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Risk Factors of Osteoporosis among Premenopausal Females: A Cross-Sectional Study in Eastern Region, Hafr Al Batin, Saudi Arabia

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Abstract: Background: The term "silent disease" has been used to describe osteoporosis. That is because many osteoporotic patients are asymptomatic and often not aware of the impact of the disease on their bones until complications such as fractures occur. This study aimed to assess and investigate lifestyle risk factors related to osteoporosis development among university females. **Method**: A descriptive cross sectional research design was adopted for this study, which enlisted 265 women. A self-reported questionnaire about osteoporosis risk factors and lifestyle habits was used to collect data. **Result**: Mean age of participants was 34.63±9.18 and about two thirds were Saudi citizen. More than half of the study females don't participate in any type of physical activity, and most are exposed to less than half an hour of sunlight a day. A statistically significant relation was found between participants' age, nationality, education level, occupation and marital status and their Body Mass Index where p. value was <0.05. **Conclusion**: The study findings highly recommend creating educational programs for osteoporosis to increase women's awareness and therefore reduce the risk of developing osteoporosis.

Key Words: Osteoporosis, Lifestyle, Risk Factors, Females

INTRODUCTION

When density of bone mineral and bone masses declined, or when the composition and strength of bone altered, osteoporosis could develop which is a bone disease. Subsequently, that could result in decreasing bone strength and increasing risks for bone fractures. Among females, this condition could start a year or two before menopausal period [1].

Since bone loss frequently is asymptomatic, osteoporosis is known as a "silent disease" that can be reported in both sexes and increases with age [2]. However, most research on the condition has focused on women because they are more prevalent to occur in female. Recent research showed a higher incidence in men in one Saudi Arabia study [3, 4]. Osteoporosis is a prevalent chronic condition that affect one third of women and one fifth of men over 50 years of age [5]. It causes impaired bone density and quality, hence the name porous.

In Saudi Arabia, recent research found the disease in 52.8% of women and 63.6% of men in a hospita-based setting [4]. About 200 million people globally have osteoporosis, resulting in more than 8.9 million fractures [6]. An epidemiological situation in the Kingdom of Saudi Arabia revealed that 34% of healthy women, and 30.7% of men 50-79 years of age, in the country, have osteoporosis [4,7]. With a reported increase in life expectancy in KSA from 4567 years in 1960 to 75.7 years in 2013, the prevalence of osteoporosis is expected to rise even further [8].

With osteoporosis, some risk factors cannot be changed (fixed), while others can change (modifiable). The non-modifiable risk factors of osteoporosis include age, gender, family history of osteoporosis, race, long-term glucocorticoid therapy and rheumatoid arthritis [9-12]. The modifiable factors include alcohol consumption, smoking status, deficiency of vitamin D, lack of nutrition, inadequate activity, and low intake of minerals. The identification ofall factors could help in establishment of appropriate preventive measures of osteoporosis [13-17].

Certainly, in a young female population, there is compelling evidence that other illnesses are major risk factors to the development of osteoporosis. These include autoimmune diseases like rheumatoid arthritis, systemic lupus erythematous, and ankylosing spondylosis, as well as conditions including hyperthyroidism, celiac disease, and chronic renal disease. Both smoking and heavy alcohol consumption are also significant modifiable risk factors [5].

Calcium absorption and bone strength are mainly controlled by vitamin D. It is a significant risk factor in countries with less than temperate climates because sunshine is vital for vitamin D synthesis. Other influencing factors of osteoporosis are the use of certain drugs, known as secondary risk factors, such as corticosteroids, thyroxine, antacids and chemotherapies, especially aromatase inhibitors [18].

Lifestyle factors also play a major role in minimizing bone loss as we age: physical activity and diet are two factors [19]. In addition, an adequate and healthy diet and weight, also influences bone loss in postmenopausal women. The proportion of Saudi population over 50 years are expected to increase over the next decades ranging from 21% in 2020 to 26% in 2025 and to 30% in 2030 [20]. Additionally, life expectancy in Saudi Arabia is expected to rise from 63.1 years in the 1980s to 74.5 in 2015 and then to 79.4 by the year 2050 [20-22].

The main effective strategy for mitigating the burden of diseases is by implementing primary preventive measures [23]. Therefore, it is essential to increase public awareness about osteoporosis which could significantly help in early detection for the disease [24, 25]. This approach was mainly considered by the Ministry of Health in Saudi Arabia which set a strategy for prevention and management of the condition [26].

Aim of the Study

This study aimed to assess risk factors related to osteoporosis among university females in Saudi Arabia.

