Assessment of osteoporosis knowledge among adult Saudi females attending the family medicine department at Security Forces Hospital, Riyadh, Saudi Arabia

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ABSTRACT

Background: Osteoporosis is a skeletal disorder characterized by loss of bone mineral density, deterioration of bone structure, bone fragility, and it is associated with high risk of fractures. The prevalence of osteoporosis among Saudis is estimated to be 34% in females and 30.7% in males. The aim of this study was to know the level of knowledge about osteoporosis among Saudi females at Security Forces Hospital, Riyadh, Saudi Arabia. **Materials and Methods:** This was a descriptive and analytical cross-sectional study conducted between January 2019 and January 2020. We used the osteoporosis knowledge assessment tool (OKAT) for data collection. The survey assessed the understanding of symptoms and fracture risk, risk factors, treatment availability and preventive factors for osteoporosis. **Results:** The overall knowledge of our 376 participants was good with a mean score of (66%). Participants had more knowledge about the symptoms and fracture risk and the preventive factors such as physical activity and diet compared to the other subscales of the OKAT. There was a significant difference between the knowledge of younger and older females (>40 yrs.), where younger females had lower scores on the OKAT. **Conclusion:** This study showed that knowledge about osteoporosis was good among females attending the family medicine clinics in Riyadh, Saudi Arabia. However, younger females were less knowledgeable, which means that more effort should be made to increase the awareness about osteoporosis especially among the younger females.

Keywords: Bone health, females, knowledge, osteoporosis, risk factors, Saudi

Introduction

Osteoporosis is a skeletal disorder characterized by loss of bone mineral density, deterioration of bone structure, bone fragility, and it is associated with high risk of fractures.[1] It is frequently called "the silent disease", as the disease is asymptomatic, and patients usually are not aware of the fragility of their bones until a fracture happens.[2] Moreover, it is associated with significant mortality, morbidity, disability and health care costs.[3]

On a global level, osteoporosis causes approximately nine million fractures per year.[4] It is estimated that it has impacted around two hundred million women worldwide.[5] It is reported that one out of every two Caucasian women and around one in every five Caucasian men will have a fracture related to osteoporosis in their lifetime.[3] Osteoporosis prevalence in Saudi Arabia was found to be 34% in females and 30.7% in males, and it is expected to increase as life expectancy increases.[6]

There are multiple risk factors linked to the development of osteoporosis such as aging, excessive alcohol intake, caffeine consumption, smoking, family history of osteoporotic fractures, immobilization, sedentary lifestyle, low calcium and vitamin D intake and White or Asian race.[3] Having good knowledge and being aware of the risk factors for osteoporosis has shown to

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be a contributor to osteoporosis prevention.[7,8] In addition, implementing healthy lifestyle decreases the risk of osteoporosis and its fracture risk as suggested by previous studies.[9,10]

A study done in 2001 on rural Turkish women found that more than 40% are unaware of osteoporosis risk factors and its complications, and only 44.9% knew the definition of osteoporosis.[11] In Lebanon, they conducted a study in 2018 where they assessed the perception of osteoporosis among women aged 50 and above and found that the level of knowledge is low, where 46% only answered correctly about osteoporosis definition.[12] In 2018 In Mansoura, Egypt they looked into the knowledge and health beliefs of osteoporosis among elderly women, the study showed that only 35% knew that there are effective treatments for osteoporosis.[13] A recent cross-sectional study in 2020, done on Australian women with premature ovarian insufficiency, found that women in rural areas had lower knowledge scores and were more likely to have family history of osteoporosis compared to women living in metropolitan areas.[14]

A survey on women of reproductive age in Qatar showed that they lack knowledge regarding the risk factors, benefit of weight-bearing exercise, and the intake of calcium and vitamin D rich diet.[15] In Saudi Arabia, a study in 2016 evaluated and compared the general population's knowledge about osteoporosis among Saudi males and females. 58% of males knew that it is a silent disease while only 44% of females did. Also, participants above 51 years old had more correct answers regarding osteoporosis than those aged 15 to 35 years.[16] In Riyadh, two studies showed that there is poor application of preventive measures for osteoporosis by the Saudi females.[17,18]

To the best of our knowledge Saudi Arabia is still lacking in studies that discuss the knowledge and awareness of osteoporosis among females, and is much needed because it plays a major role in implementing prevention programs and in managing osteoporosis. Additionally, since osteoporosis is primarily treated by primary care physicians due to the large number of patients and scarcity of specialists (endocrinologist), It will help the physicians to enhance awareness about osteoporosis and its health behaviors by understanding the patients' knowledge and beliefs. Therefore, the study aims to assess the level of knowledge of osteoporosis risk factors, symptoms, fracture risk, treatment and preventive measures and compare the level of knowledge between young and older females among adult Saudi females at Security Forces Hospital, Riyadh, Saudi Arabia.

