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Original article

Assessment of Osteoporosis Markers among Post-Menopausal Women at Sabratha Teaching Hospital, Western Libya

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Abstract
Osteoporosis is a prevalent health issue that primarily affects older women and is characterized by reduced bone mass and an increased risk of fractures, particularly among postmenopausal women. This study aimed to assess osteoporosis markers—including serum calcium, parathyroid hormone (PTH), vitamin D levels, and bone mineral density (BMD) via DEXA scan—among postmenopausal women at Sabratha Teaching Hospital, western Libya. A descriptive, analytical, community-based study was conducted on 40 postmenopausal women aged >45 to 70 years at Sabratha Teaching Hospital between June and November 2023. Serum calcium levels were measured using a fully automated spectrophotometer (Model 4040), while PTH and vitamin D levels were assessed using the Cobas e411 analyzer. BMD was evaluated using dual-energy X-ray absorptiometry (DEXA scan) at Al-Shroug Medical Center in Tripoli. Demographic and biochemical data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 25. Among the participants, 42.5% had normal serum calcium levels, and 57.5% had normal PTH levels. Notably, 92.5% (37 out of 40) of the women exhibited vitamin D deficiency. Additionally, 65% were found to have osteoporosis based on DEXA scan results. BMD assessment using DEXA scan at the lumbar spine revealed that only one woman had a normal BMD, while 65% (26 out of 40) were diagnosed with severe osteoporosis. These findings highlight a high prevalence of both vitamin D deficiency and osteoporosis among postmenopausal women in the studied population.
Keywords. Osteoporosis, Postmenopausal Women, DEXA Scan, Vitamin D, Libya.

Introduction

Osteoporosis is a common, progressive systemic skeletal disease characterized by low bone mass and deteriorated bone tissue, leading to increased bone fragility and susceptibility to fractures [1]. It is well documented that osteoporosis mainly affects older adults, with a higher prevalence among women [2]. In particular, postmenopausal women are at a higher risk than other women, with one-half of all postmenopausal women experiencing osteoporosis [3]. Osteoporosis-associated fractures often cause a significant increase in morbidity, mortality, and accompanying social and economic costs [4]. By estimation, about 50% of postmenopausal caucasian women and 20% of Caucasian men in the US will suffer at least one fragility fracture after the age of 50 [5]. With life expectancy increasing universally, osteoporosis and fractures will become an ever-growing health problem worldwide [6]. Osteoporosis is a silent disease because bone loss occurs or bone tissue deteriorates without any symptoms [6]. Patients often are not aware that they have osteoporosis until a fracture occurs. Thus, correctly diagnosing osteoporosis and identifying individuals who will sustain osteoporotic fractures is critical for the prevention of devastating fracture outcomes in the aging population. As Bone Mineral Density (BMD) is the single strongest predictor of primary osteoporotic fracture [7], clinical osteoporosis diagnosis is based on BMD measurements from dual-energy x-ray absorptiometry (DEXA) assessment [8]. Currently, the recommended method for the diagnosis of osteoporosis is bone mineral density measurement by dual-energy X-ray absorptiometry (DEXA), especially in the hip [9]. Women are at a significantly higher risk of developing osteoporosis compared to men due to a combination of anatomical, hormonal, and lifestyle factors. Women generally have lower peak bone mass as compared to men, making them more vulnerable to bone loss as they age. Hormonal fluctuations throughout a woman's life contribute substantially to the risk of osteoporosis. Estrogen, which plays a crucial role in maintaining bone density, declines sharply during menopause, leading to an accelerated rate of bone resorption [10].

Globally, osteoporosis is a significant public health concern, particularly among women. It is estimated that over 200 million people worldwide suffer from osteoporosis, with women comprising approximately 80% of this population. The increasing life expectancy and changing lifestyle patterns contribute to the rising incidence of osteoporosis, making it a major health issue globally [11]. Multiple investigations have demonstrated a reduction of Bone Mineral Density (BMD) in individuals with Parathyroid hormone (PTH) typically serves as the primary controller of calcium balance and primarily affects the kidneys and bones. It enhances the reabsorption of calcium in kidney cells and promotes the conversion of 25-hydroxy vitamin D to 1,25-dihydroxyvitamin D via activating 1,25-hydroxylase. In Primary Hyperparathyroidism, there is an

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excessive production of PTH, which results in higher amounts of calcium in the bloodstream as a result of its release from the bone reservoirs. Studies have demonstrated that this leads to an elevated Susceptibility to osteoporosis due to the accelerated pace of bone remodeling [12].

