



Comparison between Study of Bone Mineral Density in Males and Females of Various Age Groups

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Osteoporosis is one of the complex diseases which have multiple etiology. The cause of it is maybe genetic and environmental or nutritional. There are various techniques for the measurement of bone mineral density. The DXA (DUAL ENERGY X-RAY ABSORBTIOMETRY AND BONE DENSITOMETER) is frequently used to measure bone mineral density. The other measures to measure bone mineral density are Quantitative computed

Results: With the increase in negative T tomography and ultrasound tonometry. The WHO standard for distinguishing patients as normal with 1 standard deviation of peak bone mass. Osteopinic 1 to 2.5 below peak bone mass .osteoporotic ;>2.5 standard deviation below peak bone mass.

Materials and Methods: The study included 200 Subjects of various age groups of both sexes. The study was carried out in the department of anatomy with the collaboration of the Department Of Orthopedics. The proforma was structured to include the details of the subjects with height, weight, etc. With a score of one, the risk of fracture increased 1.5 to 3 fold.

Conclusion: The study of Bone Mineral Density (BMD) can help in increasing awareness about bone health in growing countries. There is a significant association between various age groups and a non-significant association between genders for BMD evaluation.

The current study puts up to our understanding of BMD disparities among people that would suggest the use of local testimonial scales for an authentic explanation of BMD reports.

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1. INTRODUCTION

Men usually have more bone solidity as compared to females. A woman's skeleton is usually very light and irregular than a male's which is thicker and uneven. Cadaverous dimensions and durability differ linking both genders. Bone shape contrast starts before childhood [1].

Additionally, more notable bone formation dissimilarities will appear when adolescence starts. Adolescence is the time of bodily changes during which an individual's body changes into a full-grown body that is efficient for the reproductive process. Bone extension design in adolescence in males is non-identical as compared to females. Males have 3 or 4 years of growth before puberty and a growth gush that will last about 5 years, whereas girls have a growth gush of the duration of 3 years [2].

In the course of childhood and adolescence, bone growth is comparatively more than bone adhesion. Bone adhesion is a process that takes place when osteoclasts break down the bone tissue which ends up releasing minerals that result in the indirect transfer of calcium from bones to circulation. Osteoclasts are the bone cells that conduct absorption of bone tissue in the course of growth and healing. Till the prior 20s, both sexes obtain peak bone mass—that is the excessive accumulation of bone a person can obtain. Bones contain the total bone mineral emanate in the course of childhood and adolescence [3].

Such countless different examinations have demonstrated that when guys and females and kids are thought about for body size, contrasts in bone mass are seen to be vanished or be diminished.

The difference between prospective male and female bone size is a decomposition when matching bone concentration between males and females [4].

Osteoporosis is a metabolic bone condition marked by a developing decrease in bone mass and bone concentration, which leads to bone weakness and an increase in the possibility of fracture. Osteoporosis tends to happen when

bone resorption outpaces bone formation in the course of bone remodeling [5].

The BMD means the bone mineral density is the important factor for bone solidity. The skeleton content of, amount of calcium and minerals, known as bone concentration. Less the content more the weakness in bones. It may keep growing until the late 20s. In this situation, bones have reached their maximum strength and density, known as peak bone concentration. Females usually experience a **slight change** in total bone concentration between age 30 to 40 and menopause. The WHO standard for **distinguishing** patients as normal with 1 SD of peak bone mass. Osteopenic 1 to 2.5 SD below peak bone mass; Osteoporotic ; >2.5 SD below peak bone mass [6].

Bone strength is indirectly assessed by Bone mineral density (BMD). Out of many parameters assessing bone strength, BMD accounts for near about 70% of bone strength. So BMD becomes the most commonly used parameter to measure bone strength. It is an average concentration of mineral principally calcium hydroxylapatite per unit area of the bone. Bone mineral density assessments are done to regulate if there is less bone mass, to anticipate the possibility of future fracture to establish which subject may require the conservative treatment, and to detect subjects on same. Bone concentration is highly linked with bone solidity and with the possibility of fracture [7]. Osteoporosis and osteopenia are the two most common subclinical states of low levels of BMD and these are the greatest predictor of risk for bone fractures as per WHO. In both, genders over the age of 50 years age-based decline in BMD is seen. Osteoporosis, the silent thief, usually remains asymptomatic until the weakened bone fractures. India is one of the largest affected countries in the world 1 out of 8 men and 1 one out of 3 females in India suffer from osteoporosis. Bone concentration proportions are used to distinguish people for osteoporosis possibility and also to recognize those who might benefit from measures to improve bone strength [8,9].

