

## RESEARCH ARTICLE

**Analytical Study of Bone Mineral Density (BMD) In Various Community of Navi Mumbai**

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**ABSTRACT**

Osteoporosis, a condition characterized by decreased bone strength, is prevalent among post menopausal women but also occur in men & women with underlying conditions or major risk factors associated with bone demineralization. Low bone mineral density (BMD) is a major risk factor for osteoporosis and its related fractures. Fracture risk increases as bone mineral density declines. The most accurate test of bone density is dual-energy X-ray absorptiometry (DXA). The measurements, known as *T-scores*, determine which category - osteopenia, osteoporosis, or normal - a person falls into. Different communities may be expected who have a different lifestyle, such as different levels of activity and different eating habits. However, from clinical and public health point of view, it is important to verify BMD for determination of bone strength of various communities.

**Key-words:** Osteopenia, Osteoporosis, BMD (Bone Mineral Density), DXA (Dual-energy X-ray Absorptiometry), BMI (Body Mass Index)

**INTRODUCTION**

Bones naturally become thinner as people grow older because, beginning in middle age; existing bone cells are reabsorbed by the body faster than new bone is made. As this occurs, the bones lose minerals, heaviness (mass) and structure, making them weaker and increasing their risk of breaking. All people begin losing bone mass after they reach peak bone density at about 30 years of age. The thicker your bones are at about age 30, the longer it takes to develop osteopenia or osteoporosis.<sup>[1]</sup>

Osteoporosis, a condition characterized by decreased bone strength, is prevalent among post menopausal women but also occur in men & women with underlying conditions or major risk factors associated with bone demineralization. Its chief clinical manifestations are vertebral & hip fractures, although fractures can occur at any skeletal site. Osteoporosis affects more than 10 million individuals in United States, but only small portions are diagnosed & treated.<sup>[2]</sup>

Fracture risk increases as bone mineral density declines. A study published in the *Journal of the American Medical Association* in 2001 reported that a 50-year-old white woman with a T-score of -1 has a 16% chance of fracturing a hip, a 27%

chance with a -2 score, and a 33% chance with a -2.5 score. But there isn't a huge difference between, say, a -2.3 T-score and -2.5, although the former would be labeled osteopenia and the latter, osteoporosis. The label matters less than the number. Regardless of exact score, if individual fall into the osteopenia category, he will probably schedule for a bone mineral density test every two to five years.<sup>[3]</sup>

In the United States as many as 8 million women & 2 million men have osteoporosis (T score < -2.5) & additional 18 million individuals have bone mass levels that put them at increased risk of developing osteoporosis (T score < -1.0). Osteoporosis occurs more frequently with increasing age.<sup>[4]</sup>

Osteoporosis is not inevitable. Osteoporotic fractures are among the main concerns of elderly population. Low bone mineral density (BMD) is a major risk factor for osteoporosis and its related fractures. Different communities may be expected who have a different lifestyle, such as different levels of activity and different eating habits. However, from clinical and public health point of

view, it is important to verify BMD for determination of bone strength of various communities.

### NEED OF STUDY

From this study different community will be alerted to red flags that signal at greater risk for a broken bone and importance to check BMD at regular intervals. So that early awareness regarding risk of Osteoporosis can be generated in different communities.

### REVIEW OF LITERATURE

Osteoporosis is defined as reduction of bone mass (or density) or the presence of fragility fracture. Loss of bone tissue causes deterioration in the architecture of skeleton, the combination leading to markedly increased risk of fracture. Based on recommendation of WHO committee, osteoporosis is defined operationally as a bone density that falls 2.5 Standard deviations (SD) below the mean for young healthy adult of same race & gender. Also referred to as T score of -2.5. Those who fall at the lower end of young normal range (T score of > 1 SD below the mean) are defined as low bone density (osteopenia) & are considered to be at an increase risk of osteoporosis.<sup>[5]</sup>

#### Etiology:

Some people who have osteopenia may not have bone loss. They may just naturally have a lower bone density. Osteopenia may also be the result of a one or more other conditions, disease processes, or treatments. Women are far more likely to develop osteopenia and osteoporosis than men. This is because women have a lower peak bone density and because the loss of bone mass speeds up as hormonal changes take place at the time of menopause. In both men and women, the following things can contribute to osteopenia:

Things that increase risk include:

- Being white (Caucasian) or to a lesser degree, being Asian.
- A family history of osteoporosis.
- Being thin.
- Long-term use of corticosteroids, such as hydrocortisone or prednisone for inflammatory conditions, or anticonvulsants, such as carbamazepine (Tegretol), gabapentin (Neurontin), or phenytoin (Dilantin) for pain or seizures.
- Eating disorders or diseases that affect the absorption of nutrients from food.

