BONE MINERAL DENSITY OF BANGLADESHI PEOPLE

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Abstract: This work is aimed to know about bone mineral density and its influence on bone health. For a preliminary study 30 patients of Nuclear Medicine Centre at Comilla, Bangladesh were chosen. After thorough physical observation and medical examination, their bone mineral density (BMD) and bone mineral content (BMC) at different sites were measured using Dual Energy X-ray Absorptiometer (DEXA). Correlations between BMD and BMC values at different sites of the skeleton were studied. A large incidence of reduced bone mass has been observed. The BMD results for lumber spine (L2-L4) showed a variation with age presenting a distribution, somewhat like an exponential curve. Correlation coefficients suggest that measurement at any site of the skeleton is a competent predictor of fracture at all sites. In addition, BMD and BMC scans of 10 volunteers of age group 5 to 25 were obtained through DEXA at Nuclear Medicine Center, Rajshahi. In the distribution. there was an almost steady rise of BMD with age.

1 Introduction

Bones are living tissues that provide support for the body, the mechanical basis for movement, storage for salts and continuous supply of new blood cells. Solid matter of bone is composed of about two-thirds mineral substances and one-third organic matter. During old age both the organic and inorganic components of bones decrease, producing osteoporosis, a reduction in the quantity of bones. The strength of bone is measured as bone density. Knowledge about the growth and decay of bone density is of great importance in preventing bone loss and old age fracture. About 10% of the adult skeleton is remodeled each year [1]. It has been found that sites that are rich in trabecular bone such as hip, wrist and spines are susceptible to fragility fractures [2].

Bone takes many years to grow. In the first twenty years of life approximately 1500gms of calcium is acquired in the skeleton. Of this 1500gms, about 50% is acquired during puberty [3]. Peak bone mineral density is the maximal lifetime amount of bone tissue acquired in the skeleton system during growth. There is a large variation in the normal range for peak BMD that is influenced by both genetic and environmental factors. Mischler in 1979 was the first to document reduced bone mineral density in adults and children [4]. People with end-stage lung disease show a universal reduction in BMD. An observational study made by Wosje et al. shows that the increase in BMD owing to higher calcium intake among children appear to occur primarily in cortical bone sites [5]. Physical activity and diet may be the most important modifiable environmental factors that can increase peak BMD for both children and adults. Large increase in BMD (up to 50%) has been reported in children involved in exercise training [3].Genetic investigations have revealed that genes influence bone density and hence the risk of fractures. These studies indicate that genetic differences account for up to 70% of human variability in bone mass, although such factors as diet and exercises play a part, too [6].

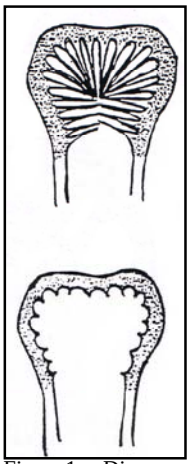


Fig. 1 Diagrammatic representations of bone trabeculae. [7]

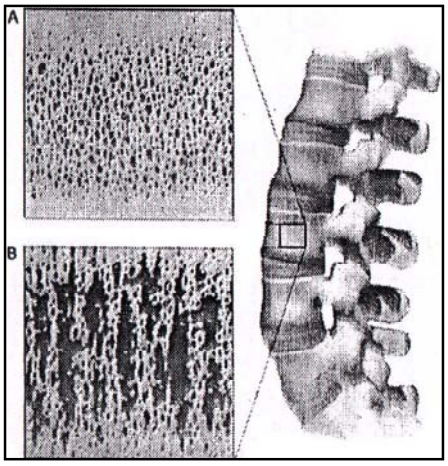
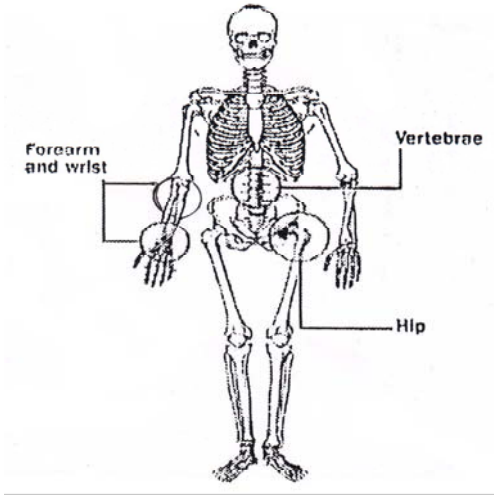
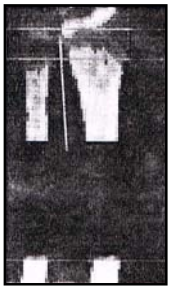


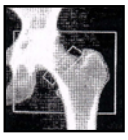
Fig. 2 (A) Bone density of strong bone. (B) Bone density of weaker bone.