Osteoporosis became a chief area of interest because of its effect on public health and finance as well. Women suffering from post-menopause are more receptive to primary osteoporosis as it is congeneric to estrogen deficiency. During the

transition of menopause, the absorption of bone is more than developed due to the low levels of estrogen which derives into osteoporosis. One of the considerable health ultimatums of osteoporosis is osteoporotic fractures. Determined by its association, the generality of osteoporosis is high in postmenopausal women as compared to older men. As we know, low estrogen levels are the main reason behind postmenopausal osteoporosis, menopause hormonal therapy is contemplated as the primarily selected way in anticipation of osteoporosis as its potency has been signified by various studies. Nevertheless, hormonal therapy is only suggested to females aged less than 60 years or less than 10 years of post-menopause. For those, who are more than 60 years old, hormonal therapy is not suitable hence except hormonal therapy, other medications should be considered [10].

Basic nutritious additives such as calcium, vitamin D along with modifications in daily habits such as exercise, evacuating smoking, quitting alcohol, and some other strategies for avoiding the reduction or deficiency of estrogen levels should be followed [10].

There are multiple options available for the measurement of BMD. Out of which Dual-energy X-ray absorptiometry (DXA) and scans of axial skeletal sites are standard assessment tools to diagnose low BMD, but its use is limited due to deleterious effects of radiations, high cost, lack of availability in remote areas. Quantitative ultrasound scan (QUS) the ultrasound-based bone densitometer known as is relatively cheaper, without radiations, portable, and widely available in India [11].

There are few studies done on BMD. However, the proper data explaining the prevalence of osteoporosis among both men and women is scanty in developed as well as in developing countries. The present study was designed and planned to screen patients attending orthopedic OPD of Jawaharlal Nehru Medical College, Sawangi (M), Wardha, Maharashtra, India for their BMD using an ultrasound scan.

1.1 Aims and Objectives

1.1.1 Aim

To study the comparison between bone mineral density of males and females of various age groups.

1.1.2 Objectives

- 1) To differentiate the bone mineral density in males and females in Wardha District.
- 2) To study the loss of bone mass in females with increasing age.
- 3) To provide a low-cost method to assess bone concentration.
- 4) To study the BMD in males and females and compare the outcomes according to their age.

2. MATERIAL AND METHODS

The study was designed by including males and females of various age groups.

Camps were arranged to detect the bone mineral density.

Subjects participating were patients attending orthopedics O.P.D.

The current study was carried out at the Department of Anatomy in collaboration with the Orthopedic department, Jawaharlal Nehru Medical College, Sawangi (M), Wardha. This prospective study was designed to include 200 patients of both sexes attending orthopedic OPD. The proforma was structured to include particulars of each subject with name, age, sex, height, weight, registration number, and address. The bone mineral density of each study subject was measured with the help of an Ultrasonographic Bone Densitometer. The distal radius and midshaft of the tibia were the sites used for measuring BMD.

The obtained results were analyzed and tabulated. Statistical analysis was done by SPSS software.

2.1 SPSS Software

The IBM® SPSS® software platform offers advanced statistical analysis, a vast library of machine learning algorithms, text analysis, open-source extensibility, integration with big data, and seamless deployment into applications.

Its ease of use, flexibility, and scalability make SPSS accessible to users of all skill levels. What's more, it's suitable for projects of all sizes and levels of complexity, and can help you and your organization find new opportunities, improve efficiency and minimize risk.

