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ORIGINAL ARTICLE

Prevalence and Risk Factors of Osteoporosis in Bahrain: A Cross-sectional Study among Young Female Attending Primary Care Centers

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Abstract

Background and aim: The study aimed to estimate the prevalence of bone mineral density (BMD) disorders among women 34 years and older in Bahrain and evaluate risk factors linked to osteoporosis.

Methods: This cross-sectional study comprised of women ³ 34 years of age, attending primary health centers in Bahrain. Multistage stratified sampling technique was used to select the samples and participants were randomly selected from the waiting area at the centers. The objectives and procedures were explained to the subjects and informed consent was obtained. Following recording of the case, the participants were screened using Achilles InSight imaging bone ultrasonometer (GE Healthcare, Chicago, IL, USA), and the findings were confirmed using a DEXA scan. The data was analyzed using univariate statistics.

Results: The study comprised of 892 female subjects. Their mean age was 47 ±11 years, 587 (66%) had normal BMD, 261 (29%) had osteopenia, 34 (3.8 %) were diagnosed with osteoporosis, and 10 (1.1%) had severe osteoporosis. History of fractures and early menopause were considerably higher in the severe osteoporosis group with a p-value < 0.001.

Conclusions: A significant fraction of the participants (34%) had osteoporosis or osteopenia.

Keywords: Bahrain; Osteoporosis; Prevalence; Primary health care; Risk factors

Introduction

Osteoporosis is defined as "a systemic skeletal disease characterized by low mineral bone mass and microarchitectural deterioration of bone tissue."[1] It is estimated that osteoporosis affects 1 in 3 women and 1 in 5 men in population above 50 years of age.[2]

It can lead to devastating outcomes that involve fractures, increased mortality, and the need for long-term medical care. It affects psychological well-being in the form of depression, deterioration of functional status, chronic pain, and loss of independence.[3-5]

Health care costs are predicted to rise with the increase of the elderly population. In the United States, the annual economic burden of spinal disorders, compression fractures, and spinal fusion complications were estimated to exceed US$90 billion, US$500 million, and US$80 billion, respectively.[6] A German study estimated that the annual cost would grow to 6.1 million Euros in the year 2050.[7] A systematic review investigating the economic burden in Asia concluded that the cost of managing one hip fracture can range from US$774 to US$14,198.90.[8]

Osteoporosis prevalence data from eight different industrialized countries showed wide variation. In the United States, the prevalence was 16%, whereas in Japan it was as high as 38%.[9]

A systematic review from Saudi Arabia found that the prevalence of osteopenia was 36.6% and osteoporosis was 34% in females aged between 50 and 79 years.[10] A study in the younger population in the United Arab Emirates (UAE) revealed that 24.2 % of the participants were osteopenic and 3.2% were osteoporotic.[11]

In Bahrain, published data on this is limited. Research done in 2009 on 17 postmenopausal women showed that the prevalence of osteoporosis was 27.1%.[12] A recent study published in 2020 reviewed the bone mineral density (BMD) scan of a total of 205 patients and found that 38.0% of the sample had osteoporosis, while 46.5 % had osteopenia.[13]

This study focuses on minimizing the gap in locally published literature, evaluates the magnitude of bone density disorders in women aged 34 years and above, as well as the risk factors associated with osteoporosis.

Methods

This cross-sectional study was conducted on females 34 years old and older, attending primary health care centers in Bahrain.

The study population comprised of female participants aged 34 years and above in the Kingdom of Bahrain attending selected primary health care centers from March 1st to August 15th, 2013. Subjects who presented with emergency conditions or who were already being treated for osteoporosis were excluded.

The sample size was determined with Epi info version 7 (Centers for Disease Control and Prevention, Atlanta, GA, USA). Considering a confidence level of 98%, a study power of 80%, and the lowest prevalence of osteoporosis in the population at 10%, the calculated sample size was estimated to be 865. However, the study eventually enrolled 892 subjects.

A multistage stratified sampling technique was used to recruit participants. Random selection from one center in each health region was conducted. Five health centers were chosen, representing five health regions in Bahrain: North Muharraq Health Center, Naim Health Center, Budaiya Health Center, Isa Town Health Center, and East Riffa Health Center. The number of candidates in each health center was selected proportionally, according to the catchment area.