Forearm

Spine



Upper femur

Fig. 3 Locations for bone density testing.

2 Experiment

Bone mineral density (BMD) and Bone mineral content (BMC) can be conveniently measured by using dual energy x-ray absorptiometry (DEXA) technique. In scanning, the energy of x-ray beams that are passed through bones is absorbed and what is not absorbed is detected on the other side of the body (Fig. 4).The more dense the bones, the more energy is absorbed and less energy is detected. In DEXA, x-ray beams of two different energies are used, giving a dose up to that of chest x-ray. Two different energies allow an estimate to be made for soft tissue absorption separately for that of bones.

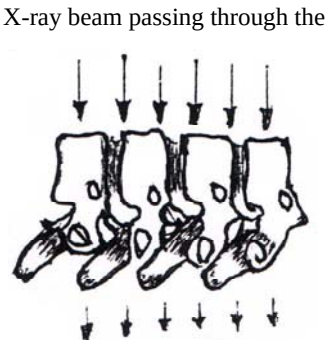


Fig. 4 Passing x-ray beam

In the DEXA® instrument, used for the present study, photon source is a stable x-ray generator. The dose to the operator is negligible. During a scan, the radiation level at a distance of one meter from the scanner is less than 0.1 millirems per hour.

The scanner is capable of taking whole-body, lumber spine, forearm and other type of scans (Fig3.). Latest consensus development conference shows that measurement at any site is a competent predictor of fracture at all sites [8].

Altogether 40 patients and volunteers of nuclear medicine centers in Comilla and Rajshahi were studied. All patients were clinically assessed by physicians. Weight and height were measured by electronic scale and wall anthropometer. BMD scans were taken in areas rich in trabecular bone (Fig1). The information about bone mineral content (BMC), expressed as gm; bone mineral density (BMD) as gm/cm^2; and area of the vertebral body of the segment, expressed as cm^2 were obtained through a scanner of DEXA (Fig 5). Age vs. BMD and BMC distribution were studied (Figs.6-9). Correlation graphs were also prepared (Fig10).