- Being inactive or bedridden for a long period of time.

- Smoking.
- Drinking excessive amounts of alcohol.
- Having a diet low in calcium or vitamin D, Eating disorders or metabolism problems that do not allow the body to take in and use enough vitamins and minerals<sup>[6]</sup>

#### Symptoms:

Osteopenia has no symptoms. Individual may notice no pain or change as the bone becomes thinner, although the risk of breaking a bone increases as the bone becomes less dense.

#### Diagnosis:

Osteopenia is diagnosed with a bone density test, usually done to examine osteoporosis. A standard X-ray is not useful in diagnosing osteopenia, because it is not sensitive enough to detect small amounts of bone loss or minor changes in bone density.

#### Treatment:

Osteopenia is treated by taking steps to keep it from progressing to osteoporosis and, for a few people, by taking medicine. Lifestyle changes can help reduce the bone loss that leads to osteopenia and osteoporosis.

Quality of food is very important to bone development. Calcium is the most critical mineral for bone mass. Best sources of calcium are milk and other dairy products, green vegetables, and calcium-enriched products.<sup>[7]</sup>

### AIM AND OBJECTIVES

- To analyze bone mineral density (BMD) in different communities of Navi Mumbai
- To determine bone mineral density in view of clinical analysis & public health

### MATERIALS AND METHODS

#### Dual-energy X-ray Absorptiometry (DXA):

DXA is highly accurate X-ray technique that has become the standard for measuring bone density. Though it can be used for measurement of any skeleton site, clinical determinations are usually made of lumbar spine & hip. Portable DXA machines have been developed that measure the heel (calcaneus), forearm (radius & ulna). Two X ray energies are used to estimate the area of mineralized tissue & the mineral content is divided by the area which partially corrects for body size.<sup>[8]</sup>

The most accurate test of bone density is dual-energy X-ray absorptiometry (DXA). The

measurements, known as *T-scores*, determine which category - osteopenia, osteoporosis, or normal - a person falls into. Although there are other methods, DXA is a form of X-ray that can detect as little as 2% of bone loss per year. [9]

Ht Scale,  
Weighing Machine  
BMI (Body Mass Index)

**Sample Size:**

**Total 100**

20 individuals of 5 communities' viz., Maharashtrian, Gujarati/Jain/Marwadi, North Indian, South Indian & East Indian.

**Inclusion Criteria:**

Individual between age 30 to 60  
Both Male & Female

**Exclusion Criteria:**

Individual suffering from DM/ HTN/ Major Surgical or Medical illness  
Pregnant woman

Athletes or Individual Performing regular exercise  
Individual consuming calcium supplements & steroids anabolic or catabolic

Individuals having addiction of Alcohol, Tobacco, Cigarette

**Methods**

Each individual is selected randomly from various communities to examine BMD.

Method used for collection of data: Observational Cross Sectional Method

$$BMI = \frac{Wt (Kg)}{(Ht (m))^2}$$

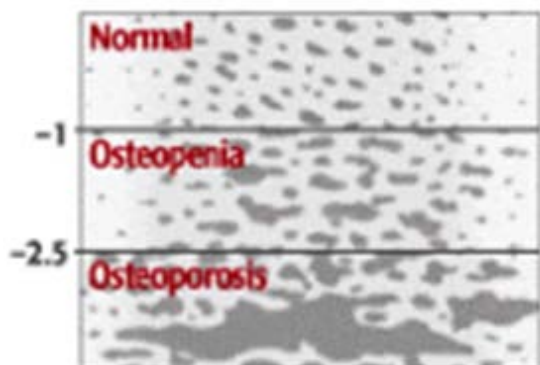
**BMD**

T-score, Z-score

T-score -1 & above : Normal  
Between -1 to -2.5 : Osteopenia  
Below -2.5 : Osteoporosis

**What's your score?**

A T-score ranging from -1 to -2.5 is classified as osteopenia.



