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Original Article

Prevalence and patterns of bone mineral density disorders among women in Buraidah, KSA

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الملخص

أهداف البحث: تسبب اضطرابات كثافة العظام عبئا صحيا واجتماعيا على الأفراد والمجتمعات. هدفت هذه الدراسة إلى تقدير انتشار وتحديد أنماط اضطرابات كثافة العظام بين النساء في مدينة بريدة بالمملكة العربية السعودية.

طرق البحث: أجريت دراسة مقطعية بين النساء اللواتي حضرن لفحص كثافة العظام في مركز صحي الأفق ببريدة. تم تضمين ما مجموعه ٣٤٢ امرأة في الدراسة. تم استخدام جهاز قياس امتصاص الأشعة السينية ذات الطاقة المزدوجة (دكسا) لقياس كثافة العظام وتم تحديد التشخيص بناءً على معايير منظمة الصحة العالمية: طبيعي= درجة ت أكبر من -١ ، لين العظام = درجة ت بين -١ إلى -٢.٥ ، هشاشة العظام = درجة ت أقل من -٢.٥ . كما تم جمع البيانات المختلفة الاجتماعية والديموغرافية والمتغيرات المتعلقة بالصحة.

النتائج: كان متوسط عمر المشاركين ٦١.٢ ± ٧.٥٤ سنة. بلغ معدل الانتشار العام لاضطرابات كثافة العظام ٧٦٪ ، بينما بلغ انتشار لين العظام و هشاشة العظام ٦٦٪ و ٣٤٪ على التوالي. تأثر العمود الفقري أكثر من عنق عظم الفخذ.

الاستنتاجات: ارتفاع معدل انتشار اضطرابات كثافة العظام بين النساء في المملكة العربية السعودية يدعو إلى إنشاء وتعزيز برامج الوقاية من هشاشة العظام لضمان الشيخوخة الصحية بين النساء. هناك حاجة لدراسات مجتمعية واسعة النطاق لتقدير عبء اضطرابات كثافة المعادن بالعظام في المجتمع بدقة.

الكلمات المفتاحية: كثافة العظام؛ ديكسا؛ قلّة النسيج العظمي؛ هشاشة العظام؛ المملكة العربية السعودية

Abstract

Objectives: Bone mineral density (BMD) disorders are disorders of bone mineralization in which bone density is reduced (T score <-1). BMD causes health and social burdens on individuals and communities. This study estimated the prevalence and determined the patterns of BMD disorders among women in Buraidah, KSA.

Methods: A cross-sectional study was conducted in 342 women visiting the DEXA Scanning Center in Buraidah. Dual-energy X-ray absorptiometry (DEXA) scan was used to measure the BMD, and cutoffs were defined based on World Health Organization criteria: normal = T score >-1, osteopenia = T score <-1 to >-2.5, and osteoporosis = T score ≤-2.5. Sociodemographic and health-related data were collected. Logistic regression was used to measure the association of various participant characteristics with BMD disorders.

Results: The mean age of the participants was 61.2 ± 7.54 years. The overall prevalence of BMD disorders was 76%, of whom 42% had osteopenia, 24% had both osteoporosis and osteopenia, and 10% had osteoporosis. Body mass index, menopause, hypertension, oral hypoglycemics, and calcium supplementation were significant predictors of BMD disorders.

Conclusions: The high prevalence of BMD disorders among women in KSA necessitates establishing and strengthening osteoporosis prevention programs to ensure healthy aging among women in KSA. Large-scale community-based studies are needed to accurately estimate the burden and risk factors of BMD disorders in the community.

Keywords: Bone mineral density; DEXA; KSA; Osteopenia; Osteoporosis

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Introduction

Osteoporosis and osteopenia are progressive bone mineral density (BMD) disorders, which are caused by a decline in bone mass and architectural changes in bone structure. These changes result in reduced bone density and bone quality. Consequently, these disorders increase the risk of fragility fractures among the affected individuals.[1] Osteoporosis is defined by the World Health Organization (WHO) as a "decline in BMD mass by more than 2.5 standard deviations (SDs)," whereas osteopenia is defined as a "decline in BMD mass 1.0−2.5 SD."[2]

Osteoporosis and associated factures are important health issues globally, especially among nations with a higher proportion of elderly individuals.[3,4] Osteoporosis affects about 200 million women globally and causes about 8.9 million fractures annually.[5,6] It is estimated that about 188,000 deaths and 5.2 million Disability Adjusted Life Years (DAYLs) are attributed to low BMD globally.[7] In the United states alone, it was estimated that about 2 million fractures were due to osteoporosis in 2005, which cost about 17 billion US dollars.[8] The number of fractures and cost are estimated to increase by 50% in 2025.

