

*Original Research Article*

## Osteoporosis, a Bigger Threat for Upcoming Generations in Saudi Arabia

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### Abstract

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Osteoporosis remains a significant public health challenge worldwide with high prevalence in the developed countries. Lifestyle plays an important role to develop osteoporosis in Saudi Arabia with low calcium intake and lack of physical activities, which predicts an increase in osteoporosis among the population. The purpose of this study was to assess the rate of undiscovered osteoporosis in Saudi population. A total of eighty healthy participants were enrolled in a cross-sectional study. Both genders above the age of fifteen years were included. While those who were diagnosed to have Osteoporosis, fragility fractures or on antiresorptive medications were excluded. Their peripheral dual energy x-ray absorptiometry (pDEXA) were measured at calcaneus, furthermore their carbon mono oxide levels were measured to determine smoking status. Patient range was mostly young to middle showed association of low Bone Mineral Density (BMD) with smoking while six of the participants with low BMD were nonsmoker. Participants with sport activity on a regular basis showed better T-score when compared to those who did not perform sports. The T-score difference was statistically significant with a p-value of 0.001. In another finding the average T-score of post-menopausal candidates was lesser than those who have not reached menopause yet. The mean difference between these two groups showed the p-value of 0.034. Study highlights the deleterious effect of smoking and lack of sporting activities which significantly potentiates loss of bone mineral density. By increasing smoking cessation community campaign awareness by community healthcare professionals may likely helpful to reduce the prevalence of osteoporosis in the region.

**Keywords:** Lack of physical activity, Lifestyle, Low calcium diet, Osteoporosis, Smoking

### INTRODUCTION

Osteoporosis remains a significant public health challenge with high prevalence in the developed countries. It literally means porous bone, is a disease in which the density and quality of bone are reduced

(Awwad et al., 2017). The number of people affected by osteoporosis worldwide is over than 200 million (Sotornik, 2016).

Osteoporosis is a common disease that is character-

ized by low bone mass with microarchitecture disruption and skeletal fragility, resulting in an increased risk of fracture (International Osteoporosis Foundation, 2017). In general, the prevalence of osteoporosis in postmenopausal women is much higher than in older men (Finkelstein et al., 2019). In Europe, at least 40% of postmenopausal women have osteoporosis (Cawthon, 2011). In the United States, 30% of postmenopausal women have osteoporosis. Also in Asia, the rates of osteoporotic fracture appear to be increasing (Cooper et al., 1992). Osteoporotic fractures in the elderly are usually followed by hospitalization, disability, retirement and even death (Rosenkranz and Klopman, 1989). One of the major complications due to osteoporosis is fractures (Liu et al., 2019), which poses a huge burden to the healthcare system. A study conducted in England and Wales suggested that the annual cost attributable to hip, vertebral, and wrist fractures are around 1.7 billion pounds. In Saudi Arabia, there are approximately 8,768 femoral fractures happen each year costing billions (Sözen et al., 2017). Similarly, in Saudi Arabia, the prevalence of osteoporosis is not that different from the world (Sadat-Ali et al., 2012; Alwahhabi, 2015). The epidemiological analysis showed that 34% of healthy Saudi women and 30.7% of men, 50-79 years of age are osteoporotic. Lifestyle plays an important role to develop osteoporosis in Saudi Arabia (Alwahhabi, 2015), with low calcium intake and lack of physical activities, which predicts an increase in osteoporosis among the population. To illustrate that how bigger is this issue globally, a study was conducted in Korea on 595 people (Alwahhabi, 2015). Of the 595 participants, 393 people (67 men and 326 women) were diagnosed with osteoporosis (T score < -2.5). The prevalence of osteoporosis showed an increasing trend, from 48.1% in 2004 to 66.1% in 2015 (Kwon et al., 2017). Another cohort study was performed in Korea on the prevalence of osteoporosis; the population age was standardized (40-year-old and above). Even though they have standardized the prevalence, the age-standardized osteoporosis prevalence was 12.81% in men and 44.35% in females, which is a substantial number (Lim et al., 2017). In Spain, another cohort study was done on a population of 1035 men aged 50 and above. Using the World Health Organization (WHO) and the National Osteoporosis Foundation (NOF) criterion, the prevalence of densitometry osteoporosis was 1.1% and 13% respectively (Olmos et al., 2018). In the Czech Republic, it is estimated that 7% of the population has osteoporosis, which is about 700,000 people is affected (Sotornik, 2016).