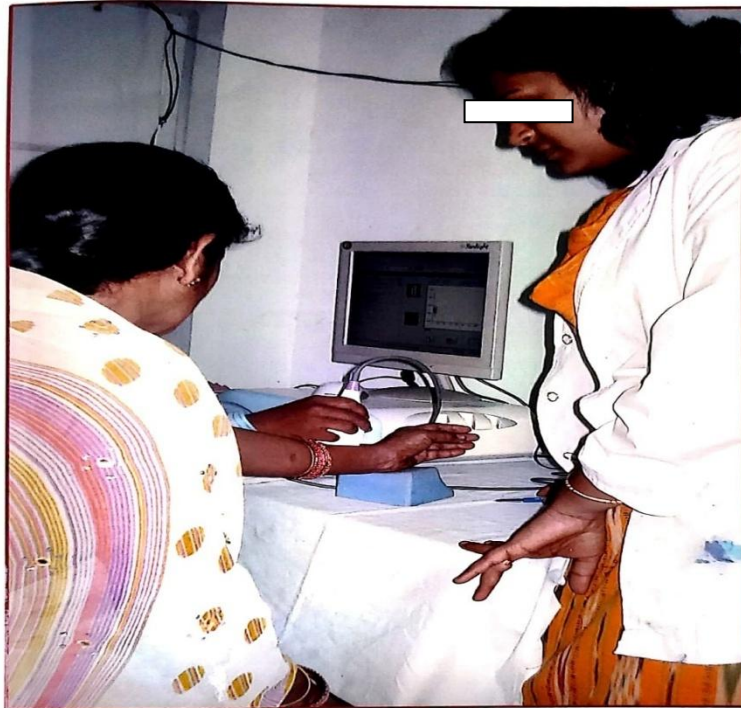


Fig. 1. Measurement of BMD by bone densitometer

Within the SPSS software family of products, SPSS Statistics supports a top-down, hypothesis testing approach to your data while SPSS Modeler exposes patterns and models hidden in data through a bottom-up, hypothesis generation approach.

2.2 Inclusion Criteria

- Patients willing to participate in study.
- Patients able to read and understand consent form carefully.
- Patients able to give informed consent.

2.3 Exclusion Criteria

- Patients having a history of Diabetes mellitus or hypertension
- Patients having a history of gastrointestinal or renal disease.
- Patients having a history of hyperthyroidism or hypothyroidism.
- Patients with ischemic heart disease.
- Patients with previous bone-related pathology.

Patients having any drug history including oral contraceptive hormonal therapy and steroid use.

3. RESULTS

In the presents study, we observed BMD of 200 subjects. The results are given in numerical form and tabulated. In the results, T score compares the bone density of study, with the standard subject considered as control who is 30 years old. This age of control was chosen because at this age human beings attain peak bone mass. Comparison to this number allows the observers to see how much bone loss has occurred. T scores are given in positive and negative numbers where negative numbers represent the bone mass. Bone goes through various stages of thinning i.e. normal, osteopenia, osteoporosis. Z-score is the number of standard deviations from the mean a data point is.

With each increasing negative T-Score of 1, the risk of bone pathology inclined 1.5 to 3 folds. So, despite being diagnosed with osteopenia, one is still at risk of fracture.

With the increase in negative T score of one, the risk of fracture increased 1.5 to 3 fold.

Table 1. T score interpretation

T score interpretation	
Above -1	Standard bone mass
Between -1 and -2.5	Osteopenia
Below -2.5	Osteoporosis