KSA has seen an increase in life expectancy and thus an increasing proportion of elderly individuals in the population. Studies from various parts of KSA have reported varying prevalence of osteoporosis among females. A systematic review by Sadat et al.,[10] which included studies until 2011, reported a prevalence of osteopenia and osteoporosis of 37% and 34%, respectively.[9] Studies from Arar found a prevalence of osteopenia of 36% in 2018, whereas another study in 2014 from the Northern part of KSA found a prevalence of osteoporosis of 18% in women.[11] In Taif, the prevalence of osteoporosis was 26% in 2019.[12] A community-based study from Riyadh in 2014 reported a prevalence of low BMD (T score <-1) of 58.5%.[13] In KSA, about 174,000 fractures annually are attributed to osteoporosis with an estimated direct cost of 636 million US dollars in 2019.[14]

Females are affected more than males. In women, estrogen helps maintain the resorptive capacities of the osteoclasts.[15] The reduction in estrogen after menopause among women increases the risk of osteoporosis and osteopenia. Therefore, these are common conditions in elderly women; however, younger women are also affected by BMD disorders although to a lesser extent.[16] In males, testosterone regulates the mineral deposition in bones, which declines slowly with age; therefore, the risk of osteoporosis is lower in males.[17]

Bone disorders are associated with health, personal, social, and financial consequences for the individual, family, and community at large. KSA is undergoing a demographic transition in which the elder population is increasing, which may add to the ever-increasing health and economic burdens of osteoporosis. The high prevalence of BMD disorders among women in KSA necessitates estimating the burden of osteoporosis in this country so that preventive and curative services can be tailored according to the needs. Furthermore, the health care system of KSA is undergoing a transition in which autonomy is transferred to regional health clusters to allocate resources according to the local needs. Therefore, it is necessary to have local data on the prevalence and patterns of osteoporosis in the Qassim region where no such study has been conducted.

To this end, this study assessed the prevalence, patterns, and risk factors of BMD disorders in Qassim, KSA.

Materials and Methods

Study design and setting

This was an institution-based cross-sectional study among women conducted at the Qassim Regional DEXA Screening Center in Buraidah. The Qassim region is located in the central part of KSA with an estimated total population of about 1.4 million people. The region has the largest date palm fields in the country. The terrain is mainly desert with extreme summers. The osteoporosis screening center of Buraidah is the only center where patients are referred from all across the region.

Sample size

Sample size was calculated using the WHO manual for sample size calculation. Previous studies in KSA have reported that the prevalence of BMD disorders ranging from 18% to 63.2%. The current study used 63.2% to calculate the sample, as this study was conducted in a referral DEXA scanning center.[18] The formula for estimation of population proportions was used to calculate sample size. At a 95% confidence level and a margin of error of 5%, the required sample size was 358. However, due to time and resource constraints, data were collected from 343 women.

Sampling procedure

Female who visited the DEXA Scanning Center Buraidah were recruited as study participants. Those who had a previously confirmed diagnosis of osteoporosis were excluded from the study. Women were recruited consecutively who visited the DEXA center from October 2020 until March 2021. Data on sociodemographic and health-related variables such as age, menopause, history of fragility fracture, presence of chorionic diseases, physical activity, and medication history was collected using a structured questionnaire by a trained nurse in Arabic language.

Dual-energy X-ray absorptiometry scanning procedure

Outcome assessment

Bone mineral densitometry was performed with dual-energy X-ray absorptiometry (DEXA) using the Horizon™ DXA System (Hologic, Inc., Bedford, MA, USA). Three sites were scanned: the lumbar spine and necks of the left and right femur. The scanner provides standardized T scores of BMD based on reference population. Z scores were interpreted according to WHO classification: normal = T score >-1, osteopenia = T score <-1 to >-2.5 and osteoporosis = T score ≤-2.5.[2] BMD disorders in this study included either or both osteopenia and osteoporosis.