The lower the score, the more porous your bone. [10]

**STATISTICAL ANALYSIS**

Analysis of Variance Test (ANOVA) is applied to compare more than two samples drawn from corresponding normal populations. [11]

Chi square Test is most commonly used when data are in frequencies such as in the number of responses in two or more categories. [12]

**OBSERVATIONS**

**BMD vs Communities:**

**Table 1: Classification of Bone Mineral density in different communities**

S. No	Community	Normal	Osteopenia	Osteoporosis
1	Maharashtrian	4	3	13
2	South Indian	2	10	8
3	North Indian	4	9	7
4	Gujrati	5	8	7
5	East Indian	2	8	10
<b>Total</b>		17	38	45

H<sub>01</sub>: No significant difference in the BMD among the different communities.

H<sub>11</sub>: Significant difference in the BMD among the different communities.

Decision Criterion: Reject H<sub>01</sub> if F cal > F tab

**Table 2: Statistical Analysis of BMD vs Communities**

Source of Variation	d.f.	Sum of Squares	Mean sum of squares	F cal
Communities	4	7.3909	1.8477	1.243
Error	95	141.1668	1.485	
Total	99	148.5577		

Since F tab=2.467, we do not reject H<sub>01</sub> and conclude that there is no significant difference in the BMD among the different communities.

**BMD vs Professions:**

**Table 3: Classification of Bone Mineral density in different professions**

S. No	Type of Profession	NORMAL	Osteopenia	Osteoporosis
1	House Wife	5	16	29
2	SERVICE	7	17	7
3	BUSSINESS	2	3	2
4	WORKER	3	2	2
5	RETIRED	0	2	3
<b>Total</b>		17	40	43

H<sub>02</sub>: No significant difference in the BMD among the different professions

H<sub>12</sub>: Significant difference in the BMD among the different professions.

Decision Criterion: Reject H<sub>01</sub> if F cal > F tab

**Table 4: Statistical Analysis of BMD vs Professions**

Source of Variation	d. f.	Sum of Squares	Mean sum of squares	F cal
Professions	4	24.1267	6.0317	4.6054
Error	95	124.4262	1.3097	
Total	99	148.5529		

Since  $F_{tab} = 2.467$ , we reject  $H_{02}$  and conclude that there is significant difference in the BMD among the different professions.

### BMD-BMI RELATION

**CORRELATION** = -0.03786

As the correlation is negative it indicates that the relation between the two is inverse i.e. as one increases other decreases. Also the magnitude (i.e. 0.03786) is close to 0 which indicates that there is very weak relationship between BMD & BMI.

#### Diet vs BMD:

$H_{03}$ : No association between diet and BMD

$H_{13}$ : Association is present between diet and BMD.

Decision Criterion: To reject  $H_{03}$  if Chi square cal > Chi square tab

**Table 5: Classification of Bone Mineral density dietwise**

	ACTUAL			
DIET/BMD	NORMAL	OSTPAN	OSTPOR	TOTAL
VEG	8	9	8	25
NONVEG	8	30	37	75
TOTAL	16	39	45	100
	EXPECTED			
DIET/BMD	NORMAL	OSTPAN	OSTPOR	TOTAL
VEG	4	9.75	11.25	25
NONVEG	12	29.25	33.75	75
TOTAL	16	39	45	100

As  $\chi^2_{cal} = 6.66$  and  $\chi^2_{tab} = 5.99$  we reject  $H_{03}$  at 5% I.o.s. and say that there is association between diet and BMD.

#### Age vs BMD:

$H_{04}$ : No association between AGE and BMD

$H_{14}$ : Association is present between AGE and BMD.

Decision Criterion: To reject  $H_{04}$  if Chi square cal > Chi square tab

**Table 6: Classification of Bone Mineral density agewise.**

AGE	NORMAL	OSTEOPENIA	OSTPOROSIS	TOTAL
20-30	3	2	3	8
30-40	5	10	5	20
40-50	5	13	16	34
50-60	1	9	25	25
60-70	2	5	6	13
TOTAL	16	45	39	100

We reject  $H_{04}$  and conclude that there is association between AGE and BMD.

