showing segmental (i.e., Head, Arms, Ribs, Thoracic Spine, Lumbar Spine, Pelvis, and Legs) and Total Bone Mineral Content BMC for both pre menopause and post menopause women groups. Noted that TS and LS represents thoracic spine and lumbar spine respectively.

The bone mineral density (BMD) of different segments of the body revealed that maximum density is seen in head and the minimum density is seen in the ribs regardless to the study group. Comparison of both groups revealed a significant lower BMD of arm, rib, leg, and total in postmenopausal women in comparison to premenopausal group (see Table-3 and Figure-2). The rest of the segments show non-significant differences in between both groups of the study.

Table 3- Comparison of segmental and total Bone Mineral Density BMD measured for pre and post menopause women groups.

Variables	Pre menopause N=42 Mean± SD	Post menopause N=130 Mean± SD	95% CI of Difference N=172 Min-max	P-value
Head BMD, gm/cm^2	1.55±0.27	1.52±0.19	-0.04 -0.10	0.5
Arm BMD, gm/cm^2	0.76±0.08	0.69±0.09	0.03 -0.10	0.0001
Rib BMD, gm/cm^2	0.70±0.11	0.66±0.09	0.00 -0.07	0.05
Thoracic BMD, gm/cm^2	1.00±0.14	1.01±0.14	-0.06 -0.03	0.5
Lumbar BMD, gm/cm^2	1.08±0.21	1.03±0.17	-0.01 -0.11	0.1
Pelvis BMD, gm/cm^2	1.02±0.13	0.99±0.14	-0.02 -0.07	0.5
Leg BMD, gm/cm^2	0.96±0.09	0.90±0.10	0.02 -0.09	0.001
Total BMD, gm/cm^2	0.88±0.09	0.83±0.09	0.01-0.08	0.005
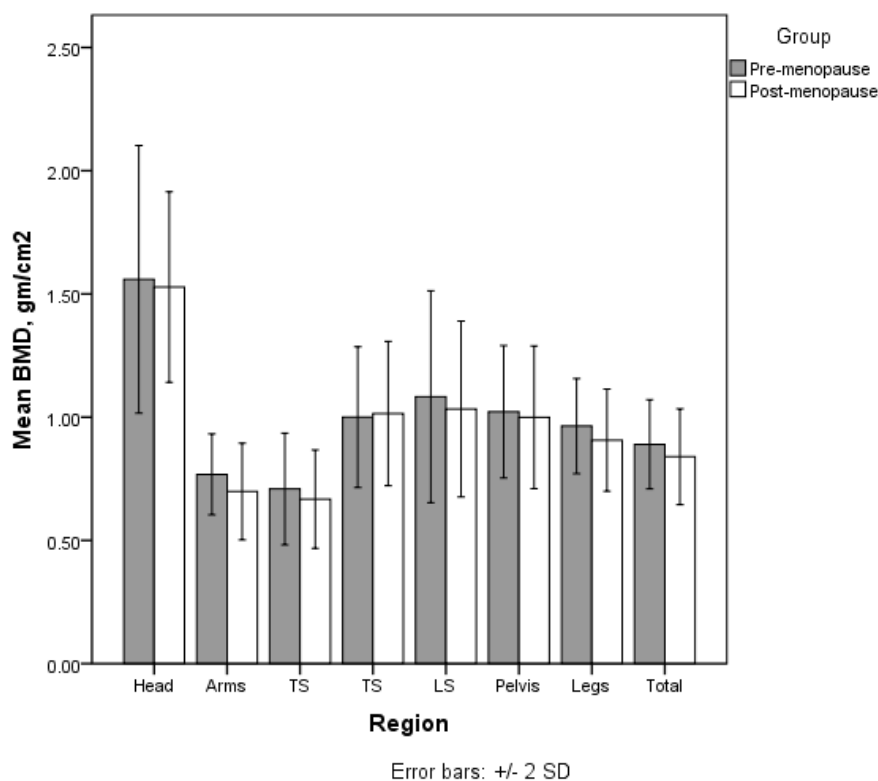
Figure 2- Graphical plot showing segmental (i.e., Head, Arms, Ribs, Thoracic Spine, Lumbar Spine, Pelvis, and Legs) and Total Bone Mineral Density (BMD) for both pre menopause and post menopause women groups. Noted that TS and LS represent thoracic spine and lumbar spine respectively.

Table- 4 and Table-5 show the distribution of weight masses of the body. There were no statistical differences in lean mass between both groups of the study as shown in Table-4. Opposite to it, fat mass was significantly higher in postmenopausal women as shown in Table-5.

Table 4-Lean Anthropometric and body composition variable showing none significant Segmental and Total Lean Mass measured for pre and post menopause women groups.