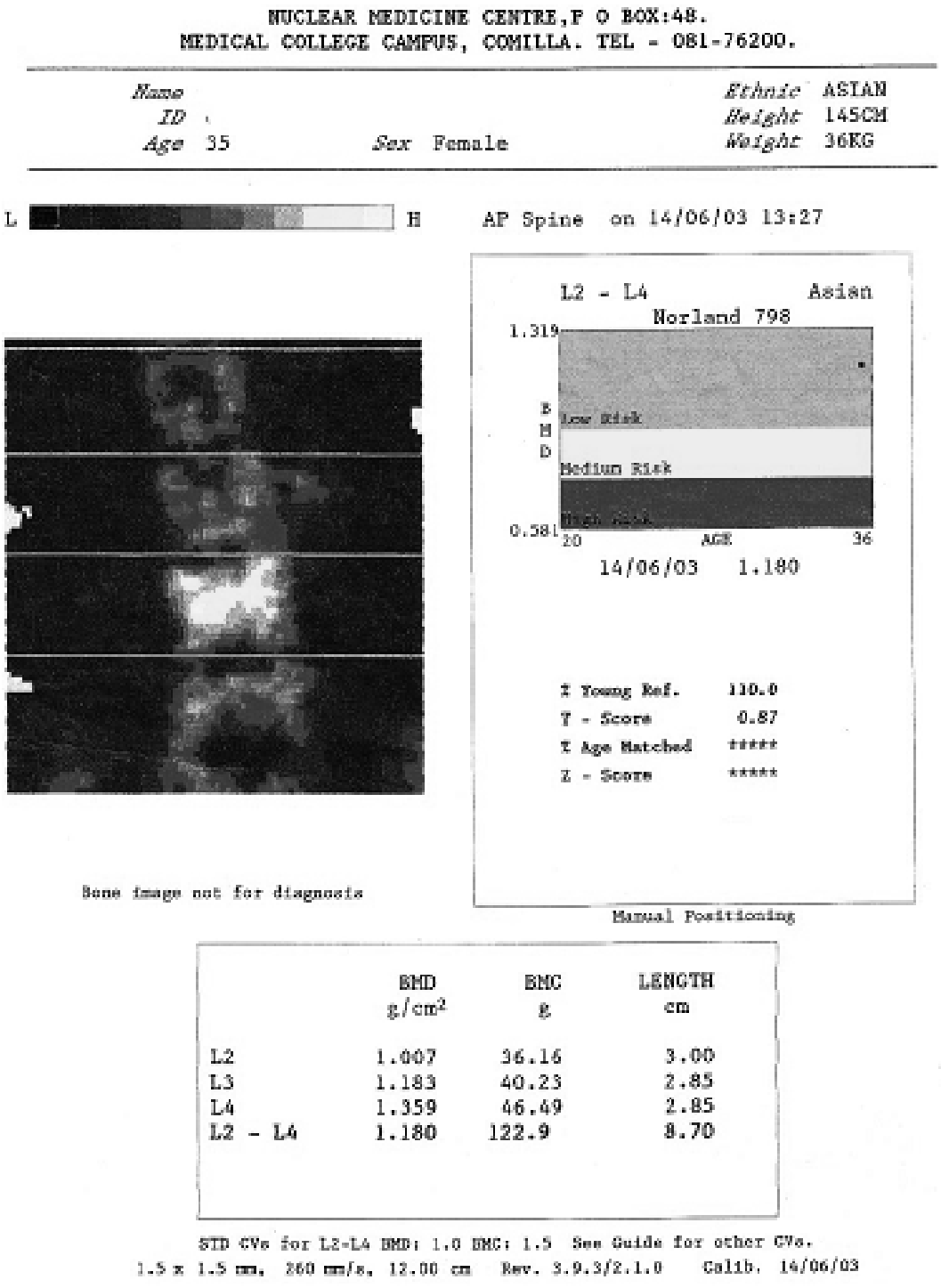


Fig. 5 Area of the vertebral body of the segment

