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DETERMINANTS OF OSTEOPOROSIS AMONG POSTMENOPAUSAL WOMEN: A CROSS-SECTIONAL STUDY IN BAGHDAD, IRAQ

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ABSTRACT

Background: Osteoporosis is a progressive skeletal disease characterized by low bone mineral density (BMD) and increased fracture risk. It is a major public health concern in Iraq, particularly among postmenopausal women due to age, lifestyle, and cultural factors affecting vitamin D and calcium levels. **Objective:** To determine the prevalence and key determinants of osteoporosis among postmenopausal women attending the DEXA unit in Baghdad's Medical City in 2023. **Methods:** An analytic cross-sectional study was conducted from February to June 2023 on 212 postmenopausal women aged ≥42 years. Data were collected through structured interviews covering socio-demographic factors, lifestyle habits, medical history, and reproductive characteristics. Physical activity was assessed across five domains using a Likert-based questionnaire. Serum vitamin D levels were extracted from laboratory reports. Bone mineral density was measured at the lumbar spine and hip using dual-energy X-ray absorptiometry (DEXA) and categorized according to WHO criteria. Data analysis was performed with SPSS v26 using Chi-square, t-test, and ANOVA, with significance set at $p<0.05$. **Results:** The prevalence of osteoporosis was 46.2%, while 32.5% had osteopenia. Older age (≥60 years), longer duration of menopause, being a housewife or retired, inadequate daily sunlight exposure (<30 minutes), and poor physical activity were significantly associated with osteoporosis ($p<0.05$). Vitamin D levels and comorbidities showed no significant associations. **Conclusion:** Osteoporosis is highly prevalent among postmenopausal Iraqi women. Preventive strategies should focus on promoting safe sunlight exposure, physical activity, lifestyle modifications, and early screening with DEXA to reduce future fracture risk and healthcare burden.

KEYWORDS: Osteoporosis, Postmenopausal, Women.

INTRODUCTION

Osteoporosis means that the bone becomes pored with under-mineralization and loss of strength; it is a widespread aging skeletal disease. It is considered a common public health disease in Middle Eastern countries in comparison to the Western world.[1] The lack of registration of osteoporosis and osteoporotic fractures in the Middle East and Iraq comprises sources of data, in addition to the modernization of Iraqi society and changes in the dietary patterns towards consuming junk food in addition to declining levels of physical activity, especially among postmenopausal women with reduced sunlight exposure resulting from Iraqi women culture of wearing long sleeves dressings, also, covering head and neck are causing limitation in the conversion of the inactive form of cutaneous vitamin D to the active form of it.[2] Osteoporosis is an ancient disease since Egyptian mummies about 4000 years ago discovered with telltale dowager‹s hump. In the 1830s French pathologist, Jean Lobstein saw variable sizes of abnormally riddled holes in bones and used the term osteoporosis for such deterioration of human bones, while in 1930 Fuller Albright of Massachusetts General Hospital noticed that postmenopausal women's bones were frail and fragile.[2] In the 20th century, the perception of osteoporosis changed from an unavoidable disease resulting from aging to a preventable and treatable one by making a clinical definition for the disease and describing its causes.[3] In the 21st century, a full understanding is that pain and physical disability worldwide are mainly caused by bone and joint diseases, hence the WHO declared that the first decade of this century (the bone and joint decade

2000-2010).[4] Aims of the study to Determine the effect of risk factors on the prevalence of osteoporosis in postmenopausal women in Baghdad in Medical City 2023.

METHOD

An analytic cross-sectional study was carried out at the Medical City, Consultation Department/Baghdad Hospital, Unit of DEXA examination, from 1 February to 30 June 2023. The study population consisted of postmenopausal women aged ≥42 years consulting the DEXA unit during the study period. Sampling was performed conveniently.