The World Health Organization established commonly accepted definitions of osteoporosis as a femur neck BMD that lies -2.5 standard deviations below (T-score ≤ 2.5) the mean value for young healthy women. This definition becomes the WHO international reference standard for osteoporosis diagnosis. In addition, because many other risk factors, including age, female gender, and previous fracture, are associated with fracture risk independently of BMD, several predictive models have been developed to estimate fracture risk from these established risk factors [7].

Therefore, the main objective of this study was to assess osteoporosis markers—including serum calcium, parathyroid hormone (PTH), vitamin D levels, and bone mineral density (BMD) via DEXA scan—among postmenopausal women at Sabratha Teaching Hospital, Western Libya.

Materials and Methods

In this descriptive analytical community-based study, a total of forty (40) post-menopausal women were enrolled in this study, their aged more than 45 years. This study was conducted at Sabratha Teaching Hospital, during the period from June to November 2023, in Western Libya. The demographic data (age, duration, disease, etc.) was collected by using a structured questionnaire. Under complete a septic condition 70% ethyl alcohol, (4ml) venous blood samples were collected, (2ml) in lithium heparin container to obtain plasma for determination of Vitamin D and Parathyroid Hormone (PTH) level by using fully automated analyzer (Cobas e411) and (2ml) in a plain container to obtain serum for measurement of calcium level by using Spectrophotometer (Model 4040) and (Dual-Energy X-ray Absorptiometry) DEXA Scan also was be done at Al-Shroug Medical center-Tripoli, Dexa scan of the left hip and lumbar spine was performed using a pencil beam Nor land (XR-46) densitometry with host software version. Average Bone Mineral Density (BMD) is expressed in grams per square centimeter. The Dexa T-score was calculated on the basis of the reference database. The diagnostic criteria established by the World Health Organization (WHO) in adults were used [9]. Osteoporosis and osteopenia are defined as a BMD T-score of -2.5 and between -1 <-2.5, respectively [10]. Since diagnosis of osteoporosis by DEXA is based on a T-score at −2.5 or below at any of the recommended sites (lumbar spine, femoral neck, or total hip), the lowest T-score was taken to dichotomously assign each result to a non-osteoporotic or osteoporotic group.

Ethical consideration

Approval was taken from the faculty of public health, Al-Jemail, Sabratha University, and verbal informed consent was also taken from all participants before sample collection, and information was used anonymously**.**

Statistical analysis

Statistical analysis was performed using Microsoft Excel and the Statistical Package of Social Sciences (SPSS) version 25, and p- p-value ≤ 0.05 was considered statistically significant.

Results

According to the data, 50% of patients fall between the ages of 51 to 60 years, additionally, 32.5% of patients their aged less than or equal to 50 years, and 17.5% of them are over 61 years. (Table 1). According to the data, 17.5% of patients they exposed to sunlight in the morning hours (Table 2). The mean of Serum Calcium is 8.05 mg/ml with standard deviation 1.31, ranging from 3.9 to 10, the mean of PTH is 45.71 mg/ml with standard deviation 26.01, ranging from 7.5 to 85, additionally, the mean of Vitamin D level is 18.47 mg/ml with standard deviation 8.13, ranging from 6 to 42.2. (Table 3). According to the data, 42.5% of patients had normal serum calcium, 57.5% had normal PTH, 7.5% had normal Vitamin D level, and 65% had Dexa Osteoporosis (Table 4).

Distribution of Postmenopausal Women according to age group with parameters as (Serum Calcium, PTH, and Vitamin D level) (Table 5).

Table (1). Distribution of Age among the Study Population

Age	Frequency	percentage
< 50 years	13	32.5%
51 – 60 years	20	50.0%
61 – 70 years	7	17.5%

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Table (2). Exposure to sunlight in the morning hours, the length of the complaint from the disease, and the Duration of the drug you have been taking. Do you expose yourself to the sunlight in the morning hours? (N =40)?

