Risk of Developing Osteoporosis and the Level of Awareness Among Adult in Eastern Province Saudi Arabia

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Abstract

Osteoporosis is one of the common and digitating problems worldwide. Besides, the disease is silent and usually affects post-menopausal ladies and it is considered as a silent disease.

This study is aiming to assess the risk of fracture and developing Osteoporosis along with the knowledge and awareness level of Osteoporosis in eastern province, Saudi Arabia papulation.

The total number of the participants is 806. The majority of the sample was male, having a bachelor's degree, living in Al-Ahsa. Most of the data are at low risk of developing Osteoporosis and fractures. The majority of participants (%) had low OKAT scores signifying poor knowledge among included subjects. The young age, being highly educated were significantly associated with good awareness.

A low risk of fracture does not mean that we stop educating the community about Osteoporosis because a poor level of knowledge about Osteoporosis was found among the included subjects. Thus, authorities should create educational programs at all health care facilities to assess a preventive program for osteoporosis.

Keywords: Osteoporosis; Awareness; Saudi Females; Eastern Province

Abbreviations

OP: Osteoporosis; MENA: Middle East and North Africa; VDR: Vitamin D Receptor Gene; BMD: Bone Mineral Density; SNP: Single Nucleotide Polymorphisms; BMI: Body Mass Index; HRT: Hormonal Replacement Therapy; OCP: Oral Contraceptive Pills; DEXA or DXA: Dual-energy X-Ray Absorptiometry; QCT: Quantitative Computed Tomography; WHO: World Health Organization; SOF: Osteoporotic Fractures; QUS: Quantitative Ultrasound; BUA: Broadband Ultrasonic Attenuation; SOS: Speed of Sound; SXA: Single X-ray Absorptiometry; pDXA: Peripheral DXA; OKAT: Osteoporosis Knowledge Assessment Tool

Introduction

Osteoporosis is one of the common and digitating problems worldwide. Also, the disease is silent and usually affects postmenopausal ladies [1]. This metabolic disease affects the skeletal system. The disease is cancerized by a decrease in the bone density, weakening, and thinning of the bone, and making it more fragile in its micro-architecture tissue. A sequence of this fragility, the first presentation of the

patient with Osteoporosis is a fracture, as international Osteoporosis foundation said [1,2]. Osteoporosis is assessed to affect 200 million ladies universally - about one-tenth of ladies aged 60, one-fifth of ladies aged 70, two- fifths of ladies aged 80 and two-thirds of ladies aged 90 [3].

Globally, the fracture that is caused by Osteoporosis is 1.5 million every year. Hip fractures are estimated to be 300,000, vertebral fractures are about 700,000. Also, more than 250,000 fractures in the wrist and 300,000 in several places in the body [4]. Locally, in the kingdom of Saudi Arabia, there are 8,768 femoral fractures annually [5]. The age of 50 is the point where the fragility fractures happen in Caucasian women about 40|% and in men about 13% [6]. Usually, the most time of death occurring at the first 6 months of the fracture, and these fractures are accompanying with morbidities and prolong the hospital staying for 20-30 days on average [7]. In the kingdom of Saudi Arabia, between the age 50 - 79 years old, there are 34% of healthy Saudi ladies, and 30.7% of men are considered to have Osteoporosis [8]. However, with the documentations that show rising in the life expectancy in kingdom of Saudi Arabia, the prevalence of Osteoporosis has been predicted to be increasing in becoming years.

The risk factors such as lifestyle low calcium intake, decreasing the physical activity, low level of vitamin D, and all of these factors play a significant role in increasing the prevalence of Osteoporosis [9,5]. This issue and bone health are severe worries in the kingdom of Saudi Arabia [5]. In the part of the cost, it is a huge burden in the countries. Annually, England and wales osteoporotic fracture charge £1.7 billion. More than 90% of the total charge because of hip fractures [10]. Osteoporosis is a significant danger to humanity and its well-being. Between the developed populations in North America, Europe, Japan and Australia, Osteoporosis at the hip/spine affects 49 million grownups extending from 9% to 38% in females and 1% - 8% in males [11]. Luckily, nonetheless death is uppermost throughout the year of fracture, the amounts of event osteoporotic fractures seem to be calming internationally [12]. Assessed direct costs for the management of osteoporotic fractures in the United States reaching $17 billion in 2005 and is anticipated to grow by 50% in 2025 [13]. In Europe, the financial affliction of event and previous fragility fractures was €37 billion in 2010 [14]. Rendering to the only study that had been published about Saudi Arabia in 2007, the yearly direct charge of osteoporotic hip fractures treatment was valued by SR 2.09 million (US$557,333) at an amount of SR 48,712 (US$ 12 989.90) each patient and that not involving all the types of fractures [15].