Material and Methods

This study was conducted at Security Forces Hospital (SFH), Riyadh, Saudi Arabia in the Family Medicine Department. The hospital cares for all Ministry of Interior (MOI) military and civilian personnel, active or retired, and their eligible dependents. It also covers all SFH employees and their eligible dependents. It is a Descriptive and analytical cross-sectional study were we used convenience sampling technique, which is a type of

non-probability sampling technique. Ethical approval was obtained from the Research Ethics Committee with reference number (19-309-7) dated 26/12/2018 and informed written consent was obtained from all the study participants. A hard-copy of the questionnaire was distributed to the subjects in waiting areas in the Family Medicine Department at SFH.

Inclusion criteria for the study participants were Saudi females, all above the age of 18 years, and willing to participate in the study. We excluded people from outside the hospital or surveys with missing data. A minimum sample size of 376 was calculated by the Raosoft calculator[19] using a confidence level of 95% and a margin of error of 5% assuming the population is more than 20,000 subjects.

We used the Osteoporosis Knowledge Assessment Tool (OKAT), a validated and reliable self-administered questionnaire.[20] OKAT evaluates the understanding of the symptoms, risk of fractures, risk factors, protective measures and treatment availability for osteoporosis. Each statement in the survey can be labeled by the participants as (true) or (false). The questionnaire was translated to Arabic and back-translated to English, and this process was repeated until a reliable and a satisfactory version of the questionnaire was reached.

Data from the survey was transferred into Excel, Then the data was analyzed using SPSS program version (24.0). For the descriptive part the data was presented using summary charts and frequency tables. T-test was used to study the relationship between the age groups. A value of $P \leq 0.05$ was considered significant.

Results

As shown in Table 1 the total number of study participants was 376 females. Distribution of the participants regarding their personal and social characteristics can be seen in Table 1 below and it summarizes the characteristics of respondents (n = 376) according to the independent variables (age group, marital status, education and income). It shows that most of the participants were between the age of 26 to 35 years old (40.7%). More than three-quarters of females were married (77.7%). Only 0.8% of the participants have had a masters or doctoral degree, whereas 50% of the them had a bachelor's degree. In terms of total monthly family income, 25% had an income more than 10,000 riyals.

The mean score of correct answers to the OKAT questionnaire was found to be 13 (66%). It can be seen from Table 2 a large majority of the participants (98.4%) answered question number one correctly which was regarding osteoporosis leading to increased risk of bone fracture, followed by question number four (88%) which states that osteoporosis is more common in men. On the other hand, only 12.8% answered correctly to question number two about the symptoms of osteoporosis.

Table 3 showed 59.8% of Saudi females had a good general knowledge about osteoporosis, whereas 37.5% had very

good knowledge and only 2.7% had a poor knowledge about osteoporosis.

The four subscales for the OKAT are shown in Tables 4 and 5. The studied Saudi females were more knowledgeable on the symptoms and fracture risk in osteoporosis (83.6%) and had a mean of (M = 4.18, SD = 0.83), followed next by the preventive factors

as physical activity and diet relating to osteoporosis with a score of (70.3%) and a mean of (M = 4.22, SD = 1.17). The participant had lower scores in regards to their knowledge about osteoporosis risk factors (54.5%) (M = 3.82, SD = 1.45) and to their knowledge about treatment availability (46.4%) (M = 0.93, SD = 0.70).

From Table 6 we can state that there was a significant difference in the knowledge about osteoporosis between females aged 18-40 and females above 40 years. The table compares between young and older Saudi females in relation to the different OKAT subscales. As all P values for OKAT subscales are less than our chosen significance level $p = 0.05$, we can conclude that the mean knowledge about osteoporosis risk factors, symptoms and fracture risk, treatment availability, and of preventive factors relating to osteoporosis for females aged 18-40 and females above 40 years are significantly different (P = 0.000, P = 0.012, P = 0.003 and P = 0.011, respectively).