Women 34 years of age and above were chosen randomly from the waiting area at the primary health centers. Objectives and procedures of the study were explained to candidates, and informed consent was obtained. A case report form (CRF) was filled out for each participant.

The case report included age, gender, height, weight, minor risk factors (family history of fractures, dietary intake of calcium and vitamin D, treatment with glucocorticoids for more than three months, exercise, fractures, early menopause, and malabsorption syndrome), major risk factors (weight less than 57 kg, smoker, rheumatoid arthritis, history of clinical hyperthyroidism, chronic anticonvulsant therapy, excessive alcohol and caffeine intake, long term heparin therapy), T-score, diagnosis, dual energy X-ray absorptiometry (DEXA) confirmation, fracture and type, number of fractures, maintenance of exercise and diet, and medication initiated.

Participants were then screened using an Achilles Insight imaging bone ultrasonometer (GE), with confirmation using DEXA. The reading of the ultrasonometer was classified according to the World Health Organization's (WHO) diagnostic criteria. (Table 1)

Table 1: World Health Organization's definition of osteoporosis based on BMD

Diagnosis	T-score
Normal	T-score > -1 SD
Osteopenia	-2.5 SD < T-score < -1 SD
Osteoporosis	T-score < -2.5 SD
Severe osteoporosis	T-score < -2.5 SD and at least 1 osteoporotic fracture

If the reading of the ultrasonometer was < -1 SD, the participant was referred to Hamad Kanoo Health Center for DEXA confirmation of osteopenia, osteoporosis, or severe osteoporosis. After the DEXA confirmation, participants consulted their respective physicians in the health center for follow-up and treatment, if needed.

Descriptive statistics described the data. For categorical variables, frequencies and percentages were reported. Differences between groups (normal, osteopenia, and osteoporosis) were analyzed using Pearson's χ^2 tests (or Fisher's exact tests). Mean and standard deviation presented continuous variables. Univariate ordinary least squares (OLS) regression was used to analyze the data. An *a priori* two-tailed level of significance was set at 0.05 level. Statistical analyses were conducted with STATA version 13.1 (STATA Corporation, College Station, TX, USA).

Approval of the Ministry of Health Research Committee was received, and participants' information was kept confidential. Consent and participation forms in both English and Arabic were made available for subjects to accept, or not enroll in the study.

Results

A total of 892 females participated in the study; the mean age was 47 years, ranging from 34 to 88 years. Most participants were younger than 50 years (594 or 66.6%), and mean weight was 75 ± 16 kg. A third of the study subjects (33%) reported a positive family history of osteoporosis. (Table 2) Two-thirds of the participants (587 or 66%), had normal BMD, 261 (29%) were diagnosed with osteopenia, 34 (3.8 %) were found to have osteoporosis, and only 10 (1.1%) were diagnosed with severe osteoporosis. (Figure 1)

The distribution of major and minor risk factors among the study subjects was analyzed. A comparison between different groups revealed that from significant risk factors, excessive caffeine intake was the most predominant, reported by 177 (20 %) participants, 50% were in the severe osteoporosis group, yet it was not statistically significant. Body weight less than 57 kg was observed in 93 (11%) of the sample, with a statistically significant percentage of 19% (n=6) was noted in the osteoporosis group (p-value = 0.017). Rheumatoid arthritis was found to be prominently higher in the osteoporosis group of 5 (15%) (p =0.028).

Among the minor risk factors; history of fractures and early menopause were considerably higher in the severe osteoporosis group with 10 (100%) reporting fractures, while 5 (50%) gave a history of early menopause. Both were statistically significant with a $p < 0.001$. Insufficient intake of calcium was evident among all groups, with a prevalence > 40%. Similarly, insufficient vitamin D intake was found across all categories, ranging from 30-46%. (Tables 3 and 4)

All study participants diagnosed with BMD disorders had their current treatment protocols evaluated. Among the 261 women with osteopenia, only 11 (4.2%) were on calcium and vitamin D supplementation. Similarly, 3 (8.8%) of those diagnosed with osteoporosis were receiving supplements.