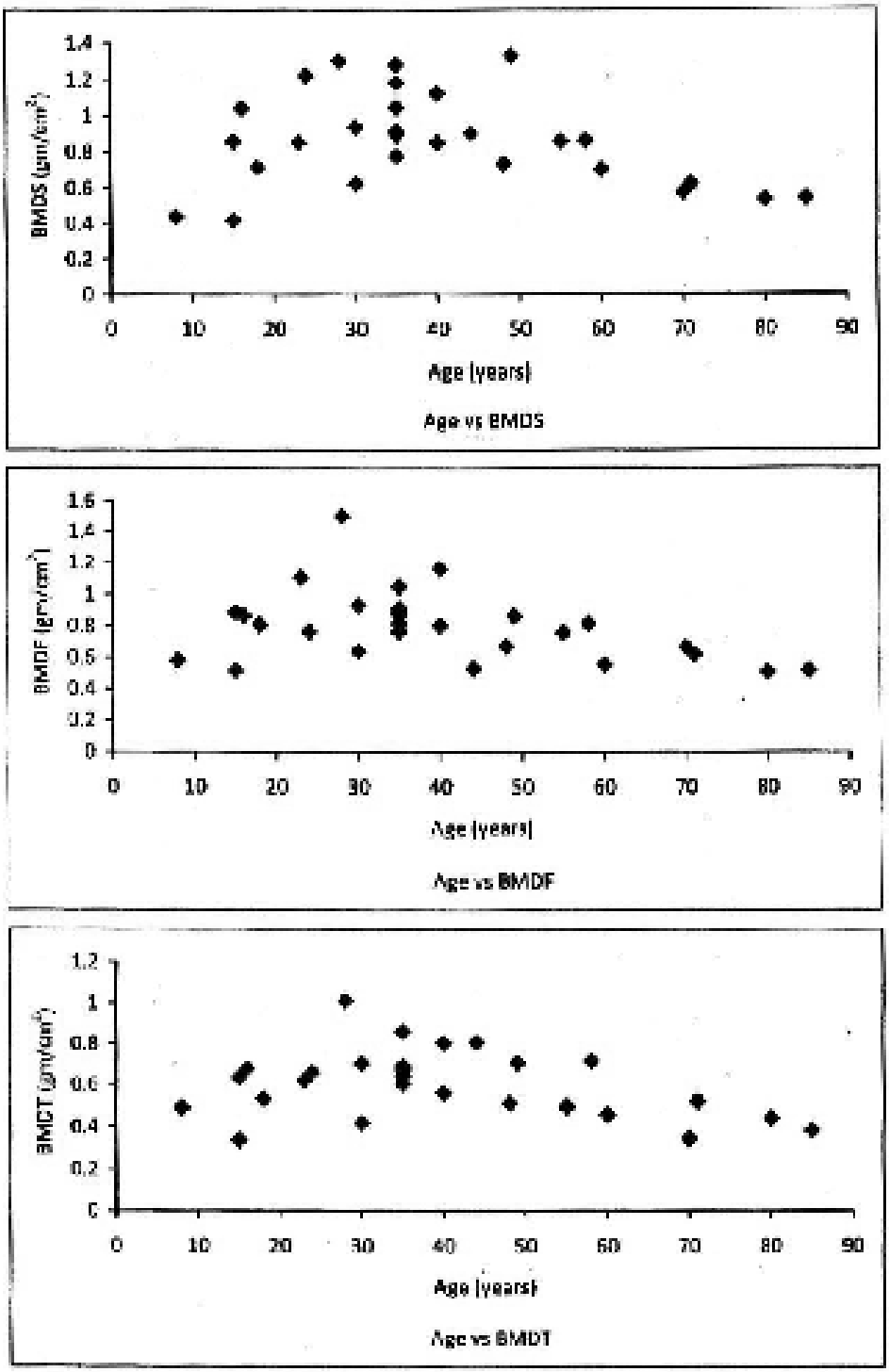
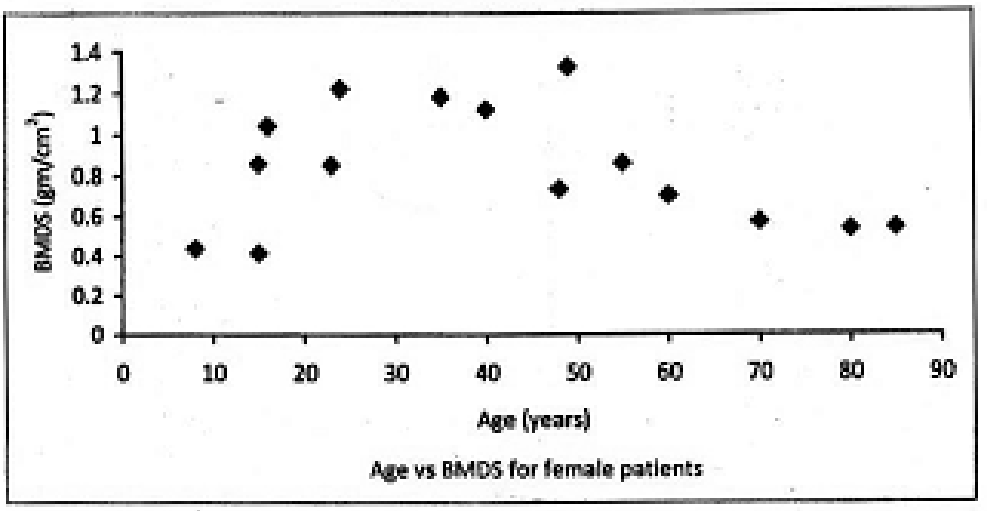