Variable	Frequency	Percentage
Exposure to the sunlight	7	17.5%
Non-exposure to the sunlight	33	82.5%
Total	40	100/0%

Table (3). Descriptive statistics for investigations among the study population

Variables	No	Minimum	Maximum	Mean	Std. deviation
Calcium	40	3.90	10.00	8.05	1.31
PTH	40	7.50	85.00	45.71	26.10
Vitamin D	40	6.00	42.20	18.47	8.13
Dexa scan	40	- 9.00	1.10	- 3.45	1.48

Table (4). Serum Calcium, PTH, Vitamin D level, and DEXA Scan among the study population

Calcium	PTH	Vitamin D	Dexa scan
Normal (n=17) = 42.5%	Normal (n=23) = 57.5%	Normal (n=3) = 7.5%	Normal (n=1) = 2.5% Osteopenia (n=13) = 32.5%
Abnormal (n=23) = 57.5	Abnormal (n=17) = 42.5%	Abnormal (n=37) = 92.5%	Severe Osteoporosis (n=26) = 65.0%

Table (5). Distribution of Postmenopausal Women according to age group with parameters as (Serum Calcium, PTH, and Vitamin D level)

Variables			Age			Total
			<=50 years	51-60 years	61-70 years	
Serum Calcium	Normal	N	5	8	4	17
		%	12.5%	20.0%	10.0%	42.5%
	Abnormal	N	8	12	3	23
		%	20.0%	30.0%	7.5%	57.5%
PTH	Normal	N	8	14	2	23
		%	20.0%	35.0%	5.0%	57.5%
	Abnormal	N	5	6	5	17
		%	12.5%	15.0%	12.5%	42.5%
Vitamin D level	Normal	N	1	2	0	3
		%	2.5%	5.0%	0.0%	7.5%
	Abnormal	N	12	18	7	37
		%	30.0%	45.0%	17.5%	92.5%

Chi-square test was conducted at a 0.05 significance level.

Discussion

Osteoporosis is a major public health problem, particularly among women undergoing menopausal and postmenopausal who are under a significantly higher risk of developing osteoporosis due to hormonal changes leading to accelerated bone resorption (Abhyuday Verma, et al, 2025) [10], Karlamangla AS, et al, 2018) [13]. The current study involved forty post-menopausal women who were classified into three age-groups (<50, 51-60, 61-70 years). The second age group (51-60 years) represents a high percentage of 50%. Moreover, the mean of Serum Calcium is 8.05 mg/dl, which is below the reference value, with a range from (3.9 to 10 mg/dl), and decreased in 23/40 (57.5%), as previously studied (Abhyuday Verma, et al, 2025) [10]. The comparative research study revealed a low mean calcium level in postmenopausal 7.6 ± 1.12 mg/dl, as well as of their comparative study had reported decreased serum calcium levels in postmenopausal women than premenopausal women (8.96±0.66, 9.49±0.63), respectively. (Chetana K Patwa et al, 2017) [14].

In Addison, our study revealed that the mean of PTH is 45.71 mg/ml with a range from (7.5 to 85 mg/ml), which decreased in 23/40 (57.5%) of the postmenopausal women; they had normal PTH, and decreased in 17/40 (42.5%) of them. In this study, the mean of vitamin D level was 18.57ng/ml, which showed a deficiency below (20ng/ml) in the majority 37/40 (92.5%) of the postmenopausal women, indicating a significantly higher number of postmenopausal women were found with vitamin D deficiency. Some studies with similar findings of vitamin D deficiency in postmenopausal women were also reported by Khan et al

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[15], and Siregar et al [16]. Vitamin D is an essential element for bone health. Having lower levels of vitamin D may be attributed to a long period of stay at home. Furthermore, might also have less physical activity; notably, low physical activity is a risk factor for osteoporosis [16].
Concerning the Body Mineral Density (BMD) was assessed using dual-energy x-ray absorptiometry DEXA scan at the lumber spine, the study found only one postmenopausal woman had normal BMD and 26 (65%) had osteopenia followed by 13(32.5%) observing osteoporosis, while a study of prevalence percentage by (Abhyuday Verma, et al, 2025)[10] reported 6/30 (20%) had osteopenia and high percentage for osteoporosis 19/30 (63.3%) and 5/30 (16%) had normal BMD, whereas Elmasry, et al, [9] had found high percentage in osteopenia 46.2% and 29.6% for osteoporosis. Moreover, other extra reports of high prevalence of osteoporosis were mentioned by Ji, et al [17], Sanders et al [18].

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Conflicts of Interest
The authors declare no conflicts of interest.

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