Data Collection: A structured questionnaire was administered through direct interviews. It consisted of two sections: Section one covered socio-demographic data (age, age of menopause, education, occupation, marital and parity status), lifestyle factors (smoking, sunlight exposure, dietary habits, physical activity, use of hormonal therapy), medical history (fractures, comorbidities, medications, family history of osteoporosis), and anthropometric measures (height, weight, BMI). BMI was categorized as underweight (<18.5 kg/m²), normal (18.5–24.9), overweight (25–29.9), and obese (≥30).[57] Serum vitamin D levels were recorded from patient laboratory reports, classified as sufficient (≥50 nmol/L), insufficient (25–50), and deficient (<25).[5] Section two assessed physical activity during the past year across five domains: walking/bending/transfer (14 items), daily activities (3), fear of fall (4), body image (3), and independence (3). Responses were scored on a 5-point Likert scale. The total score ranged from 27–135; domains were dichotomized into "good" or "poor" activity based on median cut-offs.[6] Diagnostic Tool: Bone mineral density was measured using dual-energy X-ray absorptiometry (DEXA) at the lumbar spine and hip. Results were expressed as T-scores and Z-scores. Osteoporosis was defined as T-score ≤ −2.5, osteopenia as −1.0 to −2.5, and normal as ≥ −1.0, in line with WHO criteria.[7]

Definitions: Parity was categorized as nullipara (0), primipara (1), multipara (2–4), and grand multipara (≥5).[8] Optimal sunlight exposure was considered ≥30 minutes/day.[5]

Statistical Analysis: Data were analyzed using SPSS v26. Continuous variables were presented as mean ± SD, with comparisons made by t-test and ANOVA. Categorical variables were analyzed using Chi-square and Fisher's exact tests. Significance was set at $p<0.05$.

Ethical Considerations: Approvals were obtained from the College of Medicine/University of Baghdad and the Ministry of Health. Informed consent was secured from all participants.

RESULTS

The current study was included 212 women with an average age of 63 (±9) years and ranged from 42 to 86 years. The data showed that about two-thirds of the participants were aged 60 years or more while 25.9% of the women were aged 50 – 59 years. All of the study group were urban residents; however, 59.9% of them were illiterate. The majority of the surveyed women were housewives and 97.6% of them were married with an obvious tendency to have two or more deliveries. About one in every ten women were current smokers and most of them were overweighed or obese. As shown in (Table 1).

Table 1: Socio-demographic characteristics of participants (n=212).

Variables	
Age groups	<50 years
	50 - 59 years
	60+
Education level	Illiterate
	Primary
	Intermediate
	Secondary
	Bachelor degree
	Post-graduate
Occupation	Employee
	Housewife
	Retired
Marital status	Married
	Unmarried
Parity	Nulliparous
	Unipara
	Multipara
	Grand-Multipara
Smoking status	Smoker
	Non-smoker
Body mass index categories	Normal
	Overweight
	Obese

The Dexa scan for the 212 women revealed that; about one-half of the women 46.2% were classified as osteoporosis and 32.5% were classified as osteopenia. (Figure 1).

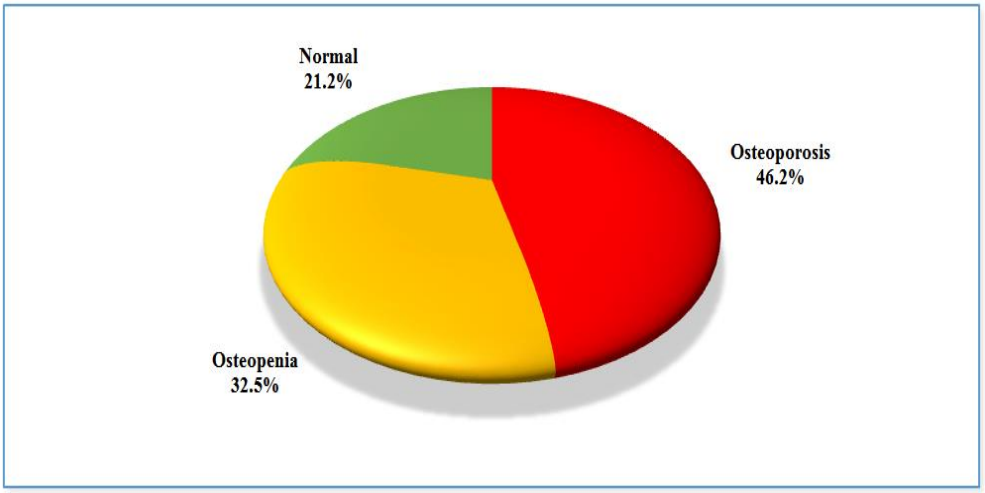

Figure 1: Bone density categories of the study group as detected by Dexa scan, n=212.