This Osteoporosis has many risk factors contribute to this disease, such as being a female, an age above 40, a previous fragility fracture, a parental fragility fracture, an abnormal BMI below 18.5 or more than 25, medications, low amount of productivity hormones, a lack of physical activity, the use of glucocorticoids, rheumatic disease, smoking, the low level of calcium and vitamin D deficiency, menopause and low sun exposure [1-3]. Most of the factors are modifiable, except for gender, age and genetics. Therefore, by awareness, knowledge and early assessment, we can avoid those risk factors.

The patient with Osteoporosis present with no symptoms and if they have a symptom, it will be a fracture in the back [16]. Thus, for diagnosing this disease, we rely on investigations and most importantly is Bone Mineral Density (BMD) tests. It is indicated in all patients who have significant risk factors that were missioned above [17]. Dual-energy X-ray Absorptiometry (DXA) is a part of BMD and the basic idea of it is assessing the x-ray transmission with great or little photons energies across the different tissues in the body [18,19]. The WHO criteria for the diagnosis of Osteoporosis mentioned to in table 1 and are based on DXA values. DXA, therefore, is the non-invasive diagnostic test of Osteoporosis. There are other BMD investigations such as ultrasound and Quantitative Computed Tomography (QCT) that can be used to help in the diagnosis of Osteoporosis [19].

Regards Osteoporosis management, it is a preventable disease, by doing a lifestyle modification involving physical activity, diet, and fall preventive instructions. There is a treatment for Osteoporosis including calcium and vitamin D supplements, bisphosphonates, alendronate, intravenous zoledronate, denosumab, and raloxifene [20,21].

This issue is very significant in our region and it is affecting our economy; however, it is preventable but when other studies assess the level of awareness, they found it low in different cities in the kingdom of Saudi Arabia. A study was done about the knowledge of Os-

teoporosis in middle-aged and elderly women in Saudi Arabia and it demonstrated a 368-female participant with 76% of them are post-menopausal age. 62% of the sample overheard about the disease. Younger females had more information about Osteoporosis. Also, the identification of the risk factor of the disease by the responders was between poor to fair. A low level of physical activity was documented as a risk factor in only 39%, and 22% recognized Osteoporosis in the family as risk factor.

Another study was conducted in Assir region for 119 ladies. The majority of the responder have a low level of awareness and the responder (57.1%) had partial physical exercise and 71.2% had no outside work at all or doing a workout. all of the sample population did not have a regular sport activity [22]. Also, there is a study in Young College Women at a University in Riyadh to assess the level of awareness and knowledge that revealed 1012 female students contributed to the study. Most of the sample that accounted for 804 (79.4%) were below the cut point (< 60%) and they considered having a low level of awareness and knowledge about the disease [23].

Methodology

Study area/setting

This study was conducted in eastern province, Kingdom of Saudi Arabia between the date 28/3/2019 to 15/4/2019.

Study subjects

Male and female above age of 18.

Study design

Analytical cross-sectional study.

Sample size

809 subjects based on Qualtrics a sample-size calculator that uses the number of general population in the eastern province, Kingdom of Saudi Arabia which was 4,900,325 in 2017 and confidence interval of 95% and a margin of error of 5%.

Sampling technique

Simple random sampling.

Data Collection methods, instruments used, measurements

The questionnaire was translated into Arabic language and revised by 3 supervisors then was published online. Demographic characteristics and Risk of fracture (Appendix 1), Osteoporosis knowledge assessment tool (OKAT) [25] (Appendix 2), used to collect the data from Male and female above age of 18 through online questioner.

Study procedures

Demographic characteristics and risk of fracture (Appendix 1), was distributed among females and males to evaluate the bone fracture risk. Also, an Osteoporosis knowledge assessment Tool (OKAT) [25] (Appendix 2) was also distributed in the same online questionnaire to see and score the level of awareness among the general population.

Analysis

All variables will be entered into IBM Statistical Package for Social Sciences (SPSS) version 21.0. Means and standard deviations were calculated for quantitative variables and frequencies and percentages for qualitative variables and chi-square and the P-value of ≤ 0.05 will be considered statistically significant.

Budget

Self-financed project.

Results

The study included a total number of 806, males represent 463 (57.4%), females represent 343 (42.6%). The majority of our data are from Al-Ahsa by 574 (71.2%), then Dammam 104 (12.9%), Khobar responses were 63 (7.8%), Dhahran 38 (4.7%), Jubail 18 (2.2%), Qatif 9 (1.1%).