Discussion

Our study's objective was to determine the level of knowledge about osteoporosis among Saudi females attending the Security Forces Hospital in Riyadh, Saudi Arabia. A survey was distributed to the participant, which included the osteoporosis knowledge assessment tool (OKAT) and demographic characteristics. The purpose for selecting only female participants is because they are considered a risk group who are more liable to osteoporosis and its complications. We found that 59.8% of the participants had a good score on the questionnaire. The mean score of correct answers for the 376 study subjects from our investigation was

Table 1: Participants characteristics (*n*=376)

	No.	%
Age group (yrs)		
18-25	63	16.8
26-35	153	40.7
36-40	68	18.1
>40	92	24.5
Marital status		
Single	67	17.8
Married	292	77.7
Divorced	10	2.7
Widowed	7	1.9
Education		
Illiterate	39	10.4
Secondary	146	38.8
University education	188	50.0
MSc-PhD	3	0.8
Income		
<5000 SR	102	27.1
5000-10000 SR	180	47.9
>10000-20000 SR	73	19.4
>20000 SR	21	5.6

Table 2: Responses to OKAT questionnaire

Question, the correct answer between two brackets.	Percentage of correct answers
1 Osteoporosis leads to an increased risk of bone fractures, (*True*)	98.4%
2 Osteoporosis usually causes symptoms (e.g., pain) before fractures occur. (*False*)	12.8%
3 Having a higher peak bone mass at the end of childhood gives no protection against the development of osteoporosis in later life. (*True*)	81.4%
4 Osteoporosis is more common in men. (*False*)	88.0%
5 Cigarette smoking can contribute to osteoporosis. (*True*)	67.8%
6 White women are at highest risk of fracture as compared to other races. (*True*)	34.8%
7 A fall is just as important as low bone strength in causing fractures. (*True*)	70.5%
8 By age 80, the majority of women have osteoporosis. (*True*)	84.6%
9 From age 50, most women can expect at least one fracture before they die. (*True*)	61.7%
10 Any type of physical activity is beneficial for osteoporosis. (*False*)	20.7%
11 It is easy to tell whether I am at risk of osteoporosis by my clinical risk factors. (*True*)	86.2%
12 Family history of osteoporosis strongly predisposes a person to osteoporosis. (*True*)	56.1%
13 An adequate calcium intake can be achieved from two glasses of milk a day. (*True*)	83.0%
14 Sardines and broccoli are good sources of calcium for people who cannot take dairy products. (*True*)	91.2%
15 Calcium supplements alone can prevent bone loss. (*False*)	59.8%
16 A high salt intake is a risk factor for osteoporosis. (*True*)	55.3%
17 There is a small amount of bone loss in the 10 years following the onset of menopause. (*False*)	26.9%
18 Hormone therapy prevents further bone loss at any age after menopause. (*True*)	59.0%
19 There are no effective treatments for osteoporosis available in "Saudi".(*False*)	66.2%
The mean score of correct answers	13 66.0%
The least score	0
The best score	19

OKAT (osteoporosis knowledge assessment tool), implemented from Winzenberg *et al.*[20]

reported to be 66%. Another study on Saudi students between the age of 18-30 years from four different universities in 2019,[21] reported lower score for the overall level of knowledge, where females had a score of 55.7%. In Majmaah city, Saudi Arabia a study done on 390 adult females showed half the participant (50%) had a fair level of knowledge about osteoporosis.[22] Women of reproductive age in Qatar had an overall knowledge score of

61.4%.[15] This score was similar to the one found in Swedish and Turkish women (61%) and (63%) respectively.[23,24]

Knowing the populations' level of knowledge about the risk factors is crucial because the level of knowledge can guide us in developing prevention programs for osteoporosis.[8] As shown previously in our results, 54.5% of our study subjects knew about the risk factors. The awareness about family history and its predisposition to osteoporosis was lower compared to the other risk factors (56.1%); which is higher than what is found at primary health care center in Dirab, Riyadh, Saudi Arabia, where only 22% of the females recognized family history as a contributing factor.[25] In Qatar, participants had lower score compared to ours (36.%).[15] A survey in New Zeeland in 2007, done on 622