METHODS

Study Design

This is a cross-sectional study design; it was conducted among university females. A survey was carried out to collect data on risk factors related to osteoporosis development. The survey comprised three parts. The first part was for demographics such as age, occupation, education level, marital status, age of menarche and obstetrical history. The second part was for assessing the Body Mass Index (BMI) using digital beam scale then classified according to a 2000 WHO report [27] as: Underweight (BMI under 18.5 kg/m^2), normal weight (BMI greater than or equal to 18.5 to 24.9 kg/m^2), Overweight (BMI greater than or equal to 25 to 29.9 kg/m^2), and Obesity (BMI greater than or equal to 30 kg/m^2). Then obesity classified into: Obesity class I (BMI 30 to 34.9 kg/m^2), Obesity class II (BMI 35 to 39.9 kg/m^2), and Obesity class III (BMI greater than or equal to 40 kg/m^2 (also referred to as severe, extreme, or massive obesity). The third part was for assessing lifestyle habits like exercise, exposure to sunlight, vitamin D and calcium supplements, and soft drinks.

The tool used in this study was developed to collect data. A comprehensive pilot and testing were done to ensure the tool is valid and reliable. The Cronbach's alpha was acceptable at ≥0.80. Also, the tool was revised by experts in nursing field, and an orthopedic specialist to ensure its clarity and validity for measuring the variables of the study.

Participants

This study employed a non-probability convenient sampling method to select females' from different colleges affiliated to University of Hafr Al Batin, Saudi Arabia. The participants were provided with a brief explanation about the study objective and assured that their participation is voluntary. Informed consents were obtained from each participant using developed form.

Data Collection

The data was collected by a self-administered survey. All participants were asked to check their body weights and heights for BMI measurements using the digital beam scale. The data collected was done on December 15, 2022, to the end of January 2023.

Data Analysis

Data was analyzed using SPSS version 22.0 [Statistical Package for Social Science]. Descriptive statistics were expressed as number, percentage, mean, and standard deviation. Chi- square test was used to compare qualitative variables. Pearson correlation was done to measure correlation between quantitative variables. P-value is considered statistically significant when ($p<0.05$).

Ethical considerations

An ethical approval was taken from the Local Research Ethics Committee at Hafr Al Batin University on 15.11.2022, the approval code given to the protocol of the study was UHB-001-10-2022. Informed consent was obtained from female participated in the study before enrolling the study.

RESULTS

Table 1 shows that the study sample mean age was [34.63±9.18], around one third aged (30-<40) years, and 29.8 % were in the age group ≥40 years. Nearly two thirds of the study participants were Saudi citizens. More than half were single, and MSc and PhD holders. Additionally, more than one third of participants were academic staff, while the rest were administrative workers. Also, more than one third reported their age of menarche were at <13 years.

Concerning lifestyle practices, results showed that 42.3% of respondents don't do any kind of physical activity. Most of them reported exposure to less than an hour of sunlight daily.

Table 1: Distribution of Participants' Sociodemographic Characteristics

Parameters	No. (265)	Percentage
Age: (years)		
20 - <30	99	37.4
30 - <40	87	32.8
≥40	79	29.8
Mean±SD (Range) 34.63±9.18 (20.0-55.0)		
Nationality		
Saudi	192	72.5
Non-Saudi	73	27.5
Educational level		
Secondary	13	4.9
University	110	41.5
Postgraduate	142	53.6
College		
Medical	131	49.4
Scientific and engineering	73	27.5
Humanities and education	61	23.0
Occupation		
Academic staff	115	43.4
Administrative worker	150	56.6
Age of menarche		
<13 year	103	38.9
≥13 year	162	61.1
Marital status		
Single	149	56.2
Married	99	37.4
Divorced	17	6.4
Gravidity		
<3	63	54.3
≥3	53	45.7
Parity		
<3	72	62.1
≥3	44	37.9

Table 2: Lifestyle Practices of the Study Participants

Parameters	No. (265)	Percentage
Do you practice any kind of physical activity?		
Yes	153	57.7
No	112	42.3
How many times do you exercise/ week?		
3 times per week	103	67.3
> 3 times per week	50	32.7
How long do you expose yourself to sunlight daily?		
<half an hour	180	67.9
≥half an hour	85	32.1
Do take vitamin D and Calcium supplements?		
Yes	128	48.3
No	137	51.7
How many times do you eat dairy products/week?		
<2 times per week	86	32.5
2-4 times per week	113	42.6
≥5 times per week 66		24.9
How many times do you eat proteins (meat, poultry, fish, etc.) / week?		
<2 times per week	63	23.8
2-4 times per week		49.4
≥5 times per week		26.8
Do you drink soft drinks daily?		
Yes	116	43.8
No	149	56.2
How many times a day do you drink soft drinks?		
1 can	79	68.1
2 cans or cups	37	31.9

Moreover, around half reported taking vitamin D/Calcium supplements. Additionally, nearly one third of study participants reported consuming dairy products less than 2 times /week, while 26.8%, reported consuming proteins 5 or more times /week.