Responders below the age of 18 are 27 (3.3%), and responders between the age 18 to 30 represent the majority of the sample papulation by 427 (53%), then between 31 to 40-year-old 148 (18.4%), in addition, responders from 41 to 60 years old are 183 (22.7%), above the age of 61 we have 21 (2.6%) responses.

The educational level for the data shows only 4 (0.5%) in elementary school and 16 (2%) in intermediate school and 154 (19.1%) in high school, in addition to that the majority of our sample papulation is in Bachelor and they accounted by 553 (68.6%), 38 (4.7%) are in master and 19 (2.4%) have PhD.

We categorized the sample according to the risk of fractures, the low risk represents the majority of the sample population 787 (97.6%) and the remaining 19 (2.4%).

For each correct answer of the questions in table seven it considers as 1 and for each wrong answer it is considered 0, the mean score was 9 and it is the cut point between the people who have good knowledge and poor knowledge. The majority of the sample have poor knowledge of 446 (55.3%) and 360 (44.7%) have good knowledge.

Discussion

This study explores the level of awareness in eastern province in Saudi Arabia and the risk of fracture as described above. An electronic questioner was distributed to see the demographical data, the risk factor for osteoporosis and the risk of fracture, and osteoporosis knowledge assessment tool (OKAT) [25].

We found the majority of our data having a low risk of fracture and only 2,4% have a high risk of fracture and that matched a study done in North-East Germany and their sample showed almost the half of their subject didn't have any risk factor of osteoporosis at all [26]. However, properly that is because most of both data are young and below the age of 40.

A study was conducted in Spain showed a higher percentage of their sample use glucocorticoids, in our sample, there is a lower percentage of people who use glucocorticoids but it very close different. Apparently, it very close due present of many people of both data above age of 40 [27].

In the part of smoking, there was no relation between it and the risk of fracture which is different in another study because they found it to be significant and we think this difference is because of the low number of smokers in our data and most of them are young [28].

BMI is an important factor for osteoporosis either being overweight or underweight and we found a significant relationship between

Osteoporosis and BMI in this presented study, like a study done by P. Ravn where they found it to be significant in both overweight or underweight as a risk factor of Osteoporosis [28].

Previous fracture as a variable was significant in our study likewise to other studies with a larger number of population and different age groups either postmenopausal or still productive and with different gender [29,30]. This is due to the strong relationship between a fracture and a previous fracture and that may indicate a poor bone quality.

The family history of parent fracture is an important risk factor for osteoporosis as a literature review showed. Comparing to other studies we have a larger number of our sample reported that one of their first-degree relatives had a hip fracture and we refer the different of the numbers due to the combining of both gender responses in our study. Also, it has a significant correlation with high-risk fracture [31]. The relation possibly due to the component of inherence from generation to another.

Aging and Gender are part non-modifiable risk factors that have a major part of getting the disease worse especially in female due to the passing menopausal age and there will be a low level of estrogen which play a major role in maintaining the bone density during productivity age. In our study, we found that aging and Gender has a significant association with high-risk fracture and developing osteoporosis similarly to other paper [29]. Regarding the Rheumatoid arthritis as a risk factor of causing facture, our results are consistent with a population-based study of 30,262 RA patients in the UK that showed it to be significant and a major cause for fracture and Osteoporosis [32].

In the analysis of osteoporosis knowledge assessment tool (OKAT) we found the majority of our data have poor knowledge about osteoporosis and our result is similar many studies in different areas in Saudi Arabia [22,23]. Furthermore, a Korean study about the awareness found that only 37.5% of their population know about osteoporosis and that is a low level of awareness which is consistent with our study results [33].

