# FREQUENCY OF LOW BONE MASS IN A COHORT OF MIXED PAKISTANI POPULATION

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## ABSTRACT

***Objective:*** To determine the frequency of low bone mass in a multiethnic group of Pakistani population at Armed Forces Institute of Rehabilitation Medicine (AFIRM), Rawalpindi.
***Study Design:*** Cross-sectional comparative study.
***Place and Duration of Study:*** Outpatient Department of Armed Forces Institute of Rehabilitation Medicine (AFIRM), Rawalpindi from October 2010 to March 2011.
***Subjects and Methods:*** A total of 400 patients, both male and female, were sampled according to inclusion criteria by non-probability purposive sampling. Bone density was measured by DXA scan model Hologic "Discovery A", focused at neck of femur and spine.
***Results:*** Four hundred patients were included in the study. Average age of the patients was 59.24 years (SD = 10.38) with 258 (64.5%) females. Two hundred and thirty two (58%) were Punjabi, 77 (19.3%) were Pathan, 64 (16%) were Kashmiri, 20 (5%) were Sindhi and 7 (1.8%) were Balochi. Average BMI was 26.45 (SD = 5.31). Average T-score was -2.037 (SD = 1.40). Out of 400 patients, 134 (33.5%) patients had normal BMD, 140 (35%) had osteopenia and 126 (31.5%) patients had osteoporosis. Frequency of osteopenia was higher in males than females i.e. 40.8% vs. 31.8% whereas frequency of osteoporosis was higher in females than males i.e. 32.9% vs. 28.9% ($p$ = 0.191). Similarly association between ethnicity and BMD was also observed to be insignificant ($p$ = 0.714).
***Conclusions:*** The study showed high prevalence of low bone mass in Pakistani population in females as well as in males. The results in various ethnic groups are comparable, however, due to availability of smaller number of Sindhi and Balochi people, further multicentre studies at larger scale are recommended.

**Keywords:** Bone mineral density, Low bone mass, Osteopenia, Osteoporosis.

## INTRODUCTION

Osteoporosis is a disease characterized by low bone mass and deterioration of micro architecture of bone tissue leading to reduced bone strength and an increased risk of fractures.

In general, over the world, 1 in 3 women over 50 years will experience osteoporotic fractures, as will 1 in 5 men[1]. It has been estimated that in USA, 37-50% women aged above 50 years are osteopenic and 13-18% are osteoporotic[2]. The burden of hospital costs attributable to osteoporosis is comparable to that of breast cancer, myocardial infarction or stroke[3]. The frequency of osteoporosis and fragility fractures has been studied only in few developing countries and to a very limited extent[4]. Evidence suggests that many women who sustain a fragility fracture are not appropriately diagnosed and treated for probable osteoporosis. Although it cannot be cured, its progression can be slowed, and actions should be taken to help and prevent the disease[5].

According to a study done in Pakistani women using peripheral ultrasound, almost 13% women had osteoporosis and 43% had low bone mass[6]. In India, prevalence of osteopenia is estimated to be 52% and that of osteoporosis is 29%[7].

In Pakistan, the proportion of elderly and post-menopausal women is on the rise[8], so in future, more Pakistani women will suffer from osteoporosis related fractures that lead to a poor quality of life[9].

Moreover, it is generally taken as disease of females but in fact it continues to be an under-recognized problem in men, and it goes untreated in the majority of men with fractures[10]. One third of all hip fractures worldwide occur in men, and more men than women die in the year after a hip fracture, with a mortality rate in men of up to 37.5%[11].

Dual-energy X-ray absorptiometry (DXA) of the spine and hip is the best method for

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diagnosis of osteoporosis and monitoring changes in BMD for its excellent accuracy, precision and low radiation exposure[12]. The T-score cut-off of -2.5 for diagnosing osteoporosis was selected in post menopausal females and males above 50 years of age[13]. For young women who present with low BMD, but who lack other risk factors for fracture, the condition is called as "low BMD," and not "osteoporosis." "Low BMD" in premenopausal women is Z-score greater than 2.0 SD below the mean of an age, gender and ethnicity-matched reference population[14].

Currently DXA is not freely available in many developing countries including Pakistan, so very limited data is available regarding prevalence of osteoporosis in Pakistani population, according to international guidelines of WHO or International Society of Clinical Densitometry (ISCD).

Armed Forces Institute of Rehabilitation Medicine (AFIRM) is a tertiary care rehabilitation centre for both Armed Forces and civilian population. Here we are using DXA scan since 2007 for measuring bone density and screening for osteoporosis. Moreover, this is the first study using DXA scan and World Health Organization (WHO) guidelines to estimate frequency of low bone mass in Pakistan. It helps in studying the prevalence of disease in different population groups which in turn helps to allocate adequate resources for its prevention and management.

