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Risk factors of Osteoporosis among women in Qassim, Saudi Arabia: A case control study

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ABSTRACT

The literature on risk factors of osteoporosis in Saudi women is scarce and has several methodological limitations. This study aimed to assess the risk factors of osteoporosis among Saudi women in Qassim region of Saudi Arabia. An institution-based case-control study was conducted among women diagnosis of osteoporosis based on DEXA scan. Cases were recruited from regional DEXA scanning center of Qassim while controls were women visiting primary health care center. Data was collected using a structured questionnaire which collected information on socio-demographic and menopause and medical history. Analysis was done on SPSS version 23.0. Logistic regression was used to assess the risk factors and crude and adjusted odds ratio along with their associated 95% confidence intervals (CI) were calculated. A total of 115 cases and 183 controls were included in the analyses. The mean age of cases was higher than controls 64 ± 8.0 years versus 56.6 ± 7.6 years respectively. In the multivariate analysis, BMI adjusted OR 0.88 (95% CI: 0.82 – 0.94), menopause adjusted OR 13.33 (95% CI: 1.56 – 113.5), History of fragility fracture adjusted OR 0.07 (95% CI: 0.015 – 0.37) and hypothyroidism adjusted OR 0.31 (95% CI: 0.13 – 0.78) were significantly associated with osteoporosis. BMI, menopause, history of fragility fracture and hypothyroidism were significantly associated with osteoporosis in this study population. Studies with larger sample size and focused exposure should be carried out to draw conclusive relationship with osteoporosis.

1. Introduction

Osteoporosis is a disorder of bone mineralization which leads to fragility in the bones. Osteoporosis is defined by National Institutes of Health (NIH) osteoporosis and related bone diseases as disorder of bones characterized by decrease in bone mass with concomitant weakening of micro-architecture of bone tissue, leading to decline I bone strength and high risk of fragility fractures of hip, spine and wrist [1]. Osteoporosis in as important public health issue globally as it affects a large number of population worldwide. The burden of osteoporosis varies from countries to countries [2]. It is estimated that about 200 million women are affected by osteoporosis worldwide [3]. Around 188000 deaths and 5.2 million disability adjusted life years are attributed to low bone mineral density (BMD) [4]. Saudi Arabia with an

increasing proportion of elderly population is no exception with an estimated prevalence of bone mineral density disorders to range from 18% to 59% [5- 9]. The cost associated with fractures attributed to osteoporosis in Saudi Arabia is estimated to be 636 million US dollars [10].

A number of risk factors of osteoporosis have been reported in the literature. The commonly reported risk factors in the literature include; age, female gender, low BMI, history of fragility fracture, hypertension, diabetes mellitus and endocrinological disorders [7], [11- 16]. Use of certain medications and other biochemicals have also been associated with osteoporosis. These include; cortisone, [11], [12] bisphosphonates, [17] perfluoroalkyl substances, [18] and oral hypoglycaemics [13]. Thiazide diuretics on the other hand have been reported to be protective factor against osteoporosis [19]. Some dietary, nutritional and behavioural factors are also associated with osteoporosis such as; low calcium, milk intake and low sun exposure [15], [20].

Literature on risk factors of osteoporosis among women in KSA is mainly cross sectional and small case-control studies. Furthermore, there are variations in the risk factors identified in various studies. It is therefore necessary to explore the risk factors locally to add in the body of literature on risk factors of osteoporosis. This study therefore aimed to assess the risk factors of Osteoporosis among women in Qassim, Saudi Arabia.

2. Material and methods

2.1 Study design and setting

Institution based case-control study was conducted in Qassim regional DEXA scanning center in Buraidah, Qassim. This is the only DEXA scanning center of the region where people are referred from whole region.

2.2 Study population

The study population for this study includes women attending DEXA scanning center and a primary health care center of Buraidah.

Cases: Case were female aged 30 years and above diagnosed by physicians to have osteoporosis based on DEXA scanning.

Controls: Control were adult female aged 30 years and above and who never have been diagnosed with osteoporosis by physician.

Women on hormonal replacement therapy were excluded from the study.

2.3 Sampling procedure

Cases were recruited consecutively from DEXA screening center Buraidah. This center is regional screening center where patients are referred from all across the region. Controls were also recruited consecutively from primary care center where DEXA screening facility is available.

2.4 Ascertainment of diagnosis of osteoporosis

The bone mineral densitometry was performed through dual-energy, X-ray absorptiometry using Horizon™ DXA System by Hologic, Inc. Three sites; Lumbar spine and necks of left and right femur were scanned. Scanner provides standardized T-scores of bone mineral density based on reference population. Z-scores were interpreted according to WHO classification; Normal = T score > -1, Osteopenia = T score <-1 to >-

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2.5 and Osteoporosis = T score ≤-2.5 [21]. We included only those who were classified as having osteoporosis.