While it is identified that awareness about osteoporosis is influenced and certainly correlated to the level of education [34]. Conversely, our data showed no association between the level of awareness and the educational level, the was P value: 0.551. in addition to that, our result supported by other study done in Saudi Arabia done on young Saudi women studying in collages show no significant between those two variables [23]. In this current paper, we split the contributors into five age clusters. Our data illustrated that age is not correlated with knowledge about osteoporosis P-value was 0.146 which is like what had been described in papers performed in her Saudi Arabia and Iran [23,24].
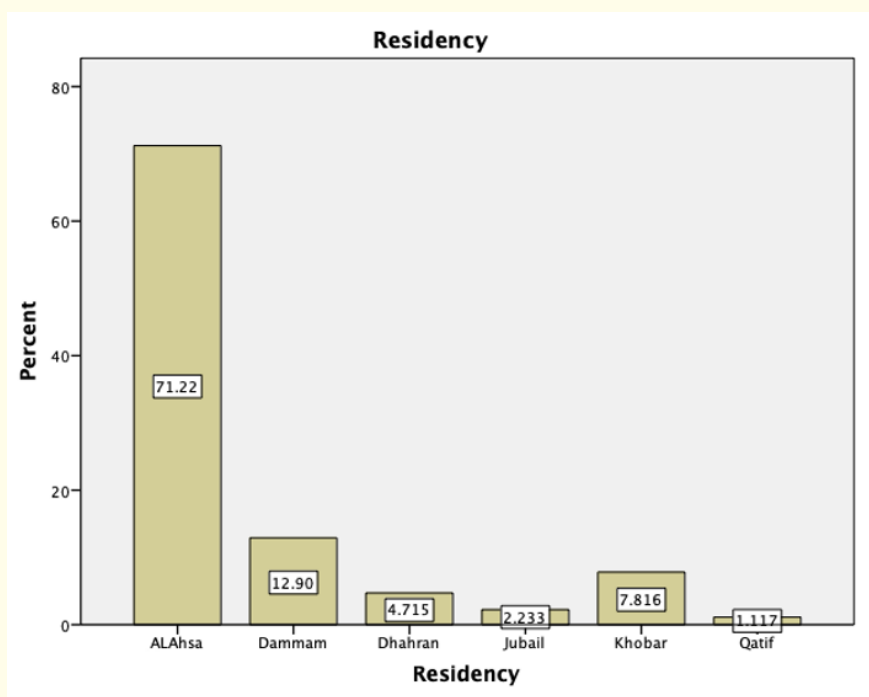

Figure 1: Viewing the distribution of the sample to the living area.
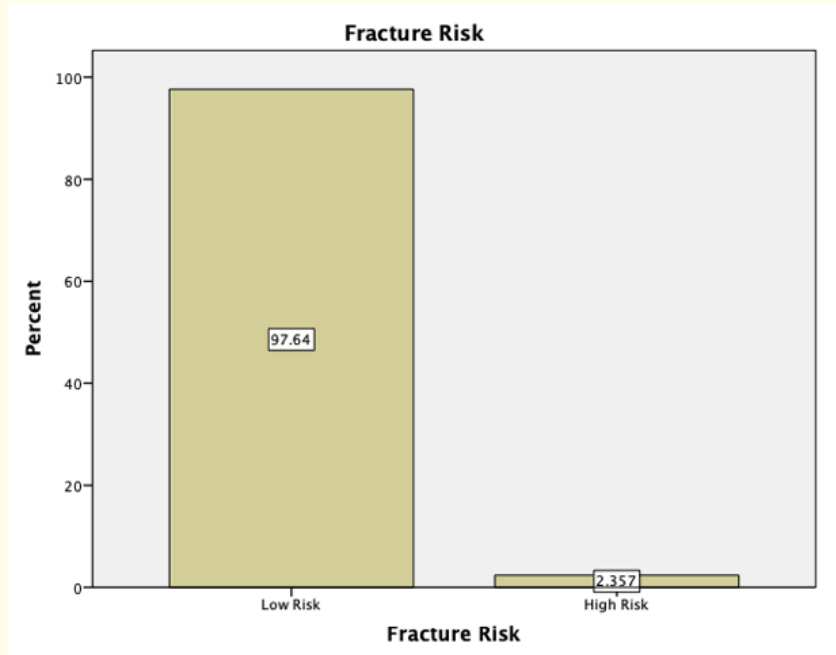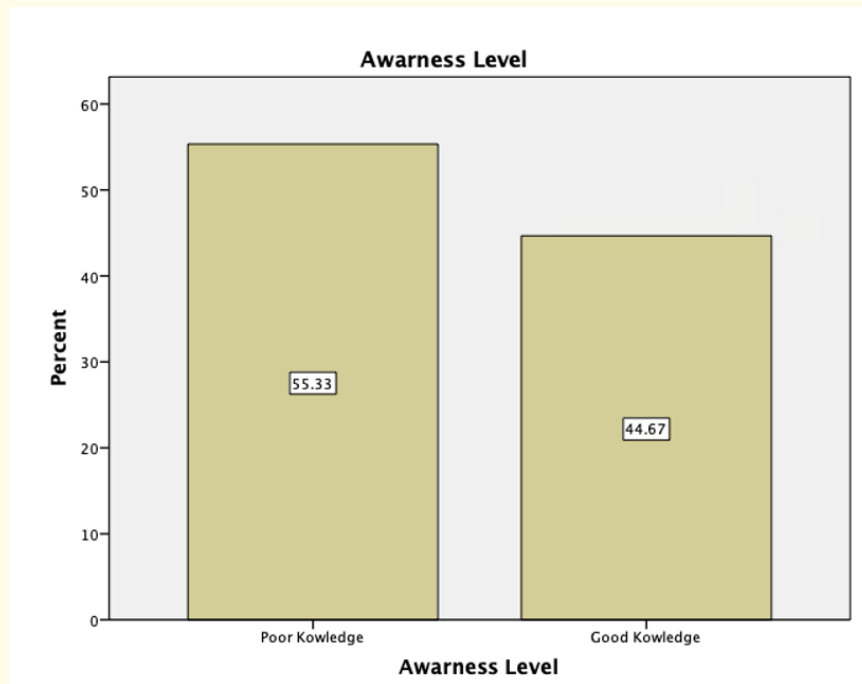
Figure 2: *Demonstrate the risk of fracture.*

