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Estimation of BMD using Portable Heel Ultrasound Bone Densitometer in a District Hospital of Northern Bangladesh- A pilot study

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Summary:

Background: *Bone is a living tissue. Solid matters of the bone are composed of minerals and organic matter. Peak Bone Mineral Density (BMD) is maximum during growth in skeleton system. There is variation of range for peak BMD, influenced by genetic and environmental factors. In women, peak bone mass is achieved by the 2nd decade and begins to decrease after 35 years of age. Osteopenia and osteoporosis are the major bone morbidities in women and usually occurs after menopause.*

Objective: *To identify the BMD in people of a community of a District of Bangladesh.*

Methodology: *This cross sectional study was done at an out-patient department in a District hospital, in February2022. Data were collected by conducting individual interview through a structured questionnaire. A total 50 cases were included, both sexes of 18-62 years of age. The T-score data were collected and BMD were presented in systematic manner based on WHO guideline. After collection, data were analyzed, tabulated and presented.*

Results: *Among study population 32 were female and 18 were male. BMD status were normal in 70% cases and low bone mass were 30%, there was no osteoporosis. Male are suffering from low bone mass than female. Low bone mass is slightly higher among old women and working women.*

Conclusions: *Bone health status in this population, 70% is normal.*

Key words: *Bone Mineral Density, Low bone mass.*

Introduction:

The average life expectancy of the people of our country is increased to72.6 years in 2019, as compared to 72.3 years in 2018[1] and at 2021, it is 73 years. Bone health is an important issue for healthy living. Bone is a living tissue which gives support to our body, gives mechanical basis for movement, storage for salt and minerals and continuous supply of new blood cells. Solid matters of the bone are composed of about two- thirds minerals and one-third organic matter. The minerals are calcium, magnesium and phosphate. During old age both the organic and inorganic components are decrease, producing osteoporosis, a reduction of quantity of bones. The strength of the bone is measured as bone density. Knowledge about the growth and decay of the bone density is of great importance in preventing bone loss and old age fracture.[2] Normally, bone formation and bone reabsorption are in balance, depending on many factors i.e. age, endocrine, nutrition and genetic factors. About 10% of the adult skeleton is remodeled each year. Peak bone mineral density is the maximum lifetime acquired in the skeleton system during growth. There is a large variation in the normal range for peak BMD that is influenced both genetic and environmental factor. In female following menopause, there is loss of bone by mass by about 3-5% per year, due to deficiency of estrogen. In industrialized countries more than one-third of women after 65 years suffer from symptoms of osteopenia/osteoporosis, a disorder characterized by low bone mass.[3]

Bone loss can be measured by measuring the bone mass density. WHO has defined diagnostic threshold

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for low bone mass and osteoporosis based upon BMD measurement compared with healthy young adult population (T-score). A T-score within 1 SD(+1 or -1) of the young adult mean indicates normal bone density. A T-score of (-1 to -2.5 SD) indicates low bone mass. A T-score of young adult mean (> -2.5 SD) indicates the presence of osteoporosis.[4]

This study aims to know about BMD in people of a community in a District of Bangladesh, who are not conscious about their BMD. The specific objective of the study includes to assess the variation in bone mass based on different socio-demographic characteristics including age, sex, location and occupation. The study also focuses on women to find the association of their age, pregnancy status and other characteristics with their BMD status.

Materials and Methods:

This cross sectional observational study was conducted on 13-15th February 2022 in a district hospital on 50 healthy person who attended the out-patient department (OPD). All the subjects were aged between 18-62 years, whose body mass index (BMI) were average and who came from middle class socio-economic status. Relevant data were obtained through face-to-face interviews based on a pre-designed questionnaire. The participants were from urban or rural area locality, including both male and female. They were included without knowing the calcium and vitamin D intake history. A small, portable heel ultrasound bone densitometer machine was used and took only 5 minutes to measure the T-score. The ultrasound based bone densitometer called "Quantitative Ultrasound, (QUS)" is used[5] . T-score reporting was done according to WHO guideline.

Results:

A total of 50 cases age ranging from 18-62 years of ages were taken. Out of 50 cases, 20 were aged between 18-30 years (40%), 19 were aged between 31-47 years (38%), and 11 were aged between 48-62 years (22%). 32 participants were female (64%) while 18 were male (36%). The majority (52%) of the participants were doing sedentary work while others (48%) worked moderately. Half (50%) of the study participants lived in the rural area of the district (Table I).

Table-I

Demographic characteristics of the study participants

Variables	N	%
Age		
18-30 year	20	40.00
31-47 year	19	38.00
Above 48 year	11	22.00
Sex		
Female	32	64.00
Male	18	36.00
Occupation		
Sedentary Work	26	52.00
Moderate Work	24	48.00
Residence		
Rural	25	50.00
Urban	25	50.00

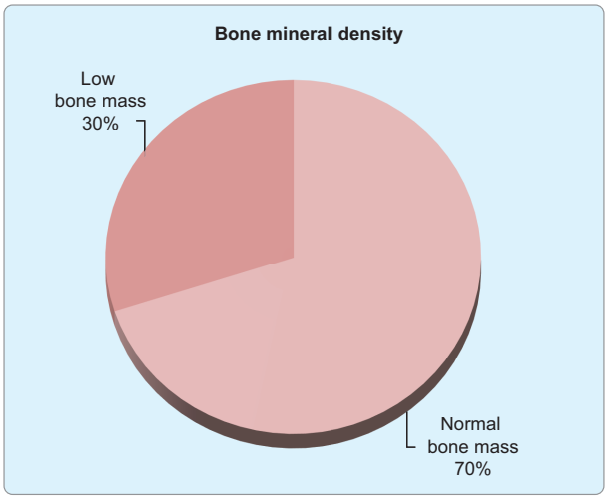

Figure I: *Bone mineral density distribution among the study participants.*

Among the study participants, 70% have normal bone mass and 30% have low bone mass. No participants having osteoporosis.Table II shows that a higher percentage of males have low bone mass (38.9%) compared to the female (25%)

Table-II

BMD status across sex.

