

Original Research Article

Comparative study of bone mineral density in males and females of various age group.

Abstract:

Background: Osteoporosis is one of the complex diseases which have multiple etiology . The cause of it is may be genetic and environmental or nutritional . There are various techniques for measurement of bone mineral density . The DXA (DUAL ENERGY X-RAY ABSORPTIOMETRY AND BONE DENSITOMETER) is frequently used to measure the bone mineral density . The other measures to measure the bone mineral density is the Quantitative computed tomography and ultra sound sonometry . The WHO standard for distinguishing patients as normal with 1 standard deviation of peak bone mass . Osteopenic 1 to 2.5 below peak bone mass .osteoporotic >2.5 standard deviation below peak bone mass .

Materials And Method : The study include the 200 Subjects of various age groups of both sexes . The study was carried out in department of anatomy with collaboration of department Of Orthopedics . The proforma was structured to includes the details of the subjects with height , weight etc.

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

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

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

Keywords: BMD ; Osteoporosis ; Osteopenia ; Bone concentration ; Menopause ; DXA ; Bone density ; QUA; Mineral density

Introduction :

Men usually have more bone solidity as compared to females.

A woman's skeleton is usually very lighter and irregular than male's which is more thicker and uneven . Cadaverous dimensions and durability differ linking both the genders . Bone shape contrast starts prior to the 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 an full grown body that is efficient for reproductive process. Bone extension design in adolescence in males are 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 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 which takes place when osteoclasts breakdown the bone tissue which ends up in releasing minerals that results in direct transfer of calcium from bones to circulation. Osteoclasts are the bone cells which conducts 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)

So many other studies have proved that when males and females and children are compared for body size, differences in bone mass is observed to be disappeared or reduced.

The differences between male and female bone size is a prospective discomposition when matching bone concentration between male and female.(4)

Osteoporosis is a metabolic bone condition marked by developing decrease of bone mass and bone concentration, which leads to bone weakness and an increase in possibility of fracture. Osteoporosis tends to happen when bone resorption outpaces bone formation in the course of bone remodeling. (5)

The BMD means 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. At this situation, bones have reached their maximum strength and density, known as peak bone concentration. Females usually experiences **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. Osteopinic 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 most commonly used parameter to measure bone strength . It is an average concentration of mineral principally calcium hydroxyl apatite per unit area of the bone . Bone mineral density assessment are done in order to regulate if there is less bone mass, to anticipate possibility of future fracture to establish which subject may required the conservative treatment, and to detect subjects on same . Bone concentration is highly linked with bone solidity and with possibility of fracture .(7) Osteoporosis and osteopenia are two most common subclinical states of low level of BMD and these are the greatest predictor of risk for bone fractures as per WHO . In both the genders over the age of 50 years an 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 in men and 1 out of 3 females in India suffers 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 development due to the low levels of estrogen which derives into osteoporosis. One of the considerable health ultimatum of osteoporosis is osteoporotic fractures. Determined by its association , the generality of osteoporosis is high in post menopausal women as compared to the older men. As we know, low estrogen levels are the main reason behind post menopausal 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 the females aged less than 60 years or less than 10 years of post –menopause. For them , 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 tool 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 with an objective of screening of patients attending orthopedic OPD of Jawaharlal Nehru Medical College , Sawangi (M) , Wardha , Maharashtra , India for their BMD using ultrasound scan.

AIMS & OBJECTIVES

- 1) To find the association of BMD in both sexes with the various age groups.
- 2) To differentiate the bone mineral density in male and female.
- 3) To study the loss of bone mass in females with middle age.
- 4) To provide low cost method to assess the bone concentration.

MATERIAL & 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 to orthopedics O.P.D.

Current study was carried out at Department of Anatomy in collaboration with 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.