The prevalence of osteoporosis among women aged <50 was 2% and those aged 50-59 years 18.3% while it was 79.5% among older women and that showed a significant association between the age and osteoporosis, P=0.001. Housewives had significantly a higher prevalence of osteoporosis in comparison with retired and employed women (83.6%, 11.2% and 5%) respectively, P=0.039. Other characteristics did not show any similar association. The duration from menopause among women with osteoporosis was significantly longer than their comparatives (16±9 years vs. 11.8±8.6; P=0.001). Sunlight exposure showed a significant relation with osteoporosis in this study as the prevalence increases among women with less than 30 minutes of daily sunlight exposure (65.3% vs. 41.2%; P<0.001). Those who didn't use sunscreen had osteoporosis more than others (96%), medications for other diseases associated with high percentage (90.8%) while hormonal therapy had no relation with the disease. In addition, vitamin D levels did not show any effect on osteoporosis. The prevalence of osteoporosis appeared to be significantly affected by physical inactivity during the last year, osteoporosis was significantly more prevalent among women with poor daily physical activity compared to those with good activity (61.2% vs. 38.7%, P=0.002). On the other hand; neither fear of falls nor independence of the studied sample had any relation with osteoporosis. As shown in **(Table 2)**.

Table 2: Association of osteoporosis with selected determinants.

Variables		Osteoporosis				P value
		Yes n=98		No n=114		
		No.	%	No.	%	
Age groups	<50 years	2	2	13	11.4	0.001*
	50 - 59 years	18	18.3	37	32.4	
	60+	78	79.5	64	56	
Education level	Primary or lower	78	79.5	92	80.7	0.957
	Intermediate/Secondary	13	13.2	15	13	
	Bachelor or above	7	7	7	6	
Occupation	Employee	5	5	8	7	0.039*
	Housewife	82	83.6	103	90.3	
	Retired	11	11.2	3	2.6	
Marital status	Married	95	97	112	98.2	0.532[f]
	Unmarried	3	3	2	1.7	
Parity	Nulliparous	5	5	6	5.2	0.085
	Unipara	7	7	2	1.7	
	Multipara	18	18.3	34	29.8	
	Grand-Multipara	65	66.3	70	61.4	
Smoking status	Yes	8	8	10	8.7	0.874
	No	90	91.8	104	91.2	
	Underweight	1	1	0	0	
Body mass index	Normal	17	17.3	12	10.5	0.307
	Overweight	26	26.5	29	25.4	
	Obese	55	56	73	64	

Variables		Osteoporosis				P value
		Yes n=98		No n=114		
		Mean	SD	Mean	SD	
Duration of menopause (years)		16	9	11.8	8.6	0.001*
		No.	%	No.	%	
Daily sunlight exposure	<30 minutes	64	65.3	47	41.2	<0.001**
	30+ minutes	34	34.6	67	58.7	
Using sunscreen	Yes	4	4	3	2.6	0.556 [f]
	No	94	96	111	97.3	
Used medications	Yes	89	90.8	94	82.4	0.077
	No	9	9	20	17.5	
Hormonal therapy	Never	78	79.5	86	75.4	0.516
	Previous	14	14.2	16	14	
	Current	6	6	12	10.5	
Vitamin D Levels	Low	32	32.6	27	23.6	0.549
	Inadequate	23	23.4	30	26.3	
	Adequate	40	40.8	53	46.4	
	High	3	3	4	3.5	