Locally, there is a cross-sectional study carried out in Applied Medical Sciences College under King Saud University on pre and post-menopausal women. The prevalence of osteopenia in post-menopausal women was 24.8% (Mahboub et al., 2014). They had a selection bias in which the women they have selected are working

in the medical fields. The population is probably well educated, know about osteoporosis, how to prevent it, and they don't represent the actual population. Another local epidemiological analysis done on 5160 healthy women 50 to 79 years of age 36.6% were osteopenic and 34.0% were osteoporotic. The prevalence of osteopenia was 46.3% and osteoporosis 30.7% in males (Melton et al., 1992).

Having that said, the issue of Osteoporosis is a persisting challenge not only in Saudi Arabia but to the whole world. Nonetheless, the number of researches made in Saudi Arabia in this field is insignificant if not minimal. Aim of our study was to assess the rate of undiscovered osteoporosis among the people in Riyadh.

## METHODOLOGY

Saudi nationals (n=80) were enrolled in a cross-sectional study in Riyadh, Saudi Arabia. The data was collected during a social event for two days from 4-11 pm. We included both genders (M= 17, F=63) above age 15. We excluded participants with diagnosed osteoporosis, already taking antiresorptive medications and previous vertebral fractures. Their informed consent was acquired prior to the beginning of the study. There were no rewards given to the participants; they had the autonomy to answer the questions and withdraw at any time. The participants were asked to fill a questionnaire, which was administered in the Arabic language. We designed a self-administered questionnaire regarding age, gender, weight, height and 14 items regarding risk factor of Osteoporosis from literature and proven hypotheses. The risk factors regarding Osteoporosis with response options were either, "Yes," or "No," Table 1

Lately, we excluded the consumption of alcohol from the original questionnaire, considering the importance that it's legally and religiously forbidden in the kingdom. Additionally, we used Carbone Monoxide meter to measure and detect the level of carbon monoxide in the participants. The equipment used for measuring end tidal Carbon monoxide level in exhaled air was MicroPlusSmokerlyzer (BedFont Instrument; UK). The smokerlyzer measures exhaled Carbon monoxide levels in part per million (ppm). The study subjects were asked to inhale deeply, hold their breath for at least 15 seconds, and then exhale rapidly and forcefully into disposable mouthpiece of instrument (Al-Sheyab et al., 2015). Any level  $\geq 6$  were considered significant for smoking exposure.

Furthermore, the participants were tested to measure the Bone Mass Density (BMD) with bone scanner (EXA-3000 by Osteosys) that takes (5seconds). We measured bone density at calcaneus then according to the t-score, we categorized our population as normal, osteopenic and osteoporotic. Table 2

**Table 1.** Questionnaire to stratify the risk for Osteoporosis.

SerialNo.	Questions	Yes	No
1	Do you take Calcium or Vitamin D supplements?		
2	Do you smoke?		
3	Do you drink Alcohol?		
4	Do you do sports regularly?		
5	Had you done gastric sleeve surgery?		
6	Do you use oral cortisone (5-7.5 mg/day)?		
7	Do you use oral cortisone (more than 7.5 mg/day)?		
8	Do you have rheumatoid arthritis?		
9	Have you had vertebral body fracture?		
10	Have you had an osteoporotic fracture?		
11	Had any of your parent's pelvis fracture?		
12	Do you have secondary osteoporosis?		
<b>These two last questions were applicable to only women</b>			
13	Do you use any contraceptive pills?		
14	Are you postmenopausal? If yes, what was your age? (Age in years)		

**Table 2.** Categorized age groups

Serial number	Age range in yrs.
1	15-20
2	21-30
3	31-40
4	41-50
5	51-60
6	>60

## RESULTS

The analysis was conducted using a validated questionnaire composed of 14 questions along with demographic data for the participants. These validated questions were related to topics of interest with the main aim of measuring the participants T-score and interpret any factors that may be significantly associated with this outcome.

Statistical Package for the Social Science (SPSS) software, version 23 (SPSS Inc., Chicago, Illinois, USA) is used for data entry and analysis. All analyses were carried out at a significance level of 0.05.

### Descriptive Statistics

Below are the descriptive statistics of the study. Independent and dependent variables are listed along with their frequency and percentage.

Figure 1 shows that most of our patients were from younger age group. 75% of our patient range from 21-50 years of age. Sixty-three patients were female while

seventeen patients were male.

Figure 2 shows the results for the assessment of the bone mineral density (BMD). 23% (n=18) of the participants had low BMD. 8% (n=6) were osteoporotic while 15% (n=12) were osteopenic. Among the 18 participants who showed low BMD only 3 were male rest were all female.

Figure 3 shows the relationship of smoking with BMD in study group. We found that nine female and three male participants showed association of low BMD with smoking while six of the participants with low BMD were nonsmoker.