Table 3: Bmi Classifications of the Study Respondents

BMI	No. (265)	%
Normal	131	49.4
Overweight	73	27.6
Obesity:	61	23.0
Class I	42	15.8
Class II	16	6.0
Class III	3	1.1
Mean±SD (Range)	26.11±5.50 (18.55-48.89)	-

Table 4: Relation Between Sociodemographic Data of the Studied Respondents and BMI

	BMI						
	Normal (n = 131)		Overweight (n= 73)		Obese (n= 61)		
Sociodemographic data	No.	%	No.	%	No.	%	p-value
Age: (years)							
20 - <30	56	56.6	26	26.3	17	17.2	0.3213
30 - <40	41	47.1	25	28.7	21	24.1	
≥40	34	43.0	22	27.8	23	29.1	
Nationality:							
Saudi	102	53.1	56	29.2	34	17.7	0.004*
Non-Saudi	29	39.7	17	23.3	27	37.0	
Educational level:							
Secondary/ University	70	56.9	32	26.0	21	17.1	0.043*
Postgraduate	61	43.0	41	28.9	40	28.2	
College:							
Medical	71	54.2	33	25.2	27	20.6	0.271
Scientific and engineering	29	39.7	26	35.6	18	24.7	
Humanities and education	31	50.8	14	23.0	16	26.2	
Occupation:							
Academic staff	53	46.1	27	23.5	35	30.4	0.038*
Administrative worker	78	52.0	46	30.7	26	17.3	
Age of menarche:							
Less than 13	53	51.5	26	25.2	24	23.3	0.791
More than or equal 13	78	48.1	47	29.0	37	22.8	
Marital status:							
Married	27	27.3	37	37.4	35	35.4	0.000*
Not married	104	62.7	36	21.7	26	15.7	
Gravidity:							
<3	19	30.2	27	42.9	17	27.0	0.422
≥3	12	22.6	21	39.6	20	37.7	
Parity:							
<3	19	26.4	30	41.7	23	31.9	0.994
≥3	12	27.3	18	40.9	14	31.8	

*Chi-square test

A significant number of respondents mentioned drinking soft drinks daily; most of them consume one can/day (Table 2).

In relation to the classification of study sample BMI, a significant proportion 49.4% of respondents had normal BMI, 27.6% were overweight, and 15.8% of them classified as had obesity class I (Table 3).

Moreover, a statistically significant relationship was found between study participants BMI and their nationality, education level, occupation, and marital status where p. value was 0.004, 0.043, 0.038, 0.007 and 0.000 respectively (Table 4)

Table 5 shows the relationship between participants lifestyle practices and classifications of BMI, and it was noticed that there is a highly statistically significant relation between practicing physical activity and obesity classifications where p-value = 0.000

DISCUSSION

As osteoporosis is prevalent health condition in many countries including Saudi Arabia, implementing appropriate preventive strategies at young age, could be an effective in mitigating the condition. This study aims to identify the risks factors related to osteoporosis in Saudi Arabia.

According to the current study's results about one third of participants were aged 31-40 years. Most were Saudi citizens, and more than half were married.

The current study revealed a remarkably high percentage of respondents don't practice any type of physical activity. Additionally, the findings revealed a significant relation between practicing physical activity and BMI. These findings are in line with a prior Saudi study in which most female participants reported low physical exercise [29]. Notably, this finding was less than that reported by Hammad and Benajiba, 2017, where 61% of women in that study did not exercise [30]. Miserably, this is a challenging reality to public health in Saudi Arabia as stated by previous studies [31, 32].

Table 5: Relation between lifestyle practices of respondents and BMI

	BMI						
	Normal (n = 131)		Overweight (n = 73)		Obese (n = 61)		p-value
Lifestyle practices	No	%	No	%	No	%	
Do you practice any kind of physical activity?							
Yes	92	60.1	42	27.5	19	12.4	0.000*
No	39	34.8	31	27.7	42	37.5	
How many times do you exercise/ week?							
3 times per week	64	62.1	27	26.2	12	11.7	0.765
More than 3 times per week	28	56.0	15	30.0	7	14.0	
How long do you expose yourself to sunlight daily?							
Less than half an hour	86	47.8	51	28.3	43	23.9	0.733
Half an hour or more	45	52.9	22	25.9	18	21.2	
Do you take vitamin D and Calcium supplements?							
Yes	65	50.8	40	31.3	23	18.0	0.131
No	66	48.2	33	24.1	38	27.7	
How many times do you take dairy products / week?							
Less than 2 times per week	44	51.2	25	29.1	17	19.8	0.656
2-4 times per week	52	46.0	34	30.1	27	23.9	
5 or more times per week	35	53.0	14	21.2	17	25.8	
How many times do you eat protein / week?							
Less than 2 times per week	36	57.1	21	33.3	6	9.5	0.054
2-4 times per week	61	46.6	32	24.4	38	29.0	
5 or more times per week	34	47.9	20	28.2	17	23.9	
Do you drink soft drinks daily?							
Yes	59	50.9	28	24.1	29	25.0	0.520
No	72	48.3	45	30.2	32	21.5	
How many times a day do you drink soft drinks?							
1 can	34	43.0	19	24.1	26	32.9	0.010*
2 cans or cups	25	67.6	9	24.3	3	8.1	