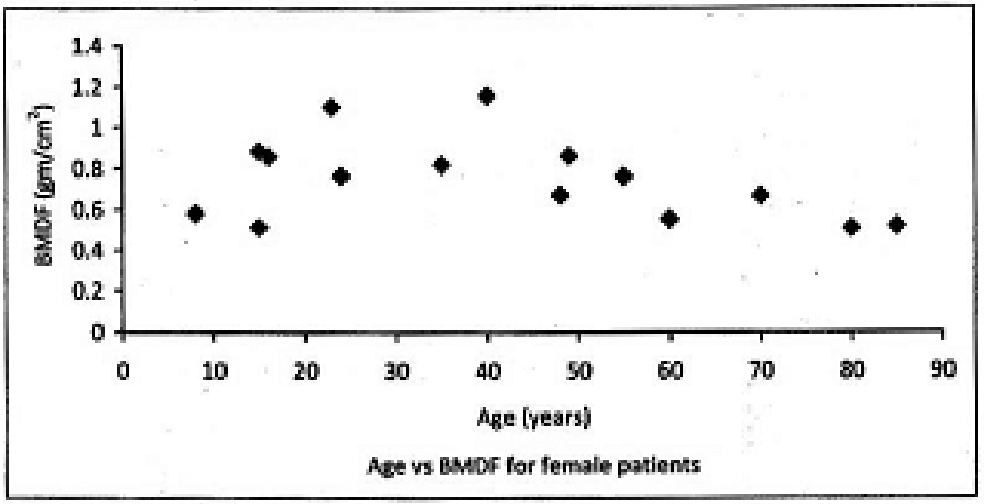
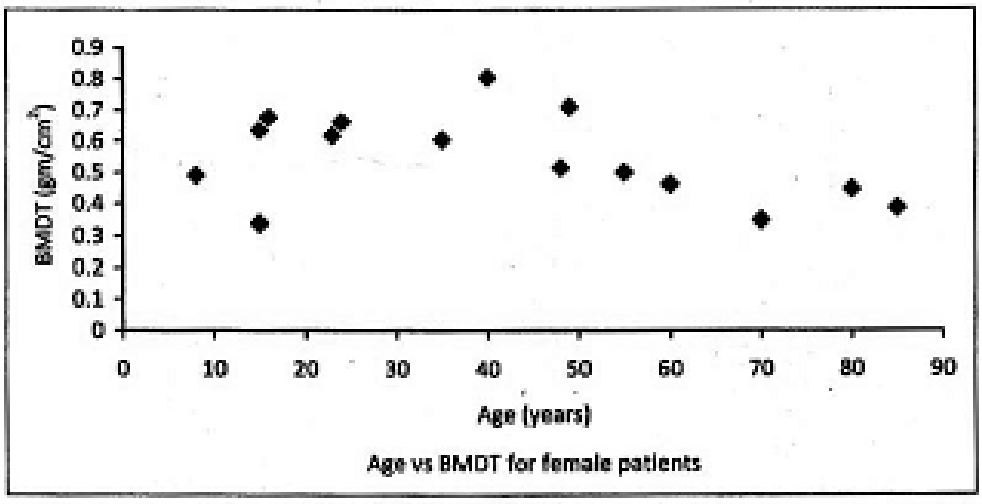