Table 3 shows that the participants who were involved in regular sporting activity showed a mean T-score of -0.272(0.812), while participants who did not perform sports regularly scored a mean T-score of -0.701(1.130). The significant mean T-score difference was 0.672(1.112) with a p-value of 0.001. The female participants who already had the menopause, the average T-score was -0.918(1.02) and other females who have not reached menopause yet -0.587(0.91). The significant mean difference between these two groups was 0.418(1.12) with a p-value of 0.034.

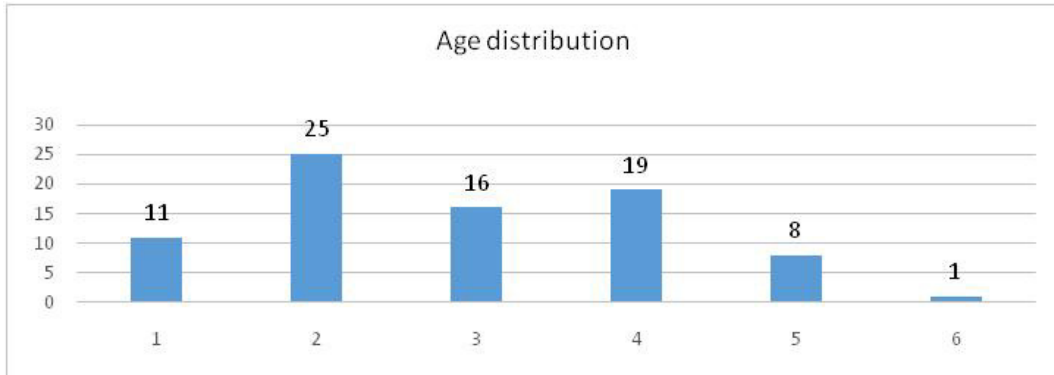


Figure 1. Age distribution

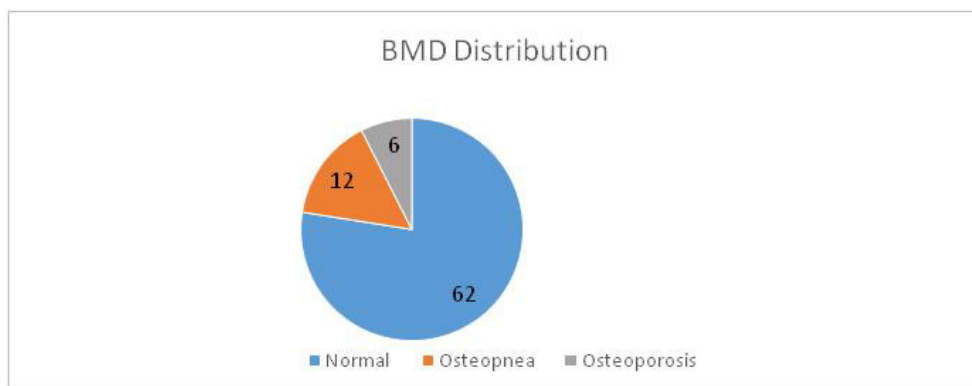


Figure 2. BMD Distribution

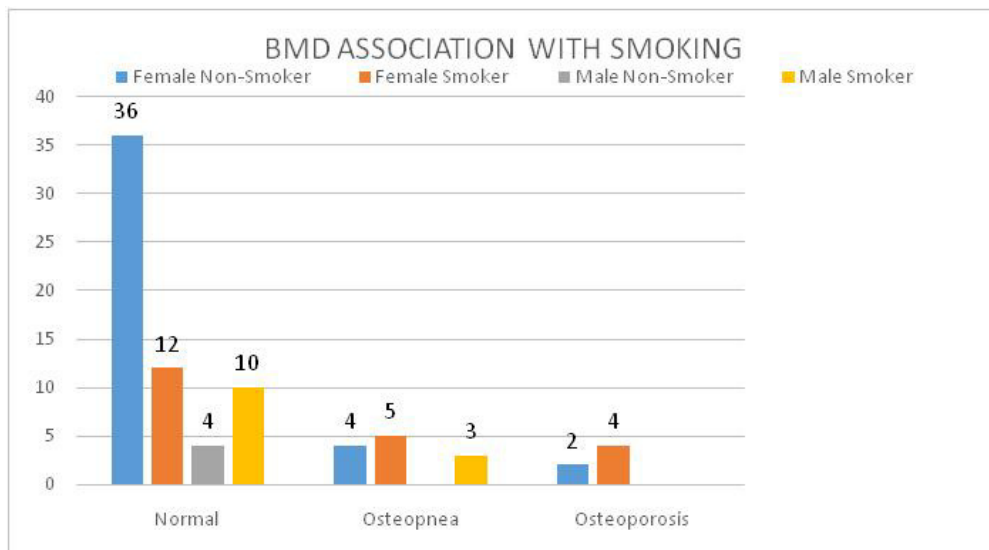


Figure 3. BMD Association with smoking

Table 3. Statistical significance of Sports and Menopause.