Statistical analyses

Data were entered and analyzed using SPSS version 21.0. Frequency and proportions of categorical variables and means with standard deviations (SDs) were calculated for continuous variables. The prevalence of BMD disorders were calculated by creating a composite variable combining the results from all three sites. The composite variable was coded as 0 = normal and 1 = BMD disorder present. The patterns of BMD disorders were determined based on the type and site. The chi square or Fisher's exact test was applied to assess the distribution of BMD disorders with respect to the patients' sociodemographic characteristics and medical history. Logistic regression analysis was used to assess the risk factors of BMD disorders. All of the predictor variables included in the regression analysis were coded as 0 = No and 1 = Yes. First, univariate logistic regression analyses were conducted. Variables that were either significant or clinically important were included in the multivariate regression analysis. Multivariate logistic regression analysis was done to adjust for the confounding effects of variables on their associations with outcome variables. The variables in the final multivariate model were retained based on their significance and effect on the −2 log likelihood ratio. The adjusted odds ratio (OR) and associated 95% confidence intervals were calculated. A p-value <0.05 was considered statistically significant.

Results

Sample characteristics

A total of 343 women were included in the analysis. The mean age of the participants was 61.2 (±7.54) years. The majority (90%) of the women had reached menopause, and the mean age of menopause was 50 years. The family history of fragility fracture was positive in 3.5% of the participants, whereas 1.7% had fragility fracture in the past. Only 30% of the participants performed physical activity >150 min/week. Three-fourths (76%) of the women had chronic diseases, of which the most common was diabetes mellitus (DM) (70%), followed by hypertension (64%). About 87% of the participants were on medication currently. Oral hypoglycemic (49%) and antihypertensive (48%) were most common medications followed by vitamin D and proton pump inhibitors (Table 1).

Table 1: Sociodemographic characteristics of women visiting a DEXA scanning center in Buraidah, KSA (n = 343).

Characteristics	n (%)
Age (years)	
Mean (SD)	61.2 (7.54)
Menopause	
No	30 (8.7)
Yes	313 (91.3)
Age of menopause (n = 313)	
Mean (SD)	50.0 (3.27)
Time since menopause (n = 313)	
≤10 years	120 (38.3)
>10 years	193 (61.7)
History of fragility fracture	
No	331 (96.5)
Yes	12 (3.5)
Family history of fragility fracture (after age of 50 years)	
No	337 (98.3)
Yes	6 (1.7)
Physical activity	
No	225 (65.6)
Yes, <150 min/week	16 (4.7)
Yes, >150 min/week	102 (29.7)
Family history of osteoporosis	
No	251 (73.2)
Unknown	87 (25.4)
Yes	5 (1.5)
Chronic disease	
No	81 (23.6)
Yes	262 (76.4)
Chronic diseases (n = 262)	
Diabetes Mellitus	183 (69.8)
Hypertension	169 (64.5)
Hypothyroidism	51 (19.5)
Hyperthyroidism	4 (1.5)
Number of chronic diseases (n = 262)	
1	135 (51.4)
2	109 (41.6)
3	18 (6.9)
Current medication	
No	39 (11.4)
Yes	304 (88.6)
Type of medicine	
Oral hypoglycemic	169 (49.3)
Insulin	23 (6.7)
Antihypertensive	164 (47.8)
Thyroxine	52 (15.2)
Vitamin D	103 (30.0)
Calcium	64 (18.7)
PPIs	73 (21.3)
Oral cortisone	2 (0.6)

Prevalence of BMD disorders

Figure 1 shows the prevalence of BMD disorders. Three-fourths (76%) of the women had BMD disorders. Osteopenia was the most common disorder and present in 42% of the participants. Osteoporosis was present in 10% of participants, whereas both osteopenia and osteoporosis were present in 24% of the women. The overall prevalence of osteoporosis was 34%, whereas the overall prevalence of osteopenia was 66%.

Patterns of BMD disorders

Table 2 presents the patterns of BMD disorders. The prevalence pf BMD disorder was higher in the spine (67.7%) compared to the right and left femur (49%) and (50%). Osteoporosis was highest in the spine (31%) compared to the right femur (13.1%) and left femur (9.0%). On the other hand, osteopenia was higher in the left femur 40.5% but lowest in the spine (37%). In 20% of the participants, osteoporosis was present in one site only, whereas 7% and 6% had osteoporosis on two and three sites, respectively. Single site osteopenia was present in 27%, whereas two sites and three sites osteopenia were present in 27% and 12% of the participants, respectively. The distribution of BMD disorders with respect to various characteristics of participants are presented in Table 3. The

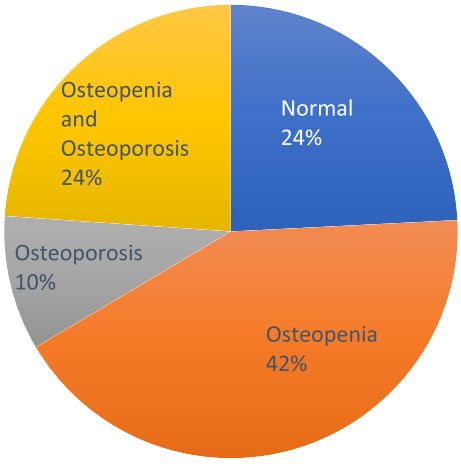

Figure 1: Prevalence of BMD disorders among women in Buraidah, KSA.