Fig. 6 BMDS, BMDF and BMDT vs. age data

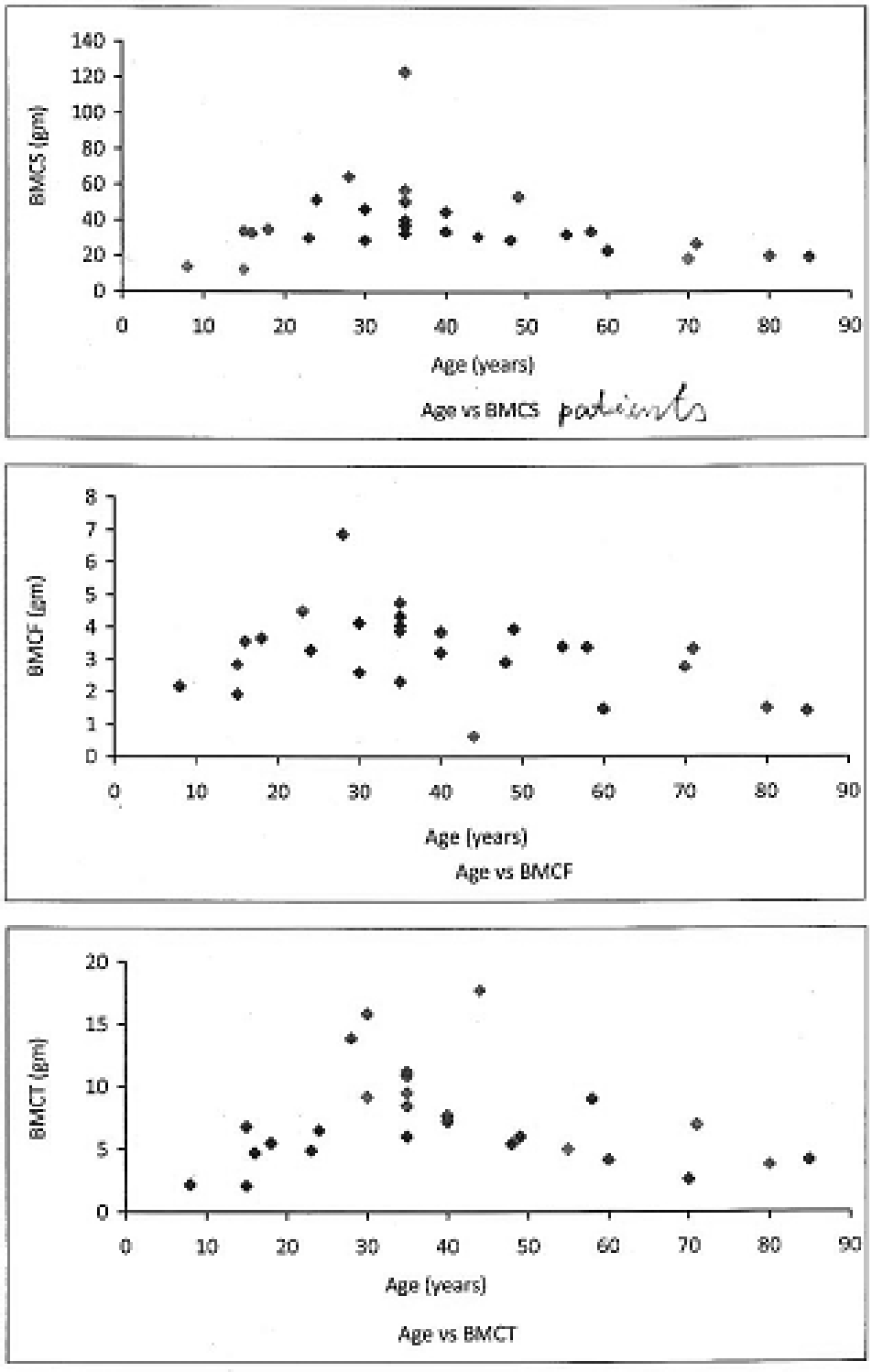






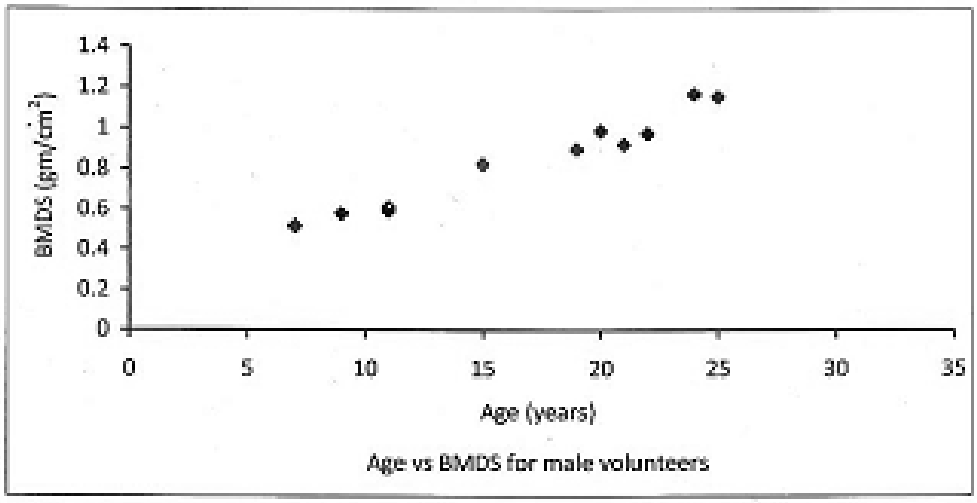
BMDS = Bone Mineral Density of Spine
BMDF = Bone Mineral Density of Femur
BMDT = Bone Mineral Density of Trochanter