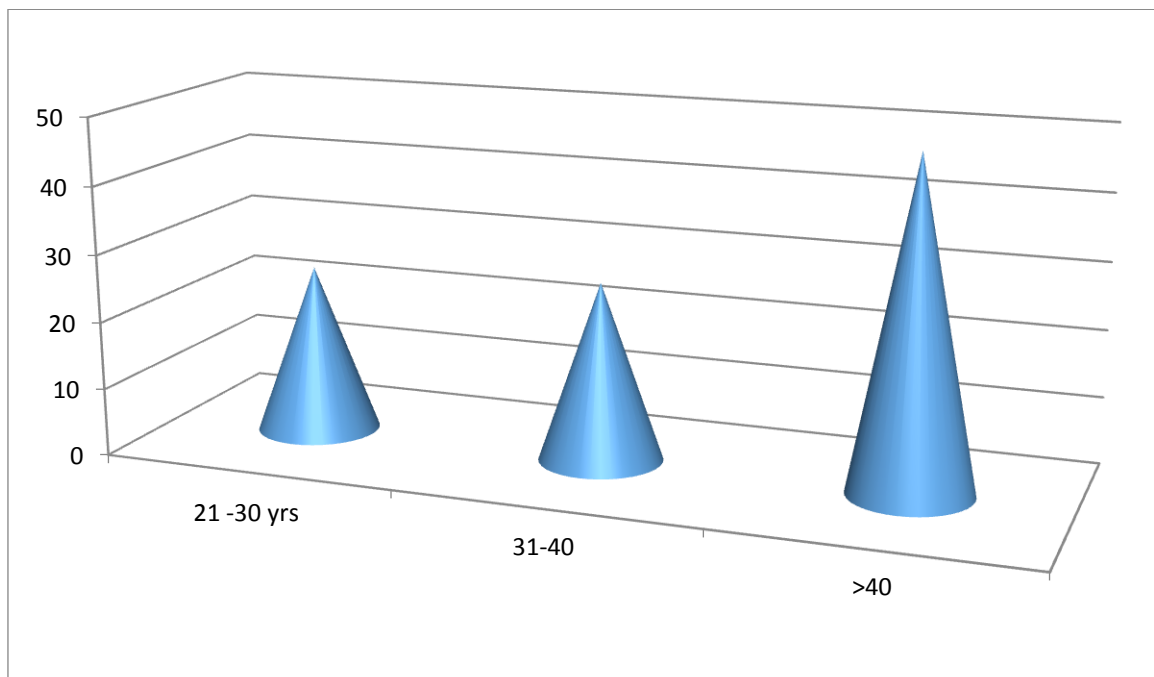
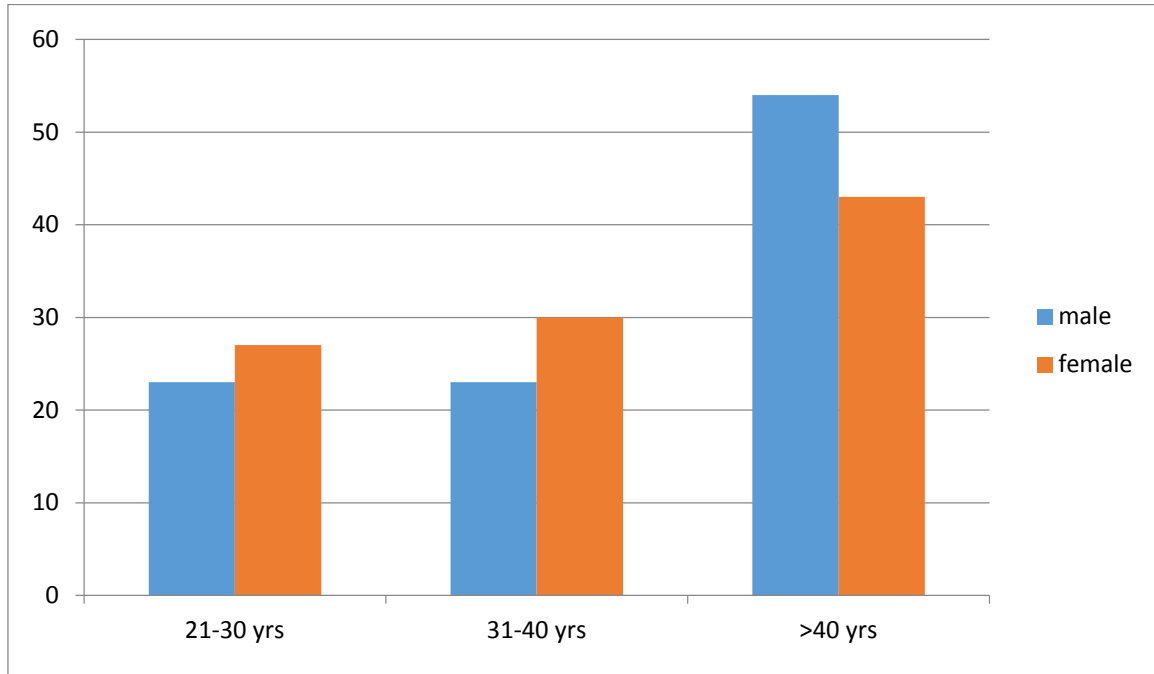
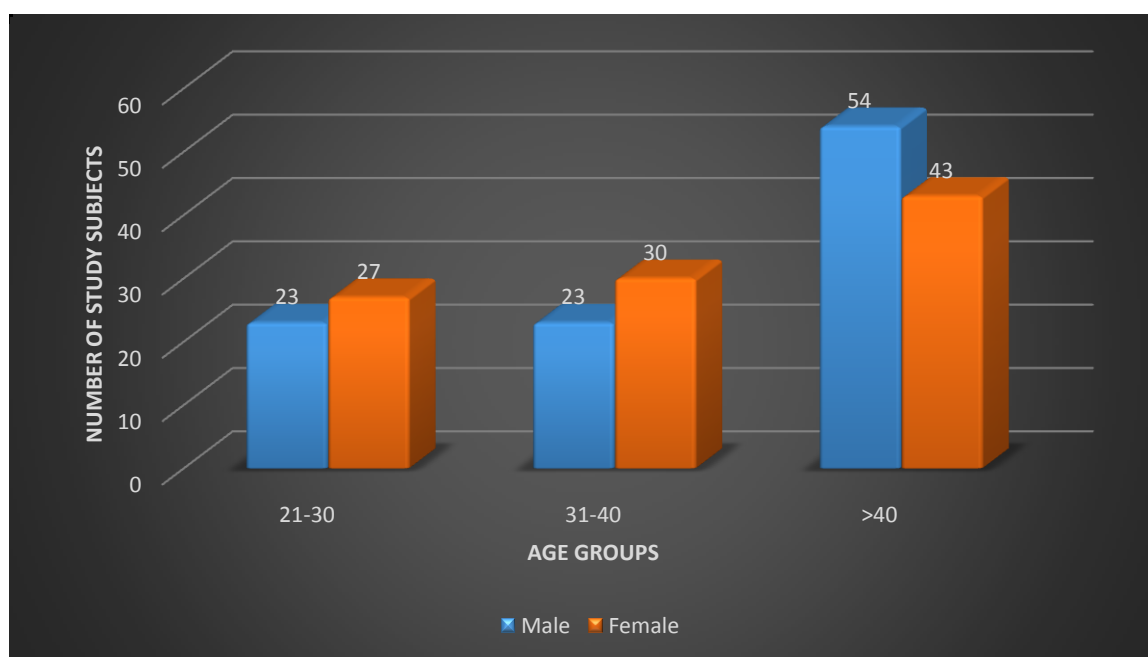