Table 2: Patterns of BMD disorder among women visiting a DEXA scanning center in Buraidah, KSA (n = 343).

Variable	n (%)
Spine BMD disorder	
No	111 (32.4)
Yes	232 (67.6)
BMD disorder right femur	
No	168 (49.0)
Yes	175 (51.0)
BMD disorder left femur	
No	173 (50.4)
Yes	170 (49.6)
BMD pattern spine	
Normal	111 (32.4)
Osteopenia	127 (37.0)
Osteoporosis	105 (30.6)
BMD pattern right femur	
Normal	168 (49.0)
Osteopenia	130 (37.9)
Osteoporosis	45 (13.1)
BMD pattern left femur	
Normal	173 (50.4)
Osteopenia	139 (40.5)
Osteoporosis	31 (9.0)
Pattern of osteopenia	
Normal	117 (34.1)
One site	93 (27.1)
Two sites	93 (27.1)
Three sites	40 (11.7)
Pattern of osteoporosis	
Normal	228 (66.5)
One site	70 (20.4)
Two sites	24 (7.0)
Three sites	21 (6.1)

mean age (62.1 [7.6] years) of the participants with BMD disorders was significantly higher compared to those without the disorder (58.5 [6.7] years) ($p < 0.001$). The body mass index (BMI) was significantly lower in those with BMD disorders ($p < 0.001$). There was a significant

Table 3: Patterns of BMD disorder with respect to socio-demographic and medical history of women visiting a DEXA scanning center in Buraidah, KSA (n = 343).

Variables	BMD disorder present n (%)	BMD disorder absent n (%)	p-value
Age			
Mean (SD)	62.1 (7.6)	58.5 (6.7)	<0.001*
BMI			
Mean (SD)	31.4 (5.8)	34.2 (4.6)	<0.001*
Menopause			
No	14 (46.7)	16 (53.3)	<0.001*
Yes	246 (78.6)	67 (21.4)	
Age at menopause (n = 313)			
Mean (SD)	49.8 (3.0)	50.6 (4.2)	0.0153*
Time since menopause (n = 313)			
≤10 years	80 (66.7)	40 (33.3)	<0.001*
>10 years	166 (86.0)	27 (14.0)	
History of fragility fracture			
No	254 (76.7)	77 (23.3)	0.034*
Yes	6 (50.0)	6 (50.0)	
Family history of fragility fracture (after age of 50 years)			
No	256 (76.0)	81 (24.0)	0.635£
Yes	4 (66.7)	2 (33.3)	
Physical activity			
No	72 (70.6)	30 (29.4)	0.224
Yes, <150 min/week	14 (87.5)	2 (12.5)	
Yes, >150 min/week	174 (77.3)	51 (22.7)	
Family history of osteoporosis			
No	187 (74.5)	64 (25.5)	0.754£
Unknown	69 (79.3)	18 (20.7)	
Yes	4 (80.0)	1 (20.0)	
Chronic disease			
No	64 (79.0)	17 (21.0)	0.440
Yes	196 (74.8)	66 (25.2)	
Diabetes mellitus			
No	130 (81.3)	30 (18.8)	0.028*
Yes	130 (71.0)	53 (29.0)	
Hypertension			
No	123 (70.7)	51 (29.3)	0.025*
Yes	137 (81.1)	32 (18.9)	
Hypothyroidism			
No	222 (76.0)	70 (24.0)	0.815
Yes	38 (74.5)	13 (25.5)	
Hyperthyroidism			
No	258 (76.1)	81 (23.9)	0.248
Yes	2 (50.0)	(50.0)	
Oral hypoglycemic			
No	140 (80.5)	34 (19.5)	0.041*
Yes	120 (71.0)	49 (29.0)	
Insulin			
No	243 (75.9)	77 (24.1)	0.827
Yes	17 (73.9)	6 (26.1)	
Antihypertensive			
No	133 (74.3)	46 (25.7)	0.498
Yes	127 (77.4)	37 (22.6)	
Thyroxine			
No	221 (75.9)	70 (24.1)	0.883
Yes	39 (75.0)	13 (25.0)	
Vitamin D			
No	179 (74.6)	61 (25.4)	0.421
Yes	81 (78.6)	22 (21.4)	