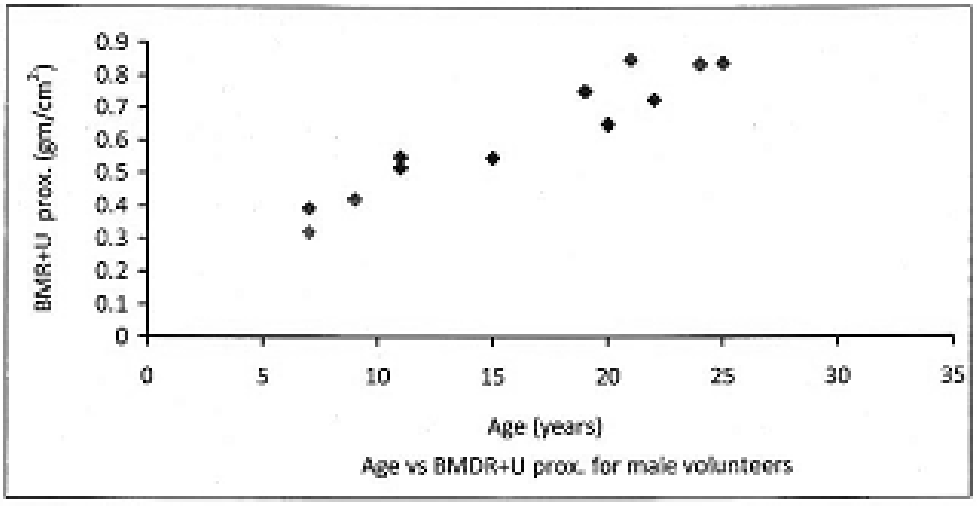
Fig. 7 BMDS, BMDF and BMDT vs. age data

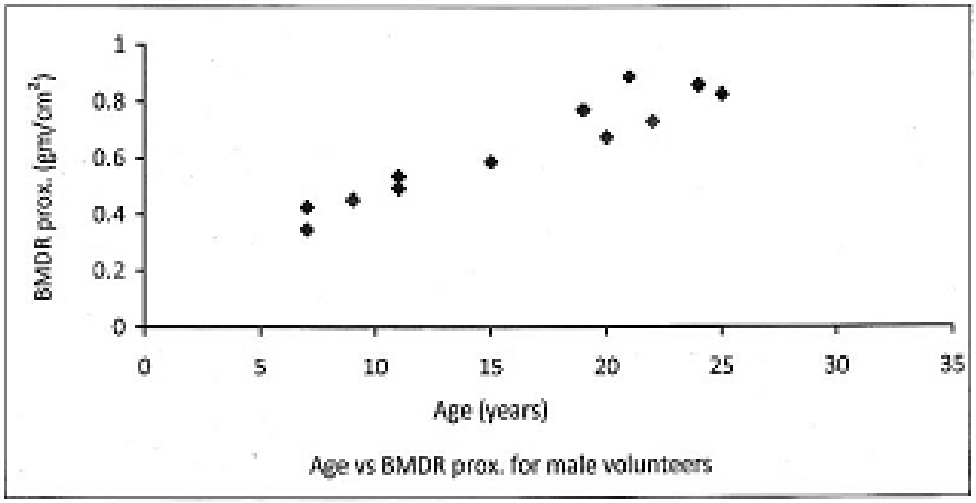


BMCS = Bone Mineral Content of Spine
BMCF = Bone Mineral Content of Femur
BMCT = Bone Mineral Content of Trochanter