The objective of this study is to determine the frequency of low bone mass in a multi-ethnic group of Pakistani population.

## MATERIAL AND METHODS

This cross sectional comparative study was carried out at the Outpatient Department of Armed Forces Institute of Rehabilitation Medicine (AFIRM), Rawalpindi from October 2010 to March 2010. Patients from both genders (females above 35 years and males above 50 years) belonging to Punjabi, Kashmiri, Pathan, Sindhi and Balochi ethnic groups were recruited for the study. These are the patients who were either referred to AFIRM for measuring BMD by DXA scan from different hospitals or those who reported for different musculoskeltal complaints (back pain, osteoarthritis knee, history of fracture etc.) and were advised to measure BMD at AFIRM. Patients with renal or liver disease, thyroid, parathyroid and adrenal disorders, those with history of malignancy, rheumatoid arthritis, those with history of intake of steroids, thyroxin and anticonvulsants, those with history of menopause before 40 yrs of age and females with pregnancy and lactation were excluded from the study. Those who were already on treatment or have taken treatment for osteoporosis were also excluded from the study.

Approval from hospital ethical committee was taken. Four hundred patients were included in the study through non-probability purposive sampling. Verbal informed consent was taken after explaining the purpose of study and use of data for research and publication. Patient's demographic profile and other important points as mentioned in proforma (annex A) were endorsed by taking brief history by the principal investigator. Ethnicity was determined by asking the place of origin. Height and weight were recorded in cm and kg respectively. BMI was calculated. Bone density was measured in all patients by DXA scan model Hologic "Discovery A" focused at neck of femur and spine and results were recorded in proforma. To cover technical aspects and errors we checked BMD by using same DXA hologic machine and same operater.

Data had been analyzed using SPSS version 15. Mean and standard deviation (SD) were calculated for qualitative variables while frequency and percentages were calculated for quantitative variables. Chi-square test was applied to study association of bone mass with gender and ethnicity. A $p$-value $< 0.05$ was considered as significant.

## RESULTS

Four hundred patients were included in the study. Average age of the patients was 59.24 years (SD = 10.38, range = 92 – 35 years) with 258 (64.5%) females. Two hundred and thirty two (58%) were Punjabi, 77 (19.3%) were Pathan, 64 (16%) were Kashmiri, 20 (5%) were

Sindhi and 7 (1.8%) were Balochi. Average BMI was 26.45 (SD= 5.31, range = 45.78 – 14.18), (table-1).

Average T-score was -2.037 (SD = 1.40, range = -9– 2.5). Out of 400 patients, 134 (33.5%) patients had normal BMD, 140 (35%) had osteopenia and 126 (31.5%) patients had osteoporosis. Frequency of osteopenia was higher in males than females i.e. 40.8% vs. 31.8% where as frequency of osteoporosis was higher in females than males i.e. 32.9% vs. 28.9% (fig-1). But this association between gender and BMD could not approach significance ($p$ = 0.191). Similarly association between ethnicity and BMD was also observed to be insignificant ($p$ = 0.714) (table-2).

**Table-1: Demographic characteristics of complete study sample.**

| Demographic Characteristics | Patients Evaluated |
|---|---|
| Gender | |
| Male | 142 (35.5%) |
| Female | 258 (64.5%) |
| Mean age (yrs) | 59.24 ± 10.38 |
| Mean BMI (kg / m2) | 26.45 ± 5.31 |
| **Ethnicity** | |
| Punjabi | 232 (58%) |
| Pathan | 77 (19.3%) |
| Kashmiri | 64 (16%) |
| Sindhi | 20 (5%) |
| Balochi | 7 (1.8%) |

## DISCUSSION

Osteoporosis is a major problem of health care delivery services, both in the developed and developing countries. It is a common public health problem which has significant mortality and morbidity due to associated fracture risk. So it is important to know about its prevalence in our population.

After the initial observations and definitions of osteoporosis based on Caucasian populations, systematic research in Asian populations started in the 1980s. Significant variations between different ethnic groups with respect to the rate of osteoporotic fractures, bone mineral density and disease risk factors emerged from the data. Osteoporosis is therefore not a homogeneous disease across the world[15].

There is very limited work done in Pakistan for measuring the frequency of this serious health problem. It was the first large scale study of its kind which was ever undertaken in Pakistani population by measuring BMD using DXA Scan, which is a standard WHO parameter for osteoporosis. Most of the studies carried out in Pakistan are based on BMD measurement at wrist or heel using quantitative or qualitative ultrasonography. However, it cannot be used for diagnosis, since the WHO criteria were established based upon BMD measurement by DXA. In addition, ultrasonography cannot be used to monitor response to therapy[16].