(*continued on next page*)

Table 3 (*continued*)

Variables	BMD disorder present n (%)	BMD disorder absent n (%)	p-value
Calcium			
No	205 (73.5)	74 (26.5)	0.036*
Yes	55 (85.9)	9 (14.1)	
PPIs			
No	200 (74.1)	25.9 (70)	0.151
Yes	60 (82.2)	13 (17.8)	
Oral cortisone			
No	258 (75.7)	83 (24.3)	1.000*
Yes	2 (100)	0 (0.0)	

$p < 0.05$ was considered statistically significant.
*Significant p-value.
£Fisher exact p-value.

association of menopause with BMD disorders, as the prevalence of BMD disorders was 78.6% compared to 46.7% among non-menopausal women. BMD disorders were significantly more frequent among participants with hypertension 81% versus 70.7% among those without hypertension. On the other hand, DM was associated with a lower prevalence of 71% compared to 81% among non-diabetics.

Table 4: Multivariate logistic regression analysis of factors associated with the presence of BMD disorders among women visiting a DEXA scanning center in Buraidah, KSA (n = 343).

Variables	Adjusted OR (95% CI)	P-value
Age§	1.04 (0.99–1.09)	0.090
BMI§	0.93 (0.88–0.97)	0.003*
Menopause		
No	1	0.009*
Yes	3.76 (1.39–10.14)	
History of fragility fracture		
No	1	0.034*
Yes	0.26 (0.07–0.90)	
Hypertension		
No	1	0.035*
Yes	1.91 (1.05–3.47)	
Hyperthyroidism		
No	1	0.121
Yes	0.20 (0.03–1.53)	
Oral hypoglycemic		
No	1	<0.001*
Yes	0.31 (0.17–0.57)	
Thyroxine		
No	1	0.276
Yes	0.65 (0.30–1.41)	
Calcium		
No	1	0.008*
Yes	3.22 (1.35–7.68)	
PPIs		
No	1	0.165
Yes	1.70 (0.80–3.59)	

$p < 0.05$ was considered statistically significant.
§Continuous variable.
*Significant p-value.

Predictors of BMD disorders

Logistics regression analysis showed that increasing BMI has protective effects on BMD disorders (adjusted OR 0.93, 95% CI: 0.88–0.97). Women who had reached menopause had a higher odds of BMD disorders (adjusted OR 3.76, 95% CI: 1.39–10.14) compared to non-menopausal women. Similarly, compared to normotensives, those with hypertension had a higher odds of BMD disorders (adjusted OR 1.91, 95% CI: 1.05–3.47). Use of oral hypoglycemics was associated with lower odds of BMD disorders (adjusted OR 0.31, 95% CI: 0.17–0.57) compared to no use of these agents (Table 4).

Discussion

To the best of my knowledge, this is the first study from the Qassim region of KSA. The BMD disorders were found to be highly prevalent in Saudi women. The spine was most commonly affected by the BMD disorders. Osteoporosis was lower in the femur compared to the spine. The factors significantly associated with BMD disorders were age, BMI, menopause, hypertension, oral hypoglycemics, and calcium supplementation.

The prevalence of BMD disorders in this study was 76%, which is higher than that reported from Riyadh 58.5%.[13] A high prevalence of BMD disorders was found in the current study, which was conducted in a DEXA referral center, whereas the community-based study by Al Quaiz et al.[13] reported a lower prevalence. However, another study from Riyadh in a similar setting reported a prevalence of BMD disorders of 63%.[18] Other hospital-based studies from KSA have reported a comparable prevalence of BMD disorders among women such as Taif 71%[12] and Arar 68%.[11]