Fig. 8 BMCS, BMCF and BMCT vs. age data

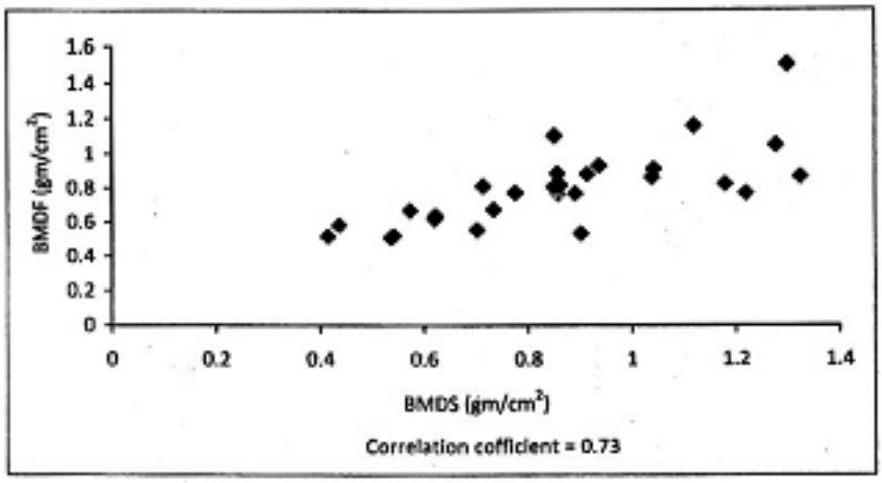


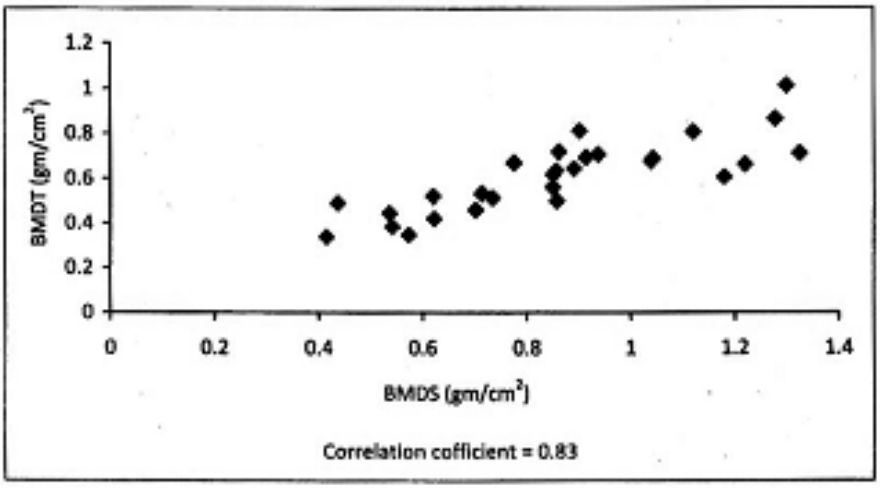




BMDR+U Prox. = Bone Mineral Density of Proximal Radius+Ulna
BMDR Prox. = Bone Mineral Density of Proximal Radius

Fig. 9 BMDS, BMDR+U Prox and BMDR Prox vs. age data





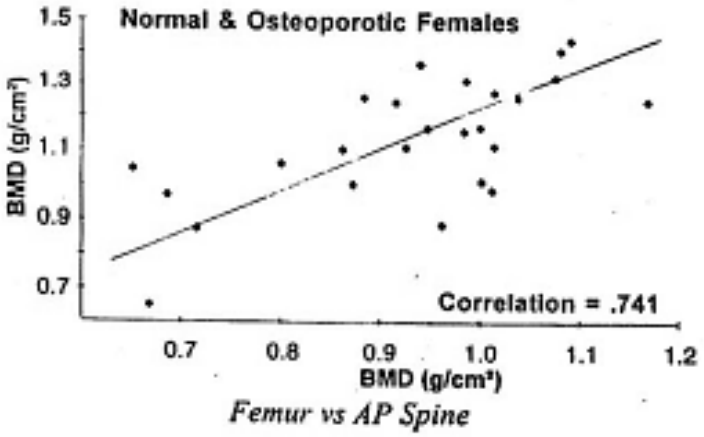


Fig. 10 Correlation graphs for BMDF, BMDT and BMD data

4 Results and Discussions

Distribution of bone mineral content of lumber spine (BMCS) and bone mineral density of lumber spine (BMDS) showed that increase of bone mass with age was not steady. The decrease, however, was more or less exponential in nature. The values of correlation coefficients between bone mineral density at femur (BMDF) and that at spine (BMDS) obtained in our study were quite similar to that obtained in an in-house study of "NORLAND" [9]. Correlation between BMDS and bone mineral density at Trochanter (BMDT) is stronger than that between BMDS and BMDF. It is thus reasonable to conclude that measurement at one site is a good indication of the values at other sites [10].

BMD scans of 10 volunteers of age group 5 to 25 were studied. In the distribution there was an almost steady rise of BMD with age.

Inadequate bone mineral accretion in childhood followed by accelerated loss in adult life is probably the key aetiological factor of osteophenia. Attention should first be directed at optimizing bone growth in childhood. In developed countries most of the people who suffer from osteoporosis are old. In Bangladesh, most of the patients are middle aged. There are economic and cultural reasons for which old and young people hide there diseases.

5 Conclusion

Although more work is needed to come to any conclusion, correlation coefficients suggest that measurement of BMD and BMC may be made at one or two of the many sites of the skeleton. Further investigations will be needed to find the pattern of growth and decay of bone density. The future research program should include features such as careful planning - flexible enough to meet the needs of the community, proper selection of volunteers, co-operation between different branches of science, and an emphasis on prevention of diseases.

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