Sex	BMDN (%)		
	Normal bone density	Low bone mass	Total
Female	24 (75%)	8 (25%)	32 (100%)
Male	11 (61.11%)	7 (38.89%)	18 (100%)
Total	35 (70%)	15 (30%)	50 (100%)

Table-III

Distribution of BMD category among female participants

	BMD N (%)		
	Normal bone density	Low bone mass	Total
Age			
18-30	12 (75%)	4 (25%)	16 (100%)
31-47	6 (75%)	2 (25%)	8 (100%)
48-62	5 (62.5%)	3 (37.5%)	8 (100%)
Pregnancy			
Non Pregnant	19 (79.16%)	5 (20.83%)	24 (100%)
Pregnant	6 (75%)	2 (25%)	8 (100%)
Occupation			
Sedentary work	22 (84.62%)	4 (15.38%)	26 (100%)
Moderate work	2 (33.33%)	4 (66.67%)	6 (100%)
Residence			
Rural	17 (77.27%)	5 (22.73%)	22 (100%)
Urban	7 (70%)	3 (30%)	10 (100%)

Low bone mass is slightly higher among higher aged women and moderate worker women. There was no significant difference found between the rural and urban women and the pregnant and non-pregnant women, in case of BMD category distribution (Table III). Among the 8 women in post-menopausal, 5 had normal bone mass and 3 had low bone mass (Figure 2).

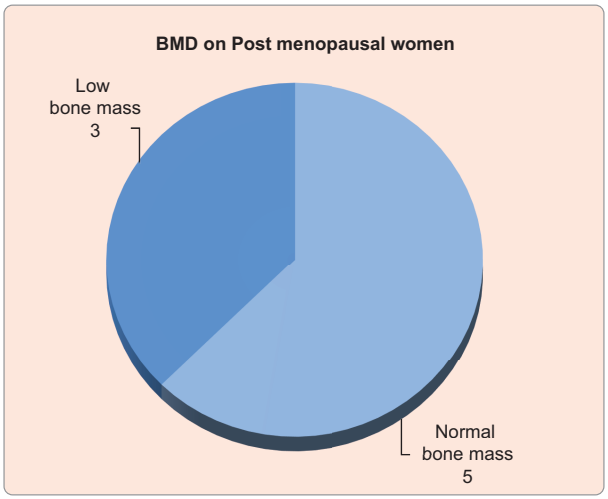

Figure 2: *BMD category distribution of Post-menopausal women.*

Discussion:

The present study shows the Bone Mineral Density of a group of population in a District hospital of Bangladesh, without knowing the history of calcium and vit-D intake. In this study 30% of population show low bone mass (osteopenia). Among the female population 25% having low bone mass. Ahmed AKMS et al shows among121, post-menopausal women BMD T-score 7.4% normal, 43% low bone mass and 49.6% shows osteoporosis.[6] In our study having no osteoporosis, probably their study done only on post-menopausal women. A study conducted among 18-33 years old Bangladeshi woman reported low vitamin D levels in 81% women despite being exposed to sun for more than 20 hours per week.[7]Our study Vit D level is not measured. Low vitamin D status was observed among female Bangladeshi garment workers aged 20-40 years.[8] Vitamin D deficiency is associated with low bone mineral density (BMD) leading to osteopenia or osteoporosis in adults. Begum et al showed that younger (16-45 year-old) Bangladeshi women had low BMD and 43.6% and 5.5% of them had osteopenia and osteoporosis respectively.[9] Osteopenia is lower in our study and there is no osteoporosis, probably the people are more conscious about their bone health or may be due to low sample size.

This study also shows low bone mass in male population. Before the age of 50 years, men tend to have more fractures than women, and these fractures mainly involve the limbs and result from a higher frequency of trauma from sports activities. A comparison of BMD between men and women before 50 years shows only small differences in bone density between the sexes.[10]

A study concludes that there is positive correlation between bone mineral density and physical activity in elder person.[11] It is similar in our study, house wife and working women having 84.62% and 33.33% normal bone mass respectively, may be physical activity was more in house hold works. Physical activity and diet may be the most important modifiable environmental factor that can increase peak BMD for both children and adult.[12] In our study female population having low bone mass with increased age, and there is no significant difference between rural and urban population. But another study shows-according to living area-rural population had a bit more normal bone mass than urban population. Urban-rural differences of bone mineral density may be context-specific. BMD may be higher in urban areas in some lower income countries.[13]

In our study, there was slight increase BMD in non-pregnant groups. Heaney et al, concluded that pregnancy appears to be a state of positive calcium balance.[14] There are reports of co-existence of vit D deficiency and low BMD among post-menopausalwomen in many countries of the world.[15] In our study only BMD is measured, but Vit D status is not measured, and among the post-menopausal women only 37.5% are suffering from osteopenia. There is no osteoporosis.

Limitations of our study were the small sample size, single site of test-(only heel) and exclusion of history taking of calcium and vit D intake.

Conclusion:

This small study was an attempt to identify one of the important public health problems like osteoporosis. The present study concludes that bone mineral density is low in 30% of healthy population in a district of Bangladesh. Male are suffering from low bone mass. Most of the post menopausal women having normal bone mass, probably having global awareness of bone health.

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