Figure 3: *Display the level of awareness among our sample.*

Task to be performed	Person assigned	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.
Finalize research proposal	Research team						
Data collection	Research team						
Prepare for data entry	statistician						
Data cleaning and preliminary analysis	Principal inv. and statistician						
Data analysis and report writing	Principal inv. and local authorities						
Finalize report	Research team						
Discuss recommendations / plan of action	Research team/KFU and local authorities						
Presentation and dissemination	Research team/policy maker MOH+ KFU						

Table 1: *Showing the number and percentage between male and female.*

	Frequency	Percent
Female	343	42.6%
Male	463	57.4%
Total	806	100.0%

Table 2: *Display The frequency and percent of the different category of age.*

	Frequency	Percent
Elementary school	4	0.5
Intermediate school	16	2.0
High school	154	19.1
Diploma	22	2.7
Bachelor	553	68.6
Master	38	4.7
PhD	19	2.4
Total	806	100.0

Table 3.1: *Showing the level of education.*

	Frequency	Percent
Below 18	27	3.3
18 - 30	427	53.0
31 - 40	148	18.4
41 - 60	183	22.7
Above 61	21	2.6
Total	806	100.0

Table 3: *Showing the level of education.*

Risk of fracture		
Age above 40	204 (25.3%) from the sample	
Female gender	343 (42.6%) from the sample	
BMI mean	27.5 of all sample	
	Yes	No
Previous fracture	199 (24.7%)	607 (75%)
Parent fracture	73 (9.1%)	733 (90.9%)
Current smoking	100 (12.4%)	706 (87.6%)
Use of glucocorticoids	43 (5.3%)	763 (94.7%)
Rheumatoid arthritis	34 (4.2%)	772 (95.8%)
Secondary osteoporosis	31 (3.1%)	775 (96.2%)
Alcohol 3 or more units/day	15 (1.9%)	791 (98.1%)

Table 4: Illustrating the answers of people about the risk of fracture.

Frequency		Percent
Low Risk of Fracture	787	97.6
High Risk of Fracture	19	2.4
Total	806	100.0

Table 5: Demonstrate the risk of fracture.

No		Previous Fracture		Total
		Yes		
Gender	Female	293	50	343
	Male	314	149	463
Total		607	199	806
P value		0.000		Significant

Table 6: There is a significate association between the gender and previous fracture as risk factor of osteoporosis the p value was 0.000.

Count				
Low Risk		Fracture Risk		Total
		High Risk		
BMI	Low risk	261	2	263
	High risk	526	17	543
Total		787	19	806
P value		0.038		Significant

Table 7: There is a significant relation between BMI and risk of fracture as p value is 0.038.

Osteoporosis knowledge assessment Tool (OKAT)	False	True
1. Osteoporosis leads to an increased risk of bone fractures.	40 (5%)	766 (95%)
2. Osteoporosis usually causes symptoms (e.g. pain) before fractures occur.	546 (67.7%)	260 (32.2%)
3. Having a higher peak bone mass at the end of childhood gives no protection against the development of osteoporosis in later life.	665 (82.5%)	141 (17.5%)
4. Osteoporosis is more common in men.	495 (61.4%)	311 (38.6%)
5. Cigarette smoking can contribute to osteoporosis.	503 (62.4%)	303 (37.6%)
6. White women are at highest risk of fracture as compared to other races.	635 (78,8%)	171 (21.2%)
7. A fall is just as important as low bone strength in causing fractures.	316 (39.2&)	490 (60.8%)
8. By age 80, the majority of women have osteoporosis	250 (31%)	556 (69%)
9. From age 50, most women can expect at least one fracture before they die.	482 (59.8%)	324 (40.2%)
10. Any type of physical activity is beneficial for osteoporosis.	123 (15.3%)	683 (84.7%)
11. It is easy to tell whether I am at risk of osteoporosis by my clinical risk factors.	465 (57.7%)	341 (42.3%)
12. Family history of osteoporosis strongly predisposes a person to osteoporosis.	337 (41.8%)	469 (58.2%)
13. An adequate calcium intake can be achieved from two glasses of milk a day.	283 (35.1%)	523 (64.9%)
14. Sardines and broccoli are good sources of calcium for people who cannot take dairy products.	338 (41.9%)	468 (58.1%)
15. Calcium supplements alone can prevent bone loss.	153 (19%)	653 (81%)
16. Alcohol in moderation has little effect on osteoporosis.	574 (71.2%)	232 (28.8%)
17. A high salt intake is a risk factor for osteoporosis.	538 (66.7%)	268 (33.3%)
18. There is a small amount of bone loss in the ten years following the onset of menopause.	81 (10%)	725 (90%)
19. Hormone therapy prevents further bone loss at any age after menopause.	621 (77%)	185 (23%)
20. There are no effective treatments for osteoporosis available in Saudi Arabia.	484 (60%)	322 (40%)