*Chi-square test

Table 6: Multiple Logistic Regression Analysis of Overweight/ Obesity Risk Factors

			95% C.I.	
Parameters	p-value	OR	Lower	Upper
Age (years)	0.186	1.023	0.989	1.058
Nationality (non-Saudi)	0.665	0.850	0.407	1.774
Education (Postgraduate)	0.228	1.468	0.787	2.738
Occupation (Academic staff)	0.140	0.594	0.297	1.187
Marital status (Married)	0.000*	3.870	2.111	7.094
Physical activity (No practice)	0.002*	2.396	1.381	4.157

Although Saudi Arabia is a sunny country, most respondents reported less than half an hour of exposure to sunlight daily. This finding is consistent with that reported by Barzanji et al, Al-Otaibi, and Mahboub et al [29, 31, 33]. On the other hand, our study's findings contradict the results from the Egyptian study, which indicating that Egyptian females are daily exposed to sunlight [34]. The exposure to sunlight has been justified by low level of awareness, hot climate and limited outdoor activities. It is well established that sun exposure helps maintain bone health by promoting vitamin D synthesis. Another supported study findings by Elgzaar *et al* 2023 emphasize that although various studies have documented that 15 min of direct sun exposure each day is a critical step in preventing osteoporosis, this item was the lowest on average among the study participants and mention that lack of exposure to sunlight may be attributed to the hot climate in most regions of Saudi Arabia. At the same time, a sedentary lifestyle and socioeconomic well-being also contributed to a lack of sun exposure and regular physical activity or walking at least half an hour per day [35].

Another strategy for prevention is taking a lot of calcium [36], which is crucial for bone health and structure [37]. It was also reported that more than one third of study participants take dairy products 2-4 times per week. In the same line a study in Saudi Arabia, by Hammad and Benajiba, found that 91% of young ladies consumed milk and dairy products less than two times per week [30] and also another study by Al Qauhiz [38]. The study findings by Al Daghri *et al* 2023 showed that the people take low dairy products [39]. Another study findings showed that only 31.1% took dairy products and 17.7% consumed calcium supplements [40].

Another issue is consumption of soft drinks. According to Euromonitor International Country report, Saudi Arabia is the largest consumer of soft drinks in the Middle East and that request is growing [41]. The current study confirms that more than one third of respondents reported drinking soft drinks daily [79.4% of them consume one can /day]. In another study conducted by Hammad and Benajiba 2017, the findings shows that soft drinks were highly and continually consumed by female

University scholars either relatively [more than two cans/week] or regularly [>than 3 and large cans/day] [30].

BMI is an important factor in bone mineral density measurements. Until recently, individuals with a high BMI had some protection against fractures [42]. The current study shows that about one third were overweight, 30.6% were obese and 21.8% of them were classified as obesity class I.

Understanding the multifactorial causes may help in developing adequate intervention with a focus on the importance of assuming a healthy lifestyle based on regular physical activity, reducing consumption of soft drinks, as well as ensuring an adequate intake of vitamin D and Calcium.

CONCLUSIONS

This study documents the main lifestyle factors that may lead to osteoporosis among young-adult Saudi women. More than one third of respondents consume soft drinks and most of them daily. Additionally, more than have of them don't practice any type of physical activity. Lack of exposure to sunlight daily and decrease taking calcium and vitamin D supplementation were noticed. This research data could be the basis for nutrition education intervention to improve lifestyle habits and promote healthy bones in later life. Thus, to prevent osteoporosis among the adult population, it is necessary to have an initial understanding about the knowledge, attitude, and practices of young adults towards preventive measures of osteoporosis.

Limitations of the Study

Convenience sampling technique used in the sample selection considered as a limitation affecting representativeness of the sample.

Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki.

Informed Consent Statement

Informed consent was obtained from all students who participated in the study before enrolling in the study.

Data Availability Statement

The data presented in this study can be available on request from the corresponding author. The data is not publicly available due to ethical and privacy restrictions.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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