Variables	Pre-menopause N=42 Mean± SD	Post-menopause N=130 Mean± SD	95% CI of Difference N=172 Min-max	P-value
Lean Arm, Kg	4.32±0.70	4.49±0.82	-0.44 - 0.11	0.1
Lean Rib, Kg	11.0±11.72	11.40±1.83	-1.02 - 0.24	0.1
Lean TS , Kg	1.39±0.27	1.30±0.24	-0.00 - 0.17	0.1
Lean LS, Kg	0.63±0.11	0.63±0.15	-0.05 - 0.05	0.1
Lean Pelvis, Kg	6.93±1.01	7.02±1.15	-0.48 - 0.30	0.5
Lean Leg, Kg	13.06±2.17	12.93±3.17	-0.09 – 1.16	0.1
Lean Total, Kg	37.37±5.31	38.12±5.55	-2.67 – 1.17	0.5

Table 5- Fat Anthropometric and body composition variable showing none significant Segmental and Total Fat Mass measured for pre and post menopause women groups.

Variables	Pre menopause N=42 Mean± SD	Post menopause N=130 Mean± SD	95% CI of Difference N=172 Min-max	P-value
Fat Arm, Kg	3.49±0.93	4.42±1.17	-1.32 - -0.53	0.0001
Fat Rib, Kg	8.81±2.66	11.54±3.56	-3.91 - -1.55	0.0001
Fat Thoracic , Kg	0.96±0.34	1.08±0.29	-0.22 - -0.01	0.01
Fat Lumber, Kg	0.46±0.12	0.59±0.19	-0.18 - -0.06	0.0001
Fat Pelvis, Kg	6.46±2.14	7.84±2.24	-2.15 - -0.59	0.001
Fat Leg, Kg	12.56±4.26	14.54±3.71	-3.33 - -0.63	0.005
Fat Total, Kg	32.79±9.64	40.14±10.19	-10.87 - -3.82	0.0001

Discussion

This study provides new insight into the differences between pre and postmenopausal Iraqi women regarding their bone density. Previous studies used either less accurate methods like quantitative ultrasound Ninevah [14] and Digital x-ray radio grametry[15], or more advanced and invasive Quantitative computed tomography QCT-scan[16]. In this study, we used the advanced Dual energy X ray Absorptiometry (DXA) technique to analyze body composition. Since, it is a simple to apply used minimum dose of X-ray, that provides most accurate assessment of bone status [17].

The findings of the current study of total BMD, and consequently T-score and Z-scores were significantly low for postmenopausal women in comparison to pre-menopausal women which confirm the fact that bone loss is a direct effect of menopause[18]. Conclude that bone mass decrease by 1% per year from midlife onwards. The total BMC was not-significantly differ between both groups of the study. This may be attributed to significant lower segmental BMC in some areas (arms, ribs, thoracic, and lumbar) and non-significant differences in segmental BMC of other areas (head, pelvis, and legs). These differences buffer each other to yield non-significant difference in total BMC between pre and postmenopausal women. The BMD, T & Z scores obtained by different techniques and different sites yield different figures. This makes comparison of results of different studies difficult. Furthermore, variation in demographic characteristics of studied samples add more difficulty to this cumbersome task.In general, the lower bone status indices of post-menopausal women are consistent with previously published studies [19-21].

T-score found in the current study was close to the figure reported by Grażyna Bączyk, et al [22], which shows that their study about the risk factors for reduced bone mineral density (BMD) among postmenopausal women, found that BMD in femoral neck was 0.59 gm/cm^{2}and in hip total was 0.58 gm/cm^2 . This figure is slightly lower than BMD reported in the current study. The difference may be attributed to older age of the studied sample[23]. Any factor may probably be behind the lower reported BMC of both pre and postmenopausal women like restricted calcium intake due to bad eating habit. As well as the deficiency of vitamin D taken from the sun, which reduces the amount of exposure to sun from wearing long sleeves and long skirt [24], and lastly, restricted physical exercise as a consequence of social barriers[25].

Neither BMI nor lean mass affected by the transition from pre to post menopause periods. On the other hand, menopausal period witness dramatic rise in both central (thoracic, lumbar, pelvis, and legs) and total fat mass. This is in agreement with the conclusion of Van der Leeuw Jet al [26] and Hassanali Vatanparas [27]. Since postmenopausal women show a steeper increase in visceral adipose tissue and a steeper decrease in subcutaneous adipose tissue. These ongoing changes might add to an unfavorable metabolic profile associated with an increased risk of recurrent cardiovascular events Van der Leeuw J [26].

Conclusion

Comparison of the anthropometric and body composition variables revealed that non-significant differences regarding lean mass; postmenopausal group were having more fat mass than pre

menopause group, T-score of both groups are from class of osteopenia, but it was significantly lower in post menopause group. Finely, Z-score was significantly lowered in post menopause group compared to pre menopause group. Total bone mineral content for postmenopausal women shows significantly lower in arm, rib, and thoracic spines. The differences in the rest of the segments were statistically not significant.

The bone mineral density BMD of different segments of the body revealed that maximum density is seen in head and the minimum density is seen in the ribs regardless to the study group. Comparison of both groups revealed a significantly lower BMD of arm, rib, leg, and total in postmenopausal women in comparison to premenopausal group. The rest of the segments show non-significant differences between both groups of the study.

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