2.5 Data collection tools and procedure

Data was collected through a structured questionnaire. The questionnaire collected information on age, weight, height, menopause, age of menopause, daily physical activity, history of fragility fracture, family histories of fragility fracture and osteoporosis, history of chronic diseases and medication.

2.6 Statistical analysis

Data was analysed using SPSS version 23.0. Chi-square and independent sample t-tests were used to compare the cases and controls. Fisher exact test was applied where expected count was less than '5' in one of the cells. Univariate and multivariate logistic regression was used to assess the association of osteoporosis with various socio-demographic and medical history variables. Crude and adjusted odds ratio (OR) along with associated 95% confidence intervals (CIs) were calculated. Multicollinearity was checked between the variables and where there was significant correlation, the variable which had more effect on multivariate model was retained in the final model.

2.7 Ethical Considerations

Ethical approval for this study was obtained from Committee of Research Ethics, Qassim University (Number: 21-07-10; dated: 05-04-2021). Informed consent was obtained from all the participants. Approval to collect data from DEXA scanning center and primary health care center were also obtained before commencing data collection.

3. Results

A total pf 115 cases and 183 controls were included in the analysis. The mean age of cases was 64 ± 8.0 years while for controls it was; 56.6 ± 7.6 years. Body mass index (BMI) was significantly higher among controls 33.0 as compared to cases 30.2. Physical activity on the other hand was lower in cases. History of fragility fracture and family history of osteoporosis was higher among controls as compared to cases. Prevalence of hypertension was higher among cases 51% versus 34% in controls while there was no significant difference in the prevalence of diabetes mellitus. There was no significant difference in the in-take of vitamin D and calcium supplements, and proton pump inhibitors. (Table 1)

Table 1: Comparison of socio-demographics and medical history between cases and controls

Variable	Control % (n) (n=183)	Cases % (n) (n=115)	p-value
Age Mean (SD)	56.6 (7.64)	64.2 (8.00)	<0.001
BMI Mean (SD)	33.0 (5.00)	30.2 (5.83)	<0.001
Menopause No Yes	27.9 (51) 72.1 (132)	4.3 (5) 95.7 (110)	<0.001
Age of menopause Mean (SD)	49.3 (3.82)	50.2 (2.94)	0.041
Daily physical activity > 150 minutes/week <150 minutes/week No	49.2 (90) 14.2 (26) 36.6 (67)	18.3 (21) 2.6 (3) 79.1 (91)	<0.001
History of fragility fracture after age			

of 50 years (n=246)			
No	88.1 (119)	98.2 (109)	
Yes	11.9 (16)	1.8 (2)	0.003
Family History of fragility fracture			
No			
Yes	96.7 (177)	98.3 (113)	
	3.3 (6)	1.7 (2)	0.715*
Family history of Osteoporosis			
No	86.3 (158)	98.3 (113)	
Yes	13.7 (25)	1.7 (2)	<0.001
Any chronic disease			
No	26.2 (48)	22.6 (26)	
Yes	73.8 (135)	77.4 (89)	0.481
Hypertension			
No	65.6 (120)	48.7 (56)	
Yes	34.4 (63)	51.3 (59)	0.004
Diabetes			
No	46.4 (85)	47.0 (54)	
Yes	53.6 (98)	53.0 (61)	0.932
Hypothyroidism			
No	77.0 (141)	89.6 (103)	
Yes	23.0 (42)	10.4 (12)	0.006
Hyperthyroidism			
No	97.3 (178)	100.0 (115)	
Yes	2.7 (5)	0.0 (0)	0.160*
Antihypertensive			
No	68.7 (124)	45.2 (52)	
Yes	32.3 (5)	54.8 (63)	<0.001
Hypoglycemic			
No	54.6 (100)	51.3 (59)	
Yes	45.4 (83)	48.7 (56)	0.574
Insulin			
No	90.7 (166)	92.2 (106)	
Yes	9.3 (17)	7.8 (9)	0.663
Thyroxin			
No	77.6 (142)	88.7 (102)	
Yes	22.4 (41)	11.3 (13)	0.015
Vitamin D			
No	63.9 (117)	71.3 (82)	
Yes	36.1 (66)	28.7 (33)	0.189
Calcium			
No	87.4 (160)	80.0 (92)	
Yes	12.6 (23)	20.0 (23)	0.084
PPIs			
No	79.2 (145)	73.0 (84)	
Yes	20.8 (38)	27.0 (31)	0.217
Oral cortisone			
No	99.5 (182)	98.3 (113)	
Yes	0.5 (1)	1.7 (2)	0.561*

Table 2 also presents results of multivariate analysis. We found that increase in BMI was associated with significant reduction in risk of osteoporosis adjusted OR 0.88 (95% CI: 0.82 – 0.94). Menopause was associated with 13 times increased risk of osteoporosis adjusted OR 13.33 (95% CI: 1.56 – 113.5). History of fragility fracture was associated with lower risk of osteoporosis adjusted OR 0.07 (95% CI: 0.015 – 0.37). Presence of hypothyroidism was also associated with 69 percent less risk of osteoporosis adjusted OR 0.31 (95% CI: 0.13 – 0.78). Other factors which were significant in the univariate analysis were not found to be significant in multivariate analysis.