**Table-2: Distribution of low bone mass in various ethnic groups.**

| Ethnicity | Normal BMD | Osteopenia | Osteoporosis |
|---|---|---|---|
| Punjabi | 83 (35.8%) | 82 (35.3%) | 67 (28.9%) |
| Pathan | 24 (31.2%) | 24 (31.2%) | 29 (37.7%) |
| Kashmiri | 19 (29.7%) | 26 (40.6%) | 19 (29.7%) |
| Sindhi | 7 (35%) | 5 (25%) | 8 (40%) |
| Balochi | 1 (14.3%) | 3 (42.9%) | 3 (42.9%) |

$p$ = 0.714

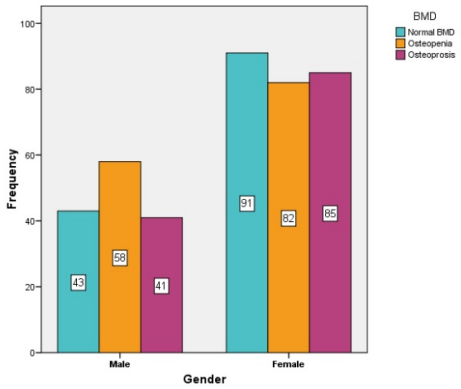


**Figure-I: Gender wise distribution of low bone mass.**

In this study, we included 400 patients was reported to a tertiary care hospital from different ethnic groups. Their BMD was measured by using DXA Hologic Discovery A at spine and femur neck. All scans were done on same machine.

Our result showed slightly decreased prevalence as compared to study done in India[7], which showed 40.6% osteopenia and 42.2% osteoporosis which may be due to the fact that comparatively older patients were included in that study. Also their BMD was measured by quantitative ultrasonography of wrist.

Fatima et al studied BMD in 334 Pakistani females older than 20 years, by quantitative ultrasonography and it was found that 43.4% were osteopenic and 12.9% were osteoporotic[6]. In our study, 31.8% females had osteopenia and 33% had osteoporosis. An increase in prevalence of osteoporosis in our results may be due to difference in mean age and BMI.

Baig et al found that in women of premenopausal age, there is comparative prevalence of osteopenia but much lesser prevalence of osteoporosis[17]. The difference may be due to the fact that BMD was measured using heel ultrasonography rather than DXA scan, which is a much more sensitive and specific way to measure BMD.

Another study done in post menopausal Pakistani women using urinary bone turnover markers showed that the frequency of osteoporosis was 13.5% for women aged between 50-59 years, while in women aged between 60-69 years the frequency was 78% and 100% in women over 70 years[9].

The study was carried out in a military hospital where we got the opportunity to record the survey of patients from different ethnic groups. In spite of extensive search, we couldn't find any other study done with respect to these ethnic groups. We found considerable number of Punjabis, Pathans and Kashmiris but comparatively lesser number of Sindhis and Balochis. Reason for this is geographic proximity of Rawalpindi, a major city of Punjab (where the study has been carried out) to KPK and Azad Kashmir. We could not comment about frequency of this condition in these groups due to small number of patients reported to our setup. Forgoing, more multicentre studies should be carried out on larger scales to establish mean BMD in these ethnic groups as well.

When we compare Punjabis, Pathans and Kashmiris, the three large groups of our study, we found highest frequency of osteoporosis in Pathans and that of osteopenia in Kashmiris. However, results are comparable in almost all large ethnic groups. Keeping in view gender based distribution, the highest frequency of osteoporosis is found in Pathan males and females and that of osteopenia in Kashmiri males and Punjabi females. The mean age for males is highest for Pathans, which may explain the highest prevalance of osteoporosis, while in females highest mean age is found in Punjabi. The factors responsible for differences in BMD with respect to various ethnicities need further research and studies.

Our study also has some limitations. As we already mentioned that we found comparatively less number of Sindhi and Balochi population, for which we suggest further studies.

## CONCLUSION

The study showed high prevalence of low bone mass in Pakistani population in females as well as in males. The results in various ethnic groups are comparable. The high frequency of osteoporosis in males is an additional finding which deserves further studies. The factors responsible for differences in BMD with respect to various ethnicities also need further research and studies. Vitamin $D_3$ deficiency can aggravate osteoporosis but could not be included keeping in view the limited availability of the facility and cost effectiveness. Further studies are recommended for correlation with disease in this part of the world.

## CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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