T-test Variables	Mean Difference (Std.)	P-value
Sports	0.672 (1.112)	0.001
Menopause	0.418 (1.12)	0.034

## DISCUSSION

Our study targeted younger age group unlike other studies and assessed their risk for reduced bone density (osteopenia). Our findings provided data like many others in favor of direct deleterious effect of smoking on bone mineral density. We found that the individuals who were smokers had reduced bone mineral density to their age matched groups. The literature has been unclear as to whether smoking may influence bone mass by hindering the achievement of peak bone mass during early adulthood, or by increasing bone loss later in life (Ward KD and Klesges, 2001). Nicotine administration has been shown to reduce bone mass in both castrated and non-castrated mice, indicating a direct effect of nicotine on bone independent of its effect on androgens (Broulik and Jarab, 1993).

We observed a strong correlation of the exercise in female at perimenopausal stage with better bone mineral density. This observation correlates with the many other authors. Hsieh et al. suggested that the positive effects of exercise on bone mass are due to the activation of osteocytes, which changes the balance between bone resorption and formation, favoring modeling, if mechanical loading creates strains of sufficient magnitude (Hsieh et al., 2001). In the past years, Kelley et al. (2001) and Martyn-St and Carroll (2008) compared premenopausal and postmenopausal women for the effects of exercise effects on bone mass. Results confirmed that exercise may have a positive influence on the skeleton, by increasing or maintaining BMD at the loading sites.

Another interesting finding was that large number of our participated population was smoker. It has been noted that the prevalence of smoking in Saudi Arabia is still on rise (Ansari and Farooqi, 2017). Abdalla et.al worked to assess different reasons for the rising trend of smoking among Saudi population and concluded that there are many reasons for the spread of smoking, which include pressure-reliving effect, social status symbol, curiosity, influence of media, and contact with other smokers (Abdalla et al., 2007). For Saudi's aged 15 years or more, the current smokers have a percentage of 37.6% and 6% among males and females, respectively (Al-Mohrej et al., 2014; Al-Zalabani and Kasim, 2015). According to the WHO report, smoking between adolescents is around 25% in Saudi Arabia. In a recent study by the Middle East, the usage of Sheesha/Huqqa (water pipes) has been increased up to 200% in females and 60% in males (Jradi et al., 2013). Kasim K et al. in his study from Madinah city, Al-Madinah region, Saudi Arabia analyzed the school age population.

Because of the limited time of the campaign and limited bone mass density scan devices; our study had a very small sample size. Our study was exclusive to only one place that does not represent the whole population. Our setting was a public place that could embarrass

some of the participants to do the bone scan. Consequently, that will let them withdraw from the study.

## CONCLUSION

Osteoporosis has a higher association with smoking tobacco regardless of age in Saudi community. Therefore, it is timely a need to allocate a specialized room in outpatient orthopedic department to educate patients about osteoporosis. Further, by increasing smoking cessation community campaign awareness by community healthcare professionals may likely helpful to reduce the prevalence of osteoporosis in the region.

### List of the abbreviations

WHO:	World Health Organization.
NOF:	National Osteoporosis Foundation.
BMD:	Bone Mass Density.
SPSS:	Statistical program for the Social Science.
pDEXA:	Peripheral Dual Energy X-ray Absorptiometry.

### Authorship and Disclosure

#### Ethics approval and consent to participate

Our Institutional Review Board (IRB) granted the ethical approval under the reference number E18-2810 in accordance with the National Committee of Bio Ethics (NCBE) guidelines.

#### Consent for publication

Written informed consent was obtained from all parents for publication. Copy of the written consent is available for review upon request.

#### Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author upon request.

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## Authors' contributions

WA reviewed the final version of the manuscript. RM contributed to the study design and manuscript preparation and performed the literature review and statistical analysis. KA, AAi, and AAn contributed to the study design and manuscript preparation. MA and AAy contributed to the study design and data collection. WA contributed to the manuscript preparation and data collection. RM contributed to the manuscript preparation and data collection. All authors read and approved the final manuscript.

## Conflict of Interest

All the authors including, Waleed Mohammad Awwad, Rohail Mumtaz, Khalid Alsaleh, Meshal Abdulhameed Alohal, Abdulaziz Almaawi, Abdulaziz N Aljurayyan, Abdulmonem Alsiddiky declare that they have no conflict of interest.

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