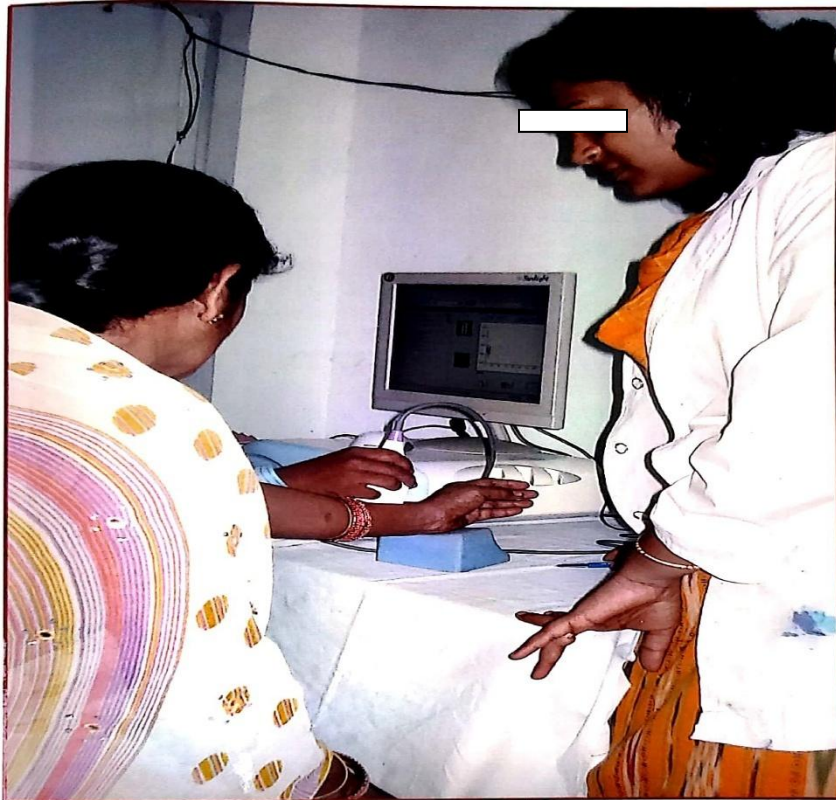
Bone mineral density of each study subject was measured with the help of Ultra sonographic Bone Densitometer. The distal radius and mid - shaft of tibia were the sites used for measuring BMD.

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

Exclusion criteria:

- Patients having history of Diabetes mellitus.
- Patients having hypertension.
- Patients having history of hyperthyroidism or hypothyroidism.
- Patients with ischemic heart disease.
- Patients with previous bone related pathology.
- Patients having any drug history including oral contraceptive and hormonal therapy.

Photograph 01: Measurement of BMD by Bone Densitometer



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 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 being attain peak bone mass . Comparison to this number allows observer 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 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 , inspite being diagnosed with osteopenia , one is still at a risk of fracture.

Table 01: T score interpretation.

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

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

Table 02: 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			
X² value	18.51			

Graph 01: Age wise and sex wise distribution of study subjects.