The prevalence of osteoporosis in this study was 34%, which was slightly higher than that reported from Riyadh where the prevalence among women visiting the DEXA scanning center was 30%.[18] On the other hand, the prevalence of osteoporosis was found to be lower in Taif 26%[12] and Arar 18%.[11] The current estimate is however similar to the 34% reported in a previous systematic review of studies in KSA.[9] Osteopenia alone was observed in 42% of the women. This result is similar to a study conducted in Arar 40% and comparable to studies from Taif 45%[12] and Riyadh 36%.[18] Studies from other Arab countries have also reported a varying prevalence of osteoporosis and osteopenia. A study from Syria reported a prevalence of osteoporosis of 24%, which is lower than this study, whereas osteopenia was comparable 45%.[19] A study from United Arab Emirates also showed a prevalence of osteoporosis and osteopenia of 26% and 36%, respectively[20] whereas in Jordan, the prevalence was 35% and 47%, respectively.[21] These variations in the prevalence of BMD disorders may be due to the differences of settings in which the study was conducted (population- versus institution-based), the population (pre-menopausal versus post-menopausal), social, cultural, and dietary patterns.[22,23] As aforementioned, there are alternative explanations for differences in the prevalence of BMD disorders across various regions of KSA, but these needs to be verified through large-scale studies using standardized tools and

comparable populations. The presence of such differences would require tailored arrangements for the prevention and management of BMD disorders in the regional context.

Spines are more frequently affected by BMD disorders than the femur.[12,21,24] This study also found that spines had a higher prevalence of BMD disorders compared to the femur. Furthermore, osteoporosis was higher in spines, 31% compared to the femur, 9.0% and 13.1% left and right femurs respectively. A consistent pattern was reported in a study from KSA[12] and Kuwait.[24] Subsequently osteopenia was higher in the femur, which is consistent with a previous study.[21] These differences in the involvement of different skeletal sites could be due to differences in age at which bone mass is achieved at different skeletal sites.[25]

This study found that increasing BMI was associated with a lower risk of osteoporosis. This finding is consistent with the results of another study conducted in KSA and other settings, where increasing BMI was associated with lower risk of osteoporosis.[26–28] Although not fully understood, the negative association of BMI with BMD disorders has been attributed to increased bone mass due to mechanical load caused by heavy weight among obese and increased production of estrogen in adipose tissues which suppresses osteoclasts leading to increased bone density.[29,30] Menopause has been found to be associated with a higher prevalence of BMD disorders, which is consistent with other studies.[31,32] Menopause causes a reduction in estrogen levels, which results in excessive bone loss along with linear bone loss with aging. This calls for clinicians to screen menopausal women for BMD disorders and fragility fracture risks.

Oral hypoglycemics are associated with a lower risk of BMD disorders. The literature on the association of DM with osteoporosis is not conclusive as there are discrepant findings across studies and type of diabetes.[33–35] Some studies have shown that oral hypoglycemic agents are associated with a lower risk of BMD disorders.[36,37] Studies have also shown that various hypoglycemic agents affect bone metabolism differently. Metformin activates rabbit muscle pyruvate kinase, which results in the differentiation and mineralization of osteoblasts, leading to increased BMD. Thiazolidinediones have been found to activate osteoclasts.[38] Due to the unavailability of data on a specific type of oral hypoglycemic used by study participants, the exact inference about the observed association may not be possible. Nonetheless, metformin is first-line medication for DM in KSA.

On the other hand, hypertension is associated with a higher risk of BMD disorders. Evidence suggests that low BMD and hypertension have a strong association.[39,40] It is postulated that high blood pressure causes loss of calcium in urine, which results in loss of bone mass.[41]

This study adds to the scarce literature on the epidemiology of BMD disorders in KSA. The DEXA scan was used to ascertain BMD and the diagnosis of osteoporosis, which is the gold standard. There are certain limitations that need to be considered while interpreting the results of this study. This study was conducted in a referral center that may overestimate the prevalence of BMD disorders, as the referred patients were at high risk of BMD disorders. This would also affect its generalizability to the general population. Another limitation is that we did not use a standardized tool to measure physical activity, which may have also affected the estimation of physical activity in this study. Finally, the associations reported in this paper should be interpreted cautiously as the sample may not have been powered enough to accurately measure the associations. Nonetheless, the results provide a basis for further exploration of risk factors of low BMD among women.

Conclusion

A high prevalence of BMD was found among women in this study. This necessitates strengthening the osteoporosis program in the country to prevent negative health and economic consequences of BMD disorders in the country. In addition, large community-based studies are recommended to establish an accurate burden of the osteoporosis in order to tailor the health care services for these disorders among women.

Source of funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest

The author has no conflict of interest to declare.

Ethical approval

This study was reviewed and approved by Qassim Regional Bioethics Committee (Approval No. 607-43-3136, date: 18-04-2020).

Consent

Informed consent was obtained from all participants before collecting the data.

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