Fig. 2. Age-wise and sex-wise distribution

Table 2. Age-wise and sex-wise distribution of study subjects

Age Groups (Yrs)	Male	Female	Total	Percentage (%)
21-30	23	27	50	25
31-40	23	30	53	26.5
>40	54	43	97	48.5
Total	100	100	200	100
Mean Age (Yrs)	44.64	40.27	42.44	
SD	14.93	12.73	13.97	
P-value	0.005			
X ² value	18.51			



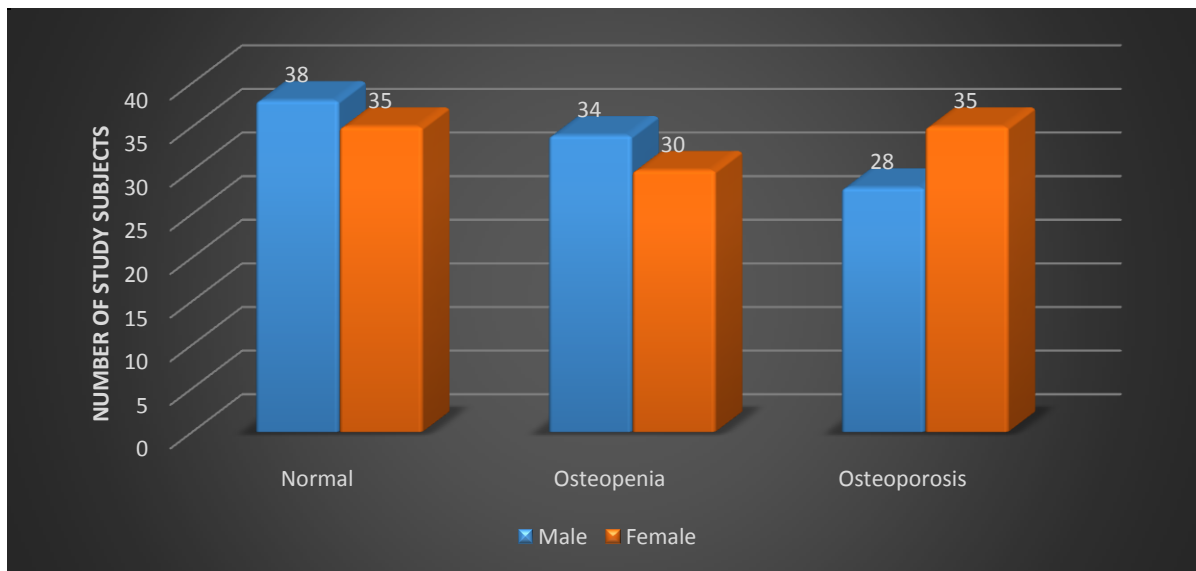
Graph 1. Age-wise and sex-wise distribution of study subjects

Table 3. Sex-wise distribution of bone mineral density

BMD	Male	Female	Total	Percentage (%)
Normal	38	35	73	36.50
Osteopenia	34	30	64	32.00
Osteoporosis	28	35	63	31.50
Total	100	100	200	100.00
Z- Test	1.00	1.00		

Table 4. Correlation of bone mineral density and sex-wise age groups

Age Groups	Normal		Osteopenia		Osteoporosis	
	Male	Female	Male	Female	Male	Female
20-30	11	11	06	07	06	09
31-40	11	13	08	10	04	07
>40	16	11	20	13	18	19
Total	38	35	34	30	28	35
p value	0.50 (NS as p>0.05)		0.55 (NS as p>0.05)		0.64 (NS as p>0.05)	



Graph 2. Sex-wise distribution of bone mineral density

4. DISCUSSION

In the present study, we observed the BMD of 200 study subjects. We distributed study subjects according to age groups and sex to find an association between them.