Table 8: *Illustrated each question from OKAT questionnaire and the participant response.*

Frequency		Percent
Poor Knowledge	446	55.3
Good Knowledge	360	44.7
Total	806	100.0

Table 9: *Display the level of awareness among our sample.*

Low Risk		Fracture Risk		Total
		High Risk		
Awareness Level	Poor Knowledge	435	11	446
	Good Knowledge	352	8	360
Total		787	19	806
P value		0.820	Not significant	

Table 10: *In the part of the relation between the level of awareness and the risk of fracture, the P value appear to be not significant 0.820.*

ALAhsa		Residency						Total
		Dammam	Dhahran	Jubail	Khobar	Qatif		
Fracture Risk	Low Risk	564	101	35	16	63	8	787
	High Risk	10	3	3	2	0	1	19
Total		574	104	38	18	63	9	806
P value		0.005			Significant			

Table 11: *The relation between the risk of fracture and the residency is appearing to be significant by 0.005.*

18-30		Age					Total
		31-40	41-60	Above 61	Below 18		
Fracture Risk	Low Risk	427	147	167	19	27	787
	High Risk	0	1	16	2	0	19
Total		427	148	183	21	27	806
P value		0.000			Significant		

Table 12: *The p value is significant between the risk of fracture and the Age by 0.000.*

Female		Gender		Total
		Male		
Fracture Risk	Low Risk	330	457	787
	High Risk	13	6	19
Total		343	463	806
P value		0.021		Significant

Table 13: *The p value is significant by 0.021 in between the risk of fracture and the gender.*

No		Previous Fracture		Total
		Yes		
Fracture Risk	Low Risk	601	186	787
	High Risk	6	13	19
Total		607	199	806
P value		0.000		Significant

Table 14: *There is a significant relation between the risk of fracture and previous fracture. The p value is 0.000.*

No		Parent fractured hip		Total
		Yes		
Fracture Risk	Low Risk	724	63	787
	High Risk	9	10	19
Total		733	73	806
P value		0.000		Significant

Table 15: *Chi-square was done, and the P value shown to be significant by 0.000 in the relation between the risk of fracture and parent fracture.*

No		Current smoking		Total
		Yes		
Fracture Risk	Low Risk	692	95	787
	High Risk	14	5	19
Total		706	100	806
P value		0.063	Not Significant	

Table 16: P value wasn't significant 0.063 between the risk of the fracture and the states of smoking.

No		Use of Glucocorticoids		Total
		Yes		
Fracture Risk	Low Risk	748	39	787
	High Risk	15	4	19
Total		763	43	806
P value		0.002	Significant	

Table 17: The relation between the risk of fracture and the use of Glucocorticoids is significant. The P value is 0.002.

No		Rheumatoid arthritis		Total
		Yes		
Fracture Risk	Low Risk	764	23	787
	High Risk	8	11	19
Total		772	34	806
P value		0.000	Significant	

Table 18: The P value is significant by 0.000 in between the risk of fracture and the Rheumatoid arthritis.

No		Secondary osteoporosis		Total
		Yes		
Fracture Risk	Low Risk	765	22	787
	High Risk	10	9	19
Total		775	31	806
P value		0.000	Significant	

Table 19: The relation between the risk of fracture and the Secondary osteoporosis is appearing to be significant by 0.000.

Poor Knowledge		Awareness Level		Total
		Good Knowledge		
Education level	Bachelor	292	261	553
	Diploma	13	9	22
	Elementary school	2	2	4
	High school	93	61	154
	Intermediate scho	10	6	16
	Master	24	14	38
	PhD	12	7	19
Total		446	360	806
P value		0.551	Not Significant	

Table 20: Education level and Awareness Level have no association as the p value shown to be 0.551.