Table 3: General knowledge level

General knowledge (No. of questions answered correctly)	Knowledge Score
Poor knowledge (0-7)	10 (2.7%)
Good knowledge (8-13)	225 (59.8%)
Very good knowledge (14-19)	141 (37.5%)

Table 4: Mean scores of OKAT subscales among the studied females

OKAT subscales	n	Minimum score	Maximum score	Mean (M)	Standard deviation (SD)
knowledge about osteoporosis risk factors (total possible score 7 points)	376	0	7	3.82	1.45
knowledge about the symptoms and fracture risk in osteoporosis (total possible score 5 points)	376	0	5	4.18	0.83
knowledge level about treatment availability. (total possible score 2 points)	376	0	2	0.93	0.70
Knowledge of preventive factors as physical activity and diet relating to osteoporosis. (total possible score 5 points)	376	0	5	4.22	1.17

Table 5: Responses to the OKAT subscales

Question, the correct answer between two brackets	Percentage of correct answers
Knowledge about osteoporosis risk factors	
Having a higher peak bone mass at the end of childhood gives no protection against the development of osteoporosis in later life. (*True*)	81.4%
Osteoporosis is more common in men. (*False*)	88.0%
Cigarette smoking can contribute to osteoporosis. (*True*)	67.8%
White women are at highest risk of fracture as compared to other races. (*True*)	34.8%
A fall is just as important as low bone strength in causing fractures. (*True*)	70.5%
Family history of osteoporosis strongly predisposes a person to osteoporosis. (*True*)	56.1%
Hormone therapy prevents further bone loss at any age after menopause. (*True*)	59.0%
Overall percentage of correct answers	54.5%
knowledge about the symptoms and fracture risk in osteoporosis.	
Osteoporosis leads to an increased risk of bone fractures, (*True*)	98.4%
Osteoporosis usually causes symptoms (e.g., pain) before fractures occur. (*False*)	12.8%
By age 80, the majority of women have osteoporosis. (*True*)	84.6%
From age 50, most women can expect at least one fracture before they die. (*True*)	61.7%
It is easy to tell whether I am at risk of osteoporosis by my clinical risk factors. (*True*)	86.2%
Overall percentage of correct answers	83.6%
knowledge level about treatment availability	
There are no effective treatments for osteoporosis available in "Saudi".(*False*)	66.2%
Hormone therapy prevents further bone loss at any age after menopause. (*True*)	59.0%
Overall percentage of correct answers	46.4%
Knowledge of preventive factors as physical activity and diet relating to osteoporosis	
Any type of physical activity is beneficial for osteoporosis. (*False*)	20.7%
An adequate calcium intake can be achieved from two glasses of milk a day. (*True*)	83.0%
Sardines and broccoli are good sources of calcium for people who cannot take dairy products. (*True*)	91.2%
Calcium supplements alone can prevent bone loss. (*False*)	59.8%
A high salt intake is a risk factor for osteoporosis. (*True*)	55.3%
Overall percentage of correct answers	70.3%

OKAT (osteoporosis knowledge assessment tool), implemented from Winzenberg *et al.*[20]

Table 6: Results of Student *t*-test for comparison between young females and older females in regard to sub-scales of osteoporosis knowledge test

Osteoporosis knowledge sub-scales	Sample	*n*	Mean	SD	*t*-test	*P*
Knowledge about osteoporosis risk factors	Females aged 18-40	284	3.62	1.45	4.677	0.000**
	Females above 40 years	92	4.41	1.28		
Knowledge about the symptoms and fracture risk in osteoporosis.	Females aged 18-40	284	4.12	0.86	2.530	0.012*
	Females above 40 years	92	4.37	0.71		
Knowledge level about treatment availability.	Females aged 18-40	284	0.87	0.70	3.039	0.003**
	Females above 40 years	92	1.12	0.68		
Knowledge of preventive factors as physical activity and diet relating to osteoporosis.	Females aged 18-40	284	4.13	1.17	2.552	0.011*
	Females above 40 years	92	4.49	1.13		

**Significant at 0.01, *Significant at 0.05, SD=Standard deviation

women found that only 22% knew that having family history of osteoporosis made them susceptible to it.[2] Smoking was another risk factor mentioned in the questionnaire. Almost two-thirds of our participants (67.8%) agreed that smoking contributes to osteoporosis. In Lebanon in 2018, a study on post-menopausal women showed only 36% were aware of the role of smoking.[12] Another study conducted in Pakistan where only 15% of the study subjects knew that smoking could lead to the disease.[26]