Domains of physical activity		Osteoporosis				P value
		Yes n=98		No n=114		
		No.	%	No.	%	
Physical activity during the last year (Domain 1)	Good	66	67.3	96	84.2	0.004*
	Poor	32	32.6	18	15.7	
Daily Physical activities (Domain 2)	Good	38	38.7	68	59.6	0.002*
	Poor	60	61.2	46	40.3	
Fear of fall (Domain 3)	Good	63	64.2	86	75.4	0.076
	Poor	35	35.7	28	24.5	
Body Image (Domain 4)	Good	86	87.7	110	96.4	0.016*
	Poor	12	12.2	4	3.5	
Independence (Domain 5)	Good	67	68.3	86	75.4	0.252

SD: standard deviation; *Significant at 0.05 level by independent t-test; ** Significant at 0.01 level by Pearson's chi-square test, [f] Fisher exact test

The symptoms that had been reported by the study group did not show any significant association with osteoporosis, nevertheless, joint stiffness was significantly less prevalent among women with osteoporosis (64.3% vs. 78.9%; P=0.018). No significant association between osteoporosis and other comorbidities in the study group **(Table 3)**.

Table 3: Symptoms and comorbidities associated with bone density status.

Symptoms	Osteoporosis				P value
	Yes n=98		No n=114		
	No.	%	No.	%	
Backache	93	94.9	107	93.9	0.744
Stiffness	63	64.3	90	78.9	0.018*
Sleep disturbances	75	76.5	91	79.8	0.562
Depression	5	5.1	4	3.5	0.566 [f]
Fatigue	70	71.4	86	75.4	0.509
Other	18	18.4	19	16.7	0.745

Comorbidities	Osteoporosis				P value
	Yes n=98		No n=114		
	No.	%	No.	%	
Hypertension	68	69.3	68	59.6	0.14
Diabetes Mellitus	27	27.5	33	29	0.822
Surgery	49	50	47	41.2	0.201
IBS	33	33.6	31	27	0.305
Asthma	7	7	4	3.5	0.234

Thyroid	7	7	11	9.6	0.514
Rheumatoid arthritis	9	9	7	6	0.403

The vitamin D level of the studied women was also checked and the mean level was 20 (±12) ug/dl, the median level was 18 ug/dl and ranged from 5 to 70ug/dl. And according to the cut-off levels the women were classified as shown in **(Figure 2**).