## OBSERVATION AND RESULTS

### BMD Vs Communities:

Among communities, 17 were normal individuals, out of 38 Osteopenic individuals 3 were Maharashtrians, 10 were South Indians, 9 were North Indians, and each 8 were from Gujarati & East Indians. Out of 45 Osteoporotic individuals

13 were Maharashtrians, 8 were South Indians, each 7 were North Indians & Gujarati and 10 were East Indians.

### BMD Vs Professions:

Among Professions, 17 were normal, out of 40 Osteopenic individuals 16 were House wives, 17 were doing Service, 3 were Businessman, and each 2 were workers & retired. Out of 43 Osteoporotic individuals 29 were House wives, 7 were doing Service, each 2 were Businessman & Worker and 3 were retired.

#### Diet vs BMD:

Among Veg & Non vegetarians, 16 individuals were normal, out of 39 Osteopenic individuals 9 were vegetarian & 39 were non vegetarian, out of 45 Osteoporotic, 8 were vegetarian & 37 were non vegetarian.

#### Age Vs BMD:

In Age group individuals 16 were normal, out of 45 Osteopenic, 2 were from 20-30 age groups, 10 were from 30-40 age groups, 13 were from 40-50 age groups, 9 were from 50-60 age group, 5 were from 60-70 age group. Out of 39 Osteoporotic, 3 were from 20-30 age groups, 5 were from 30-40 age groups, 16 were from 40-50 age groups, 25 were from 50-60 age group, 6 were from 60-70 age group.

## DISCUSSION & CONCLUSION

### BMD Vs Communities:

As per Statistical analysis showed among communities, we concluded that there is no significant difference in the BMD among the different communities

### BMD Vs Professions:

Among Professions House wives were more prone to Osteoporosis. Therefore we concluded that there is significant difference in the BMD among the different professions.

### BMD Vs BMI:

As the correlation between BMD & BMI is negative & also the magnitude is close to 0 which indicates that there is very weak relationship between BMD & BMI.

#### Diet vs BMD:

As per statistical analysis of chi square test, there exists association between Diet & BMD.

#### Age vs BMD:

As per statistical analysis of chi square test, there exists association between Age & BMD.

## REFERENCES

1. <http://www.webmd.com/osteoporosis/tc/osteopenia-overview>.
2. 16<sup>th</sup> Edition, Harrison's principles of Internal Medicine, Kasper, Braunwald, Fauci, Hauser, Longo, Jameson, Vol. II, pg. no. 2268, Mc graw hill Medical Publishing Division.
3. [http://www.health.harvard.edu/newsweek/Osteopenia\\_When\\_you\\_have\\_weak\\_bones.htm](http://www.health.harvard.edu/newsweek/Osteopenia_When_you_have_weak_bones.htm).
4. 16<sup>th</sup> Edition, Harrison's principles of Internal Medicine, Kasper, Braunwald, Fauci, Hauser, Longo, Jameson, Vol. II, pg. no. 2268, Mc graw hill Medical Publishing Division.
5. 16<sup>th</sup> Edition, Harrison's principles of Internal Medicine, Kasper, Braunwald, Fauci, Hauser, Longo, Jameson, Vol. II, pg. no. 2268, Mc graw hill Medical Publishing Division.
6. <http://www.webmd.com/osteoporosis/tc/osteopenia-overview?page=2>.
7. <http://www.webmd.com/osteoporosis/tc/osteopenia-overview?page=3>.
8. 16<sup>th</sup> Edition, Harrison's principles of Internal Medicine, Kasper, Braunwald, Fauci, Hauser, Longo, Jameson, Vol. II, pg. no. 2271, Mc graw hill Medical Publishing Division.
9. <http://www.webmd.com/osteoporosis/tc/osteopenia-overview?page=2> [http://www.health.harvard.edu/newsweek/Osteopenia\\_When\\_you\\_have\\_weak\\_bones.htm](http://www.health.harvard.edu/newsweek/Osteopenia_When_you_have_weak_bones.htm).
10. B.K. Mahajan revised by Arun Bhadra Khanal Methods in Biostatistics 7<sup>th</sup> edition JAYPEE Publication Pg No- 138, 2010.
11. B.K. Mahajan revised by Arun Bhadra Khanal Methods in Biostatistics 7<sup>th</sup> edition JAYPEE Publication Pg No- 154, 2010.