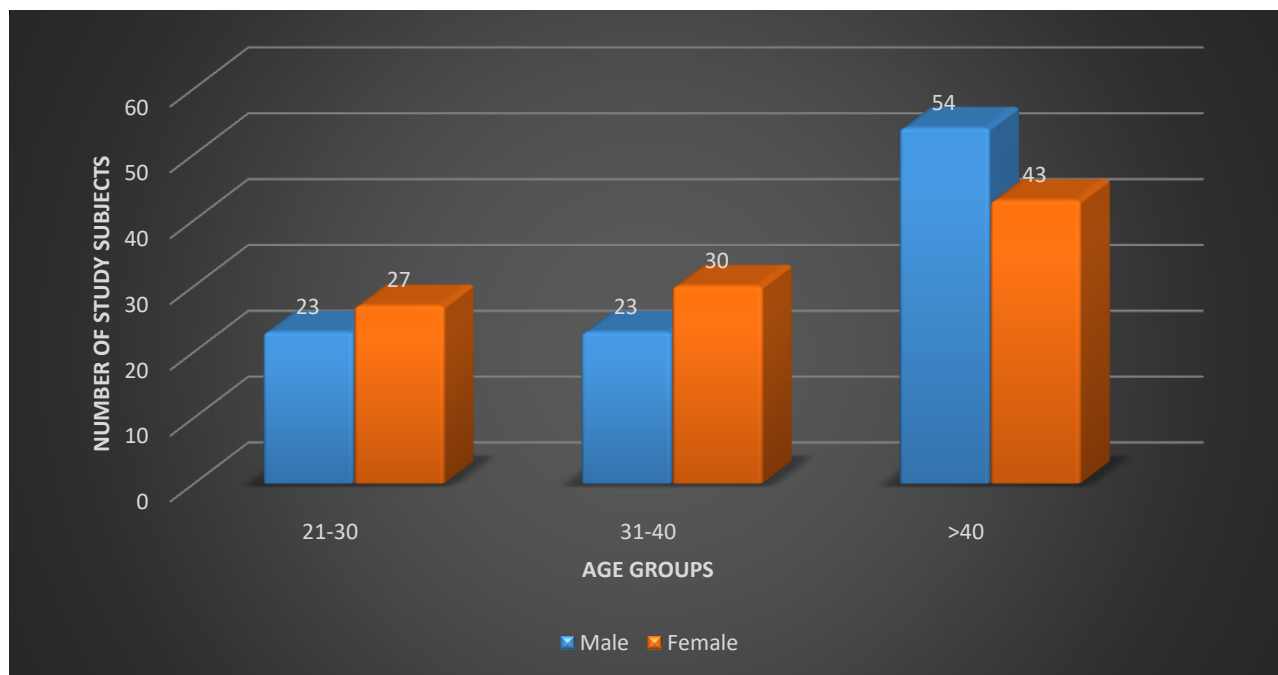


Table 03: Sex wise distribution of bone mineral density.

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		

Graph 02: Sex wise distribution of bone mineral density.

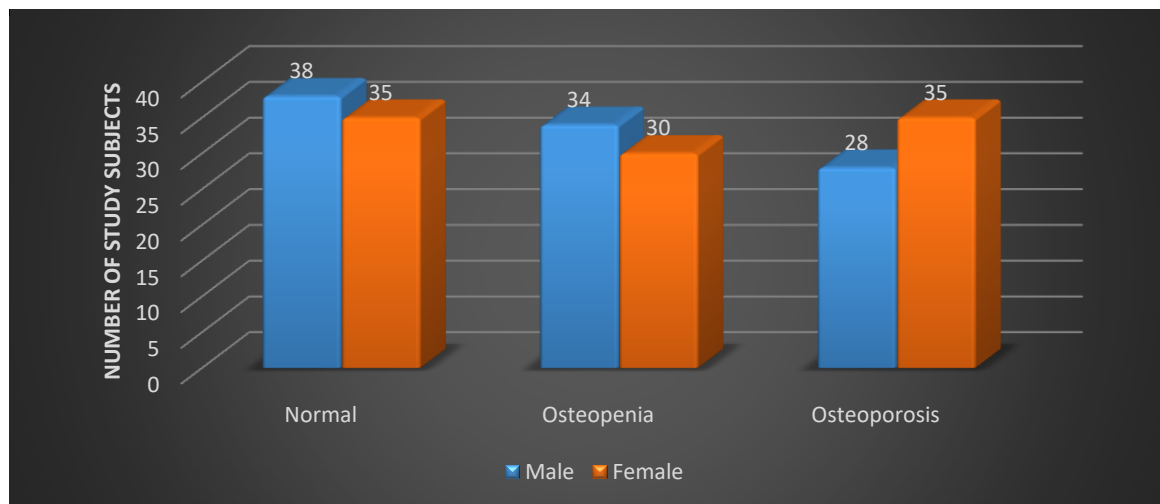


Table 04: Correlation of bone mineral density and sex wise age groups.

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 $p>0.05$)	

DISCUSSION:

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

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

In the similar study done by Sharma et al they screened total of 215 participants for their BMD . The mean age of sample was 46.93(SD 13.31) with 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 the table no. 03 we have discussed 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 male was 1.00 and for female 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 maximum male 20 and female 13 belongs from 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 non significant for all three classes in case of male and female as 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 expand in 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 where as 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 . Pack et al systematically measured the BMD of 130 consecutive patients , seen over a 6-month period 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 Neives 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 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 consults greater skeletal cohesion in males . The find out the reason behind that requires further more studies . (2)

Hiroshi Naka et al in 2005,proved outcomes of pubescence growth , anthropometric measurements and grip solidity on bone concentration of lumbar spine and hip around puberty in children in Japan . They came to an interpretation that confusing factors due to physical and pubescence development should be taken into contemplation in various ways for male and females in study on the effects of environment and behavioral components on bone mass accession during peri-pubescence in children.(13)

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 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 to all males and females belonging to age group of 35 – 40 and the younger ones who have who are suffering from clinical risk factors as BMD testing is non-invasive method.

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