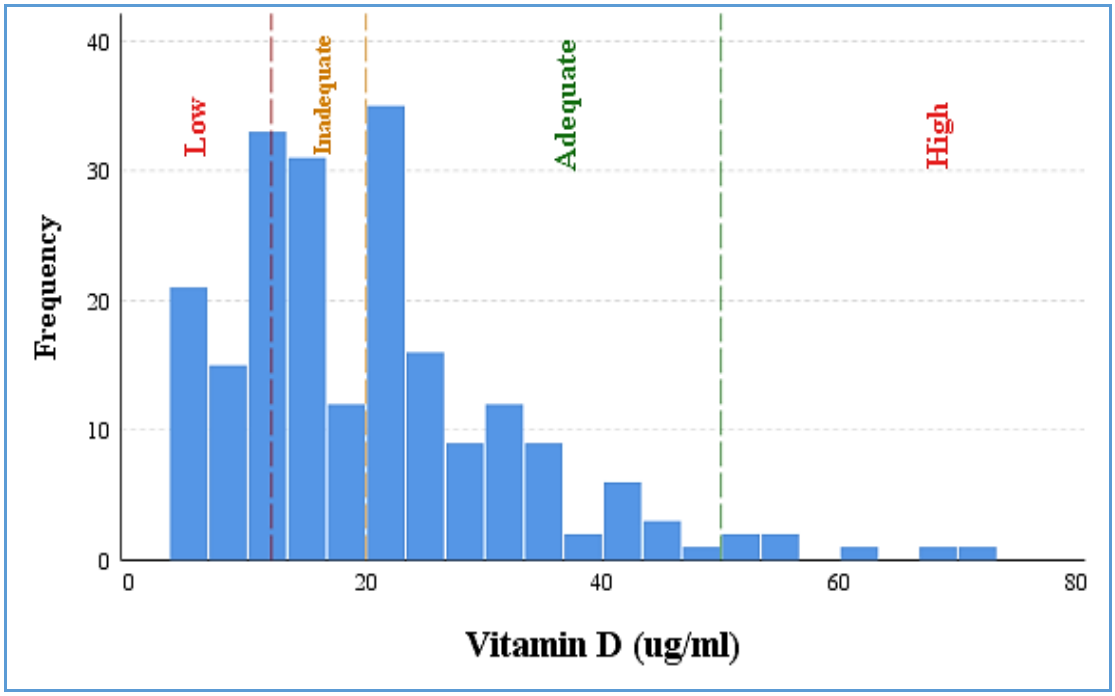

Figure 2: Vitamin D levels among the participants.

Figure 3 shows that; in general, there was a significant difference in the mean age according to diagnosis by Dexa scan (P<0.001). The women diagnosed with osteoporosis were significantly older than those diagnosed with osteopenia (65.2 ± 8 vs. 61.4 ± 8, P=0.006) as well as normal women (65.2 ± 8 vs. 59.2 ± 11, P<0.001). On the other hand, the age of the women with osteopenia did not significantly differ from the normal group.

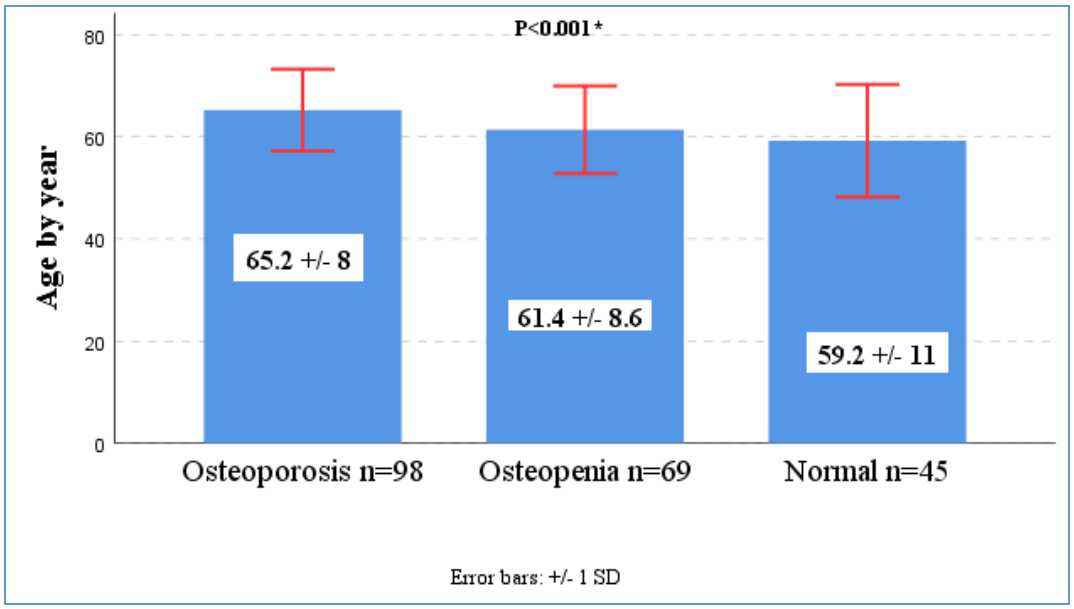

Figure (3): Comparison of age among women according.
Figure 3: difference in the mean age according to diagnosis by Dexa scan (P<0.001).