Understanding the seriousness of osteoporosis is necessary for modifying certain health behaviors related to diet and physical activity. Preventative factors such as adequate calcium intake was part of the survey. Getting sufficient daily calcium intake is important to reduce the risk of osteoporosis.[27] From the 376 subjects, 83% were aware of the recommended dietary allowance (RDA) for calcium, and 91% identified sardines and broccoli as a source of calcium. Our study's percentages were higher compared to the study done on Saudi female college students, they had a score of 68% and 57% respectively, which might be explained by the different age group selected in our study.[28] In the study of New Zeeland mentioned previously, just over half the participant identified broccoli as a source of calcium,[2] and in another study conducted on Qatari woman only a few knew that broccoli and sardines are rich in calcium.[15] This emphasizes the importance of knowing the non-dairy sources of calcium, especially for those who can't tolerate lactose or people who are following a vegan diet.

One of our objectives was to find if there is knowledge discrepancy between young and older females. This study resulted in a statistically significant relation between the age and the level of knowledge. Females above the age of 40 had higher scores in all of the four OKAT subscales. A national cross-sectional study in Saudi Arabia in the year 2016[16] had a similar result, especially in the 51–65 year age group. Similarly, in a study done in Pakistan in 2006[26] revealed that younger females had poor knowledge compared to older females. On the contrary, a study on the population of Greek during 2007[29] showed that females of older age had insufficient knowledge about osteoporosis.

A limitation of this study was due to the cross-sectional design and the convenience sampling used in the study. The participants were only recruited from primary care clinics at SFH. Future researches should involve larger population from different hospital areas and from multiple regions of Saudi. Further research should also shed light on the population's awareness about the symptoms of osteoporosis and the benefit of physical activity since both had the lowest correct answers scores.

Conclusion

It can be concluded that the overall knowledge of our participants was good with a mean score of (66%). Our results showed that the older females (above 40 years) had a higher level of knowledge in all the subscales of the questionnaire compared to the younger females. This shows that awareness campaigns and prevention programs are necessary and should target high schools and universities, so females can know if their at risk of developing osteoporosis and as a result change their health behaviors.

Conflicts of interest

There are no conflicts of interest.

References

1. Cosman F, de Beur SJ, LeBoff MS, Lewiecki EM, Tanner B, Randall S, *et al.* Clinician's guide to prevention and treatment of osteoporosis. Osteoporos Int 2014;25:2359-81.

2. von Hurst PR, Wham CA. Attitudes and knowledge about osteoporosis risk prevention: A survey of New Zealand women. Public Health Nutr 2007;10:747-53.

3. (US) Office of the Surgeon General. Bone Health and Osteoporosis. Bone Health and Osteoporosis: A Report of the Surgeon General. Office of the Surgeon General (US); 2004.

4. Johnell O, Kanis JA. An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. Osteoporos Int 2006;17:1726-33.

5. Group KJA on behalf of the WHOS. Assessment of osteoporosis at the primary health care level [Internet]. Geneva; 2007 [cited 2018 Dec 19]. Available from: www.who.int/chp/topics/rheumatic/en/index.html.

6. Sadat-Ali M, Al-Habdan IM, Al-Turki HA, Azam MQ. An epidemiological analysis of the incidence of osteoporosis and osteoporosis-related fractures among the Saudi Arabian population. Ann Saudi Med 2012;32:637-41.

7. Kasper MJ, Peterson MG, Allegrante JP, Galsworthy TD, Gutin B. Knowledge, beliefs, and behaviors among college women concerning the prevention of osteoporosis. Arch Fam Med 1994;3:696-702.

8. Riaz M, Abid N, Patel J, Tariq M, Khan MS, Zuberi L. Knowledge about osteoporosis among healthy women attending a tertiary care hospital. J Pak Med Assoc 2008;58:190-4.

9. Swaim RA, Barner JC, Brown CM. The relationship of calcium intake and exercise to osteoporosis health beliefs in postmenopausal women. Res Soc Adm Pharm 2008;4:153-63.