In table no.02, we distributed study subjects into various age groups according to sex. We found a maximum of 97 study subjects (54 male and 43 female) belonging from more than 40 years of age group. Followed by 53 study subjects from 31 to 40 years age group. The mean age of males was 44.64 ± 14.93 years and for females, it was 40.27 ± 12.73 years. The total mean age of the study population was 42.44 ± 13.97 years. These findings were statistically significant as the p-value was 0.0051.

In a similar study done by Sharma et al, they screened a total of 215 participants for their BMD. The mean age of the sample was 46.93(SD 13.31) with a minimum age of 25 years and maximum age of 75 years. In the sample, there were 58.1% ($n = 125$) female subjects and 41.9% ($n = 90$) were male. Hamson C et al in their study of BMD evaluation they randomly selected subjects by age (20–40 years) and ethnicity. Out of 262 participated volunteers they have chosen 201 study subjects (51 white women, 71 Gujarati women, 37 white men, 42 Gujarati men) .³

In table no. 03 we have discussed the sex-wise distribution of study subjects explaining in the

form of normal osteopenia and osteoporosis. We found that normal BMD in 73 (38 male and 35 female) subjects, osteopenia in 64 (34 male and 30 female) subjects, and osteoporosis in 63 (28 male and 35 female) subjects. Z score for males was 1.00 and for females also 1.00. Table no 04. Explain BMD with sex-wise age groups and we found that out of 73 normal BMD subjects more than 40 years of age group consists of maximum i.e. 16 male and 11 female subjects. Out of 64 osteopenia subjects, the maximum male is 20 and the female 13 belongs to the more than 40 years of age group. Osteoporosis also consists of maximum study subjects i.e. 28 male and 35 female from more than 40 years of age group. The test of significance was nonsignificant for all three classes in the case of male and female as the p-value was more than 0.005 .

Similarly, Sharma et al in their study found that out of 215 study subjects 24 with osteoporosis . 121 with osteopenia and 70 were with normal BMD. There has been observed an efficient tendency of lessening bone density with an expansion in an age in both the gender groups . The percentage of osteoporotic female participants (58.8%) was more than male participants in the age group of <55 years whereas, in the same age group, the percentage of osteopenic participants was more among males (46.7%) than females (27.5%). (3) One case of osteoporosis was also reported in the age group of 25 – 35 years among female participants. A noteworthy confederation ($\chi^2 = 18.64$, $P < 0.005$) was reported between the

T-score and different age groups. Whereas, a non-significant association exists between gender and the T-score. Packet al systematically measured the BMD of 130 consecutive patients, seen over 6 months in 2005, and found a higher than expected prevalence of clinically significant low BMD; 39% of patients had osteopenia and 16% had osteoporosis [12].

Jeri W Nieves Et al proved that dissimilarity in male and female bone size and bone mass and bone concentration continues at most skeletal locations even after comparing the body size. Gender dissimilarity in male and female bone concentration is assumed to be skeletal position-dependent with appendicular bones that have a large portion of cortical bone exhibiting greatest gender mismatched. So they concluded that the male-female dissimilarities in bone size and mass consult greater skeletal cohesion in males. The find out the reason behind that requires further more studies [2].

5. CONCLUSION

The study of BMD can help in increasing awareness about bone health in developing countries. There is a noteworthy association between various age groups and a non-significant association between genders for BMD evaluation. The present study adds to our understanding of BMD disparities between populations that would recommend the use of local reference ranges for well-grounded interpretations of BMD reports. The high standard to measure the bone concentration is dual X-ray absorptiometry (DXA). Its value is denoted in form of standard deviation units.

As per our findings, bone density testing should be compulsory for all males and females belonging to the age group of 35 – 40 and the younger ones who have who are suffering from clinical risk factors as BMD testing is a non-invasive method.

CONSENT AND ETHICAL APPROVAL

As per international standard or university standard guideline Patient's consent and ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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