None of the study participants was on anti-osteoporotic medication. (Table 5)

Table 2: Demographic and general characteristics of the study participants

Variable		N (%)
Age	< 50 years	594(66.6%)
	≥ 50 years	298(33.4%)
	Total	892 (100%)
Age (mean±SD)		47 ± 11
Height(mean±SD)		157±6 (n=865)
Weight(mean±SD)		75 ± 16 kg (n=871)
Positive Family History of Osteoporosis	Yes	291(33%)
	No	596 (67%)
	Total	887(100%)

SD: Standard Deviation, N: number

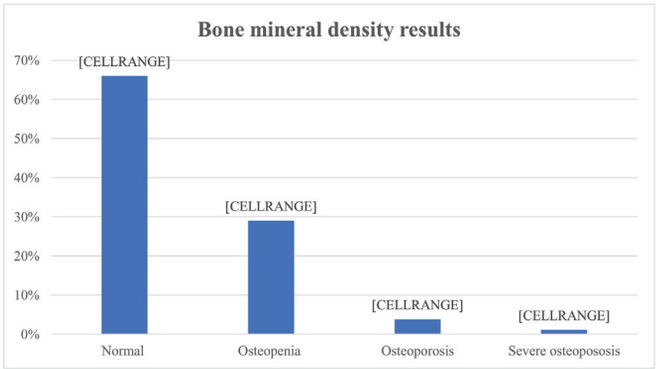

Figure 1: **BMD results: Normal - T-score > -1.0 SD, Osteopenia - (T-score -2.5 - <=-1.0 SD), Osteoporosis - (T-score < -2.5 SD), Severe Osteoporosis - (T-score < -2.5 SD) with at least 1 osteoporotic fracture**

Table 3*:* Major risk factors associated with development of osteoporotic fractures (N=892)

Factor	All n (%)	Normal n (%)	Osteopenia n (%)	Osteoporosis n (%)	Severe Osteoporosis n (%)	*p*-value
Weight < 57 kg (N=871)	93 (11%)	50 (8.6%)	37 (15%)	6 (19%)	0 (0%)	0.017
Smoker (N=888)	59 (6.6%)	32 (5.5%)	24 (9.2%)	3 (9.1%)	0 (0%)	0.160
Rheumatoid arthritis (N=887)	42 (4.7%)	30 (5.1%)	7 (2.7%)	5 (15%)	0 (0%)	0.028
Clinical hyperthyroidism (N=888)	68 (7.7%)	44 (7.5%)	21 (8.1%)	1 (2.9%)	2 (20%)	0.318
Anticonvulsant therapy (N=886)	3 (0.03%)	2 (0.3%)	1 (0.4%)	0 (0%)	0 (0%)	1.000
Alcohol (N=888)	0	0	0	0	0	N/A
Excessive caffeine intake (N=889)	177 (20%)	109 (19%)	58 (22%)	5 (15%)	5 (50%)	0.065
Long-term heparin therapy (N=890)	35 (3.9%)	16 (2.7%)	19 (7.3%)	0	0	0.018

Normal - T-score > -1.0 SD
Osteopenia - (T-score -2.5 - < = -1.0 SD)
Osteoporosis - (T-score < -2.5 SD)
Severe osteoporosis - (T-score < -2.5 SD) with at least 1 osteoporotic fracture
N/A not applicable
SD: Standard Deviation, N: number

Table 4: Minor risk factors associated with development of osteoporotic fractures (N=892)

Factor	All n (%)	Normal n (%)	Osteopenia n (%)	Osteoporosis n (%)	Severe Osteoporosis n (%)	*p*-value
Family history of fractures (N=883)	173 (20%)	119 (20%)	44 (17%)	6 (18%)	4 (44%)	0.181
Insufficient dietary intake of calcium (N=889)	411 (46%)	270 (46%)	123 (47%)	14 (41%)	4 (40%)	0.896
Insufficient dietary intake of vitamin D (N=885)	363 (41%)	232 (40%)	117 (46%)	11 (33%)	3 (30%)	0.266
Treatment with glucocorticoids >3 months duration (N=878)	43 (4.9%)	25 (4.3%)	17 (6.7%)	1 (3.0%)	0 (0%)	0.463
Exercise (N=889)	318 (36%)	221 (38%)	89 (34%)	7 (21%)	1 (10%)	0.056
Fractures (N=886)	90 (10%)	46 (7.9%)	34 (13%)	0 (0%)	10 (100%)	<0.001
Early menopause (N=886)	121 (14%)	63 (11%)	48 (18%)	5 (15%)	5 (50%)	<0.001
Malabsorption syndrome (N=886)	99 (11%)	65 (11%)	23 (8.9%)	8 (24%)	3 (30%)	0.016