10. Werner P. Knowledge about osteoporosis: Assessment, correlates and outcomes. Osteoporos Int 2005;16:115-27.

11. Gemalmaz A, Oge A. Knowledge and awareness about osteoporosis and its related factors among rural Turkish women. Clin Rheumatol 2008;27:723-8.

12. Ahmadieh H, Basho A, Chehade A, Al Mallah A, Dakour A. Perception of peri-menopausal and postmenopausal Lebanese women on osteoporosis: A cross-sectional study. J Clin Transl Endocrinol 2018;14:19-24.

13. RagaaElMasry R, GhadaElkhawaga G, AbdelHadyElGilany A, Alam R. Knowledge and health beliefs of elderly women toward osteoporosis in Mansoura, Egypt. Prog Med Sci 2018;2:27.

14. Jones AR, Goh M, Langham R, Boyle J, Milat F, Ebeling PR, et al. Osteoporosis and premature ovarian insufficiency: Geographic variation in clinicians' and consumers' knowledge gaps and barriers to care. Arch Osteoporos 2020;15:1-10.

15. Al-Muraikhi H, Said H, Selim N, Chehab MA. The knowledge of osteoporosis risk factors and preventive practices among women of reproductive age in the state of Qatar: A cross-sectional survey. Int J Community Med Public Heal 2017;4:522.

16. Tlt A, Barghash S, Al-Salamah N. Knowledge, attitude and practice (KAP) regarding osteoporosis among general population in Saudi Arabia. Br J Med Med Res 2016;13:1-10.

17. Barzanji AT, Alamri FA, Mohamed AG. Osteoporosis: A study of knowledge, attitude and practice among adults in Riyadh, Saudi Arabia. J Community Health 2013;38:1098-105.

18. Alshammari KF. Women knowledge, attitude and practices about osteoporosis prevention " Riyadh Saudi Arabia ". World J Med Sci Community Heal Nurs Ment Heal Dep 2014;11:422-31.

19. Raosoft, Inc. [Internet]. Raosoft Sample Size Calculator; 2004. Available from: http://www.raosoft.com/samplesize. html. [Cited on 2018 Dec 5].

20. Winzenberg TM, Oldenburg B, Frendin S, Jones G. The design of a valid and reliable questionnaire to measure osteoporosis knowledge in women: The osteoporosis knowledge assessment tool (OKAT). BMC Musculoskelet Disord 2003;4:17.

21. Khan JA, McGuigan FE, Akesson KE, Ahmed YM, Abdu F, Rajab H,. Osteoporosis knowledge and awareness among university students in Saudi Arabia. Arch Osteoporos 2019;14:1-7.

22. ElTohami K, Sami W, Eidan A, Mubarak M, Alotaibi F. Study of knowledge, attitude and practice of osteoporosis among adult women in Majmaah City, Saudi Arabia. Int J Heal Rehabil Sci 2015;4:185-92.

23. Waller J, Eriksson O, Foldevi M, Grahn Kronhed AC, Larsson L, Löfman O, et al. Knowledge of osteoporosis in a Swedish municipality-A prospective study. Prev Med (Baltim) 2002;34:485-91.

24. Ungan M, Tümer M. Turkish women's knowledge of osteoporosis. Fam Pract 2001;18:199-203.

25. Alshahrani FM, Alzahrani AM, Alhaqawi A. Knowledge of osteoporosis in middle-aged and elderly women-PubMed. Saudi Med J 2010;31:684-7.

26. Bilal M, Haseeb A, Merchant AZ, Rehman A, Arshad MH, Malik M, et al. Knowledge, beliefs and practices regarding osteoporosis among female medical school entrants in Pakistan. Asia Pac Fam Med 2017;16:1-7.

27. Borer KT. Physical activity in the prevention and amelioration of osteoporosis in women: Interaction of mechanical, hormonal and dietary factors. Sports Med 2005;35:779-830.

28. Alshareef SH, Alwehaibi A, Alzahrani A, Fagihi A, Alkenani A, Alfentoukh M, et al. Knowledge and awareness about risk factors of osteoporosis among young college women at a University in Riyadh, KSA. J Bone Res 2018;06. doi: 10.4172/2572-4916.1000194.

29. Alexandraki KI, Syriou V, Ziakas PD, Apostolopoulos NV, Alexandrakis AI, Piperi C, et al. The knowledge of osteoporosis risk factors in a Greek female population. Maturitas 2008;59:38-45.