Poor Knowledge		Awareness Level		Total
		Good Knowledge		
Age	Below 18	13	14	27
	18-30	225	202	427
	31-40	83	65	148
	41-60	109	74	183
	Above 61	16	5	21
Total		446	360	806
P value		0.146		Not Significant

***Table 21:** The relation between the Age and the awareness level is appearing to be not significant by 0.146.*

Conclusion

The majority of the sample was a low risk of fracture and developing osteoporosis in the future. In addition, a low level of awareness was found in the sample that been collected from the eastern province in Saudi Arabia, thus a program of education from the physician to the patient and general population in order to maintain the majority of the people how are at a low risk and increase the level of awareness among people how are having low level of awareness about the disease

Limitations of the Study

The study designs, time of conduction, sampling technique, the online questionnaire.

Recommendations

- Increase the level of awareness among physicians and teachers about the disease and put them in short course to teach them the what is the best way to deliver the information about the disease

- Make an ads and Infographics and purplish it in TV, malls and public parks

- Make a campaign about the disease in malls and schools.

Appendix I

Demographic characteristics and Risk of fracture		Write	
1	Age		
2	Sex		
3	Weight		
4	Height		
5	Education level		
		Yes	No
6	Previous fracture		
7	parent fractured hip		
8	Current smoking		
9	Use of Glucocorticoids		
10	Rheumatoid arthritis		
11	Secondary osteoporosis		
12	Use of alcohol 3 or more unit/day		
	Major osteoporotic		
	Hip fracture		

Appendix II

Osteoporosis knowledge assessment Tool (OKAT)	Yes	No	I don't know
1. Osteoporosis leads to an increased risk of bone fractures.			
2. Osteoporosis usually causes symptoms (e.g. pain) before fractures occur.			
3. Having a higher peak bone mass at the end of childhood gives no protection against the development of osteoporosis in later life.			
4. Osteoporosis is more common in men.			
5. Cigarette smoking can contribute to osteoporosis.			
6. White women are at highest risk of fracture as compared to other races.			
7. A fall is just as important as low bone strength in causing fractures.			
8. By age 80, the majority of women have osteoporosis			
9. From age 50, most women can expect at least one fracture before they die.			
10. Any type of physical activity is beneficial for osteoporosis.			
11. It is easy to tell whether I am at risk of osteoporosis by my clinical risk factors.			
12. Family history of osteoporosis strongly predisposes a person to osteoporosis.			
13. An adequate calcium intake can be achieved from two glasses of milk a day.			
14. Sardines and broccoli are good sources of calcium for people who cannot take dairy products.			
15. Calcium supplements alone can prevent bone loss.			
16. Alcohol in moderation has little effect on osteoporosis.			
17. A high salt intake is a risk factor for osteoporosis.			
18. There is a small amount of bone loss in the ten years following the onset of menopause.			
19. Hormone therapy prevents further bone loss at any age after menopause.			
20. There are no effective treatments for osteoporosis available in Saudi Arabia.			

Bibliography

1. AlHarthi Basim Khalid., *et al*. "Assessment of Osteoporosis Knowledge among Saudi Females in Riyadh, KSA". *The Egyptian Journal of Hospital Medicine* 69.3 (2017): 2088-2092.

2. Zakai Ghadeer Haytham and Haytham Ahmed Zakai. "Awareness about osteoporosis among university students in Jeddah, Saudi Arabia". *Journal of Advanced Laboratory Research in Biology* 4.2 (2015).

3. Klotzbuecher Carolyn M., *et al*. "Patients with prior fractures have an increased risk of future fractures: a summary of the literature and statistical synthesis". *Journal of Bone and Mineral Research* 15.4 (2000): 721-739.

4. NIH/ORBD. www.osteo.org. (2000).

5. Alwahhabi Basmah K. "Osteoporosis in Saudi Arabia: Are we doing enough?". *Saudi Medical Journal* 36.10 (2015): 1149.

6. Melton III and L Joseph. "Who has osteoporosis? A conflict between clinical and public health perspectives". *Journal of Bone and Mineral Research* 15.12 (2000): 2309-2314.

7. Johnel O., *et al*. "The apparent incidence of hip fracture in Europe: a study of national register sources". *Osteoporosis International* 2.6 (1992): 298-302.

8. Sadat-Ali, Mir., *et al*. "An epidemiological analysis of the incidence of osteoporosis and osteoporosis-related fractures among the Saudi Arabian population". *Annals of Saudi medicine* 32.6 (2012): 637-641.

9. World Health Organization. Saudi Arabia Health Profile 2013. Geneva (CH): WHO (2013).

10. Taylor JC., *et al*. "Opinions and experiences in general practice on osteoporosis prevention, diagnosis and management". *Osteoporosis International* 12.10 (2001): 844-848.

11. Wade SW., *et al*. "Estimating prevalence of osteoporosis: examples from industrialized countries". *Archives of Osteoporosis* 9.1 (2014): 182.