Normal - T-score > -1.0 SD

Osteopenia - (T-score -2.5 - <=-1.0 SD)

Osteoporosis - (T-score < -2.5 SD)

Severe Osteoporosis - (T-score < -2.5 SD) with at least 1 osteoporotic fracture

N/A not applicable

*SD: Standard deviation, N: numbe*r

Table 5*:* Treatment in participant diagnoses with BMD disorders

Treatment	Osteopenia n (%)	Osteoporosis n (%)	Severe Osteoporosis n (%)
Calcium supplement	4.2% (11/261)	8.8% (3/34)	0% (0/10)
Vitamin D	4.2% (11/261)	8.8% (3/34)	0% (0/10)
Anti-osteoporotic medications	0% (0/261)	0% (0/34)	0% (0/10)

Discussion

This study concluded that a significant proportion (34%) of the study subjects have at least one of the BMD disorders, ranging from osteopenia to severe osteoporosis with 29% diagnosed as osteopenia and 4.9% with osteoporosis and severe osteoporosis.

Compared to international data, this research demonstrated a lower prevalence of osteoporosis than in the United States (10.3 %), China (34.6%), and Japan (38%).[7,9,14] This lower prevalence might be explained by the difference in the age of the study population, as the above studies considered populations of 50 years of age and above.

Similar research conducted in the UAE with a mean age of 42 years, found that osteopenia prevalence ranged between 22-24%; while osteoporosis ranged

between 2.5-3%. These numbers are comparable to the results of this research.[11]

Another study published in the Kingdom of Saudi Arabia on participants 50 years of age and above showed a higher prevalence (34 %) of osteoporosis and osteopenia (36.6%).[10]

With bone mineral disorders being more common in females, studies that recruited males tend to dilute overall prevalence. In a survey conducted in the United States, the total prevalence was 10.3%. Nevertheless, the prevalence reached 15.4% when analyzed separately for females. [14] Recruiting only female participants impacts the final results.

It is important to note that varying methods estimating BMD play a role in the reported prevalence. For instance, some studies calculated it from the femur, while others from the spine, and some used ultrasound, while others used DEXA scanning.[9]

An interplay of factors is involved in increasing the risk of osteoporosis. Genetic constitution, lifestyle, and dietary habits play a role. A study conducted in Kuwait that compared the effect of conservative clothing revealed a linear decrease in vitamin D concentration in veiled compared to unveiled females. There was no statistically significant difference in the mean results, but such cross-cultural differences must be considered when evaluating medical issues.[15]

Compared to two prior studies in Bahrain, sample size differences could explain varying results. The first one was completed in 2009 on 17 postmenopausal women. [12]

The second study was a retrospective analysis, which may have overestimated the prevalence of various disorders, as indications of the DEXA scan were not mentioned as being inclusive of a screening program.[13]

While investigating prevalence, it was noted that none of the participants was on anti-osteoporotic medication. Undertreatment status was congruent with data from the literature. For instance, a population-based study in Sweden with 3028 older women found that from 1,107 who were eligible for treatment, only 21.8% were receiving anti-osteoporotic treatment.[16] Another paper published in Singapore stated that only 40.1% received anti-osteoporotic medication even after a hip fracture.[17] This substantiates that osteoporosis is an underdiagnosed and undertreated disorder, despite well-known devastating outcomes and availability of treatment.

This study is the first of its kind in Bahrain in terms of representability and inclusiveness. Although the gold standard for diagnosis was not used, those who showed low BMD by ultrasound were referred for DEXA scan for confirmation.

Conclusions

The prevalence of BMD disorders was high in the group of participants (34%), but considerably undertreated.

Conflicts of Interest

The authors declare no conflicts of interest.

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