DISCUSSION

The present study assessed the determinants of osteoporosis among postmenopausal women attending the DEXA unit in Baghdad/Medical City. The findings revealed a high prevalence of bone density disorders, with 46.2% of participants diagnosed with osteoporosis, 32.5% with osteopenia, and only 21.2% maintaining normal bone density. These results underscore the significant burden of osteoporosis in this population and align with both national and regional data, where high prevalence rates have been reported among women of similar age groups.[9-12]

Socio-demographic characteristics: showed that most affected women were aged 60 years or more, highlighting the role of advancing age as a strong determinant of bone loss. The relationship between older age and osteoporosis is well established, as aging is accompanied by cumulative bone resorption, reduced bone formation, and a decline in estrogen after menopause, which accelerates bone turnover.[13,14] Longer duration of menopause, as observed in our data, further intensified the risk, consistent with the biological mechanism of prolonged estrogen deficiency.[15]

Bone density distribution: clearly demonstrated that almost half of the study group fell into the osteoporotic range, while one-third were osteopenic. This pattern reflects a continuum of skeletal deterioration, emphasizing the importance of early detection at the osteopenic stage to prevent progression to osteoporosis and subsequent fractures. The clinical implications are considerable, as women with osteopenia remain at significant risk of fragility fractures if preventive measures are not adopted.[11,13]

Vitamin D levels: showed suboptimal values, with mean concentrations below recommended cut-offs, yet statistical association with osteoporosis was not significant. This paradox may be attributed to methodological variations in laboratory testing, supplementation habits, or the possibility that other stronger determinants, such as physical activity and sunlight exposure, masked the effect of serum vitamin D. Despite this, vitamin D remains a cornerstone of bone metabolism, as it facilitates calcium absorption and mineralization.[16-19] The finding still highlights the need for routine monitoring and correction of deficiency in postmenopausal women.

The analysis of determinants: revealed that osteoporosis was significantly associated with age, occupation, duration of menopause, low sunlight exposure (<30 minutes/day), and poor physical activity. Women who were housewives or retired exhibited higher prevalence rates compared to employed women, a finding that may be explained by reduced mobility, sedentary lifestyle, and fewer opportunities for outdoor activities. Sunlight exposure emerged as a critical factor; nearly two-thirds of osteoporotic women reported inadequate exposure. This reflects cultural practices of full-body covering, indoor living, and avoidance of sunlight due to hot climate, all of which contribute to diminished cutaneous vitamin D synthesis.[17-19] Physical inactivity was also a key determinant. Poor performance across multiple activity domains significantly increased the risk of osteoporosis, supporting the concept that mechanical loading and regular exercise stimulate osteoblast activity and bone formation, while inactivity accelerates bone resorption.[20,21]

Symptoms and comorbidities: provided additional insights. Although backache, fatigue, and sleep disturbances were highly prevalent across all bone density categories, joint stiffness was significantly less common among osteoporotic women compared with osteopenic and normal groups. This finding might reflect differences in symptom perception or the overlap of musculoskeletal complaints with other conditions. Comorbidities such as hypertension, diabetes, thyroid disease, and rheumatoid arthritis were common in the cohort but did not demonstrate a statistically significant relationship with osteoporosis. This may suggest that lifestyle and reproductive factors had stronger effects in this group, although other studies have shown that chronic illnesses can negatively affect bone health.[22,23]

The comparison of age among bone density categories: confirmed that women with osteoporosis were significantly older than those with osteopenia or normal bone density. This reinforces the linear relationship between age and skeletal fragility, as cumulative bone loss increases fracture risk with advancing years.[9,10]

CONCLUSION

The study identifies older age, prolonged menopausal duration, housewife or retired status, limited sunlight exposure, and physical inactivity as the most important determinants of osteoporosis in postmenopausal Iraqi women. Although vitamin D levels and comorbidities did not show significant associations in this cohort, the biological plausibility of their role cannot be discounted. The high prevalence of osteoporosis and osteopenia emphasizes the urgent need for preventive interventions. These should include awareness campaigns targeting lifestyle modifications, encouragement of safe sunlight exposure, promotion of weight-bearing physical activity, and improved access to DEXA screening. Early identification and management of at-risk women are critical steps in reducing the future burden of fractures, disability, and associated healthcare costs in Iraq.

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