12. Sattui Sebastian E and Kenneth G Saag. "Fracture mortality: associations with epidemiology and osteoporosis treatment". *Nature Reviews Endocrinology* 10.10 (2014): 592.

13. Burge Russel., *et al*. "Incidence and economic burden of osteoporosis-related fractures in the United States, 2005–2025". *Journal of Bone and Mineral Research* 22.3 (2007): 465-475.

14. Svedbom A., *et al*. "Osteoporosis in the European Union: a compendium of country-specific reports". *Archives of Osteoporosis* 8.1-2 (2013): 137.

15. Bubshait Dalal and Mir Sadat-Ali. "Economic implications of osteoporosis-related femoral fractures in Saudi Arabian society". *Calcified Tissue International* 81.6 (2007): 455-458.

16. Zelman D. What is osteoporosis? What you need to know.

17. Gregory Tanya and Michael Kleerekoper. "Using bone remodeling markers in osteoporosis treatment". *Patient Care* 33.4 (1999): 121-122.

18. Jilka Robert L., *et al*. "Increased osteoclast development after estrogen loss: mediation by interleukin-6". *Science* 257.5066 (1992): 88-91.

19. Ammann Patrick., *et al*. "Transgenic mice expressing soluble tumor necrosis factor-receptor are protected against bone loss caused by estrogen deficiency". *The Journal of Clinical Investigation* 99.7 (1997): 1699-1703.

20. Al-Saleh Yousef., *et al.* "2015 guidelines for osteoporosis in Saudi Arabia: recommendations from the Saudi Osteoporosis Society". *Annals of Saudi Medicine* 35.1 (2015): 1-12.

21. Al-Shahrani Fahad M., *et al.* "Knowledge of osteoporosis in middle-aged and elderly women". *Saudi Medical Journal* 31.6 (2010): 684-687.

22. Osman Amani A. "Assessment of Osteoporosis KAP among women in Assir region, Saudi Arabia". *Journal of Medicine and Medical Sciences* 4.2 (2013): 50-55.

23. Alshareef Sayaf H., *et al.* "Knowledge and Awareness about Risk Factors of Osteoporosis among Young College Women at a University in Riyadh, KSA". *Journal of Bone Research* 6.194 (2018): 2.

24. Mansoureh Safizadeh., *et al.* "Awareness of osteoporosis among female employees in Kerman, Iran". *Russian Open Medical Journal* 4.1 (2015).

25. Winzenberg Tania M., *et al.* "The design of a valid and reliable questionnaire to measure osteoporosis knowledge in women: the Osteoporosis Knowledge Assessment Tool (OKAT)". *BMC Musculoskeletal Disorders* 4.1 (2003): 17.

26. Schürer Christian., *et al.* "Fracture Risk and Risk Factors for Osteoporosis: Results From Two Representative Population-Based Studies in North East Germany (Study of Health in Pomerania: SHIP-2 and SHIP-Trend)". *Deutsches Ärzteblatt International* 112.21-22 (2015): 365.

27. Rentero Maria Luz., *et al.* "Risk factors for osteoporosis and fractures in postmenopausal women between 50 and 65 years of age in a primary care setting in Spain: a questionnaire". *The open rheumatology journal* 2 (2008): 58.

28. Ravn Pernille., *et al.* "Low body mass index is an important risk factor for low bone mass and increased bone loss in early postmenopausal women". *Journal of Bone and Mineral Research* 14.9 (1999): 1622-1627.

29. Edwards M H., *et al.* "Clinical risk factors, bone density and fall history in the prediction of incident fracture among men and women". *Bone* 52.2 (2013): 541-547.

30. Klotzbuecher Carolyn M., *et al.* "Patients with prior fractures have an increased risk of future fractures: a summary of the literature and statistical synthesis". *Journal of Bone and Mineral Research* 15.4 (2000): 721-739.

31. Keen R W., *et al.* "Family history of appendicular fracture and risk of osteoporosis: a population-based study". *Osteoporosis international* 10.2 (1999): 161-166.

32. Staa TP Van., *et al.* "Clinical assessment of the long-term risk of fracture in patients with rheumatoid arthritis". *Arthritis and Rheumatism: Official Journal of the American College of Rheumatology* 54.10 (2006): 3104-3112.

33. Kim Kyae Hyung., *et al.* "Prevalence, awareness, and treatment of osteoporosis among Korean women: the Fourth Korea National Health and Nutrition Examination Survey". *Bone* 50.5 (2012): 1039-1047.

34. Alamri Fahd A., *et al.* "Knowledge, attitude, and practice of osteoporosis among Saudis: a community-based study". *The Journal of the Egyptian Public Health Association* 90.4 (2015): 171-177.