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4. Discussion

This study aimed to find the risk factors of osteoporosis among Saudi women in Qassim region of Saudi Arabia. It was found that; BMI, menopause, history of fragility fracture and hypothyroidism were significantly associated with osteoporosis.

Association of age with osteoporosis has been inconsistent in literature. Some studies have shown increasing age a significant predictor of higher risk of osteoporosis [7], [12, [22] while other studies showed no significant association of age with osteoporosis [11], [23]. In this study, the mean age of cases was significantly higher in the bivariate analysis. However, when adjusted for confounding effects of other factors, there was no significant association of age with osteoporosis. Aging causes shift in the bone remodelling towards negative and there less formation of bone than resorption. This process is affected by various external and internal factors [24]. The inconsistency in the cited literature with respect to association of age with osteoporosis could be attributed to variations in the factors included in the regression models to adjust for associations.

This study found that increasing BMI was associated with lower risk of osteoporosis. This finding is consistent with results of another study conducted in Saudi Arabia and other settings, where increasing BMI was associated with lower risk of osteoporosis [13], [25], [26]. On the other hand, other researchers have reported that obese women were at higher risk of osteoporosis [22], [27]. The mechanisms underlying the protective effects of BMI on osteoporosis are not fully understood. However, it has been alternatively explained by mechanical load on bones due to increased weight which cause increase in the bone mass. Another mechanism proposed is that higher amount of adipose tissue in obese women increases the production of oestrogen suppression of osteoclasts which results in increased bone mass [28], [29].

Fragility fractures results from weakening of bone. Osteoporosis has been positively associated with fragility fractures [7], [30]. On the contrary, this study found an inverse association of osteoporosis with history of fragility fracture after the age of 50 years. This could be due to possibility of non-diagnosis of osteoporosis in controls despite having fragility fractures. Two systematic reviews reported a wide gape in fragility fractures and diagnosis of osteoporosis globally. They found that across studies, less than one third of the adults with fragility fracture were investigated further for osteoporosis through bone scans [31], [32]. Situation has not improved over the period as another systematic review reported investigations after fragility fracture were done in only 43% of the patients [33] and similar were observations in China reported by a recent study [34]. This calls for strengthening screening and risk assessment programs as fragility fractures are associated with further fractures in future and morbidity.

Hypothyroidism was found to be protective against osteoporosis in current study. This finding is similar to a s study among Korean population where researchers found that there was lower risk of osteoporosis among post-menopausal women [35]. The exact mechanisms underlying this relationship between hypothyroidism and are unclear. It is hypothesized that lower T3 and T4 levels lead to reduced activities of osteoblasts and osteoclasts. This change in metabolism of bones might result in an increased mineralization and therefore reduced risk of osteoporosis [36]. However, available evidence suggests no effect of hypothyroidism on risk of BMD disorders [36], [37]. Effect of long term thyroxine treatment on BMD is also inconclusive [36]. A meta-analysis showed that long term treatment with T4 has no effects on bone metabolism in premenopausal women while there was detrimental effects in post-menopausal women [38]. Another systematic review concluded that overtreatment of hypothyroidism is associated with osteoporosis [39].

This study included a relatively large sample from a regional DEXA scanning center. However, there are certain limitations which should be kept in consideration while interpreting results of this study. First, this study was conducted among women in a single center therefore results may not ne generalizable to whole Saudi Arabia. Secondly, sample may not be adequately powered for some of the associations as frequencies of exposure were low for some of the variables. Thirdly, detailed data on comorbidities such as hypertension, diabetes mellitus and thyroid disorders and their treatment was not gathered which could have provided better inferences, Nonetheless, this study has provided insights into the risk factors of osteoporosis among Saudi women in Qassim region.

5. Conclusions

This study found that BMI, menopause, history of fragility fracture and hypothyroidism were associated with osteoporosis among Saudi women. This information could be helpful in primary care for identifying women at higher risk of osteoporosis and thus screening and early treatment to prevent morbidity and fractures associated with osteoporosis. It is also recommended that large scale studies with focus on specific risk factors should be carried out in order to establish strong relationship with osteoporosis.

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