Exploring the Bone Mineral Density of Health Professionals of Medical College by Using Calcaneal Quantitative Ultrasound

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Abstract

Background: Osteoporosis, an important cause of fracture in Bangladesh is a highly unrecognized and un-addressed issue among health professionals. Osteoporosis means low bone mineral density (BMD) and screening is not done routinely to diagnose it. Moreover, the prevalence of low BMD among Health professionals in the country is not well known. To prevent osteoporosis-induced fracture it demands more attention to early detection, prevention, and treatment.

Objectives: The present study was carried out to assess the bone mineral status of health professionals of Cox's Bazar medical college and also to find out the correlation with age, sex, Vitamin D, calcium supplementation, and physical activity by using quantitative ultrasound (QUS) of the calcaneus.

Materials and Method: This is a descriptive, cross-sectional study that has been done at Cox's Bazar Medical College.

Result: The total number of participants was 267 which were screened by using a calcaneal ultrasound heel bone densitometer. Among them 190 were female and 77 were male. The majority of the health professionals 237(88.76%) were below 45 years. Mostly, 194(72.66%) participants had normal BMD, 73(27.34%) participants were in osteopenia and none of them were osteoporotic. Among those above 45 years old study people, nearly half 14(46.67%) were osteopenic, and for ages below 45 years of health professionals, only 59(24.89%) were osteopenic. Out of 77 male participants, 15(19.48%) were osteopenic and out of 190 female participants, 58(30.53%) were osteopenic. Out of the total 267 study people, 81(30.34%) agreed to take calcium and vitamin-D supplementation with significant p-value = 0.003 whereas 32(39.51%) participants were in the osteopenic stage and 49(60.49%) had healthy bony status. The number of using Calcium and vitamin-D supplementation was high, which may be due to positive answers from particular participants like the elderly and health care supporting staff. In our study 120(44.94%) participants did exercise but mostly irregularly, and 147(55.06%) did not do exercise. Out of 120(44.94%) participants doing regular exercise 37(30.83%) were osteopenic and the rest of 83 (69.17%) health professionals were in normal BMD.

Conclusion: Among the health care professionals, osteopenia is not uncommon and regular exercise practice and rational Calcium and vitamin-D supplementation may be preventive for osteoporosis.

Keywords: Calcaneal Quantitative Ultrasound, bone mineral density, osteoporosis, osteopenia, Health professionals

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Introduction

Osteoporosis is defined as decreased bone mass and bone density (BD) which lead to bone fracture. It is assessed by measuring BMD using dual-energy X-ray absorptiometry (DXA). The World Health Organization (WHO) has set levels of T scores obtained from DXA at the proximal femur and spine for diagnosis of osteoporosis. The gold standard for diagnosis of BMD is DXA but it is not easily accessible for mass screening due to high cost, availability, and radiation hazards[1]. As a result, Quantitative ultrasound (QUS) of calcaneus emerging as an acceptable, low-cost, portable, non-invasive, time-saving with no use of ionizing radiation and a readily-accessible alternative to dual X-ray absorptiometry (DXA) measurements of bone mineral density (BMD) in the detection and management of osteoporosis[2-5]. Few

studies showed that calcaneal bone QUS indices were sufficient to identify bone fractures in both genders[6,7]. Bone Mineral Density (BMD) defines outcome measurements such as subsequent fracture risk and mortality. In 1994, WHO classify a T-score e" -1 as normal, a T-score between -1 and -2.5 as osteopenia, and T-score d" -2.5 as osteoporosis[8]. A study done on urban and rural women reported that high prevalence (37.3%) of osteoporosis in Bangladesh[9].

But to our knowledge, there is no data regarding the evaluation of the BMD and prevalence of osteoporosis in health professionals of Bangladesh by using quantitative ultrasound (QUS) of the calcaneus.

Therefore, the current study aimed to identify osteopenia, and osteoporosis among health professionals and moreover to assess the impact of age, sex, and exercise with calcium and vitamin D supplementation on Bone Mineral density.

Material and Methods

A cross-sectional study was conducted in October 2022 at the Cox's Bazar Medical College campus, in Bangladesh. Non-probability convenient sampling was used to collect data. After ethical review committee approval, the study was conducted on the college campus. The date and timing of tests were informed to students through class monitor before this activity. The procedure was verbally explained to participants. By using a non-probability convenient sampling technique, 267 health professionals were included in the study. Among participants, female students of MBBS were high (148) as they were in the most focused. All health professionals mostly female students were included and only unwilling to participate in the study were excluded from the study. Pre-designed standard questionnaires were used to collect data regarding age, sex, calcium and Vitamin-D intake, and physical activity status. BMD was measured in the calcaneus (heel bone) by using Furuno's CM-300 light ultrasound bone densitometer and the measurement method was Ultrasound Pulse Penetration. Tests were performed free of cost and only 3-10 seconds per measurement. A single technician performed all QUS measurements to minimize subjective error. The study data analysis was done by using SPSS (Statistical Package for Social Sciences) version 23. For comparison of study health professionals, a chi-square test was used. The level of significance of the study results was set to a p-value <0.05 as significant. The study populations were categorized into three groups based on WHO criteria of T-Score i.e. normal, osteopenic, and osteoporotic. T- Score is the number of standard deviations relative to the standard speed of sound (SOS) value of the young age group. Normal is a T-score of "1.0 or higher. Osteopenia is defined as between "1.0 and "2.5 and Osteoporosis is defined as "2.5 or lower.

Among 267 participants in the study, 77 (28.84%) were male & 190(71.16%) were female. Out of 267, the Highest 237(88.76%) were below the 45 years of age group and the rest 30(11.24%) were above the 45 years age group. The male and female ratio was 1:2.47. Among the study people, the Majority were medical students 180(67.42%), Supporting Staff (Nurses, Ward boys, Cleaners, etc.), and Doctors 49(18.35) and 38(14.23) respectively. (Table-1).

Out of 267 participants, the Majority 194(72.66%) of participants had satisfactory bony mineral status. On the other hand, 73(27.34%) were in the osteopenia stage more specifically in osteoporotic risk and none of the health professionals had osteoporosis (Table 2).

Result and Analysis

Table-1: *Age, gender, and professional group distribution of Participants (n= 267).*

Variables		Male n (%)	Female n (%)	Total n (%)	
Age group	Above 45 years	18(60.00)	12(40.00)	30(11.24)	
	Below 45 years	59(24.89)	178(75.11)	237(88.76)	
Total			77 (28.84)	190(71.16)	267(Grand Total)
Professional Category	Doctors	27(71.05)	11(28.95)	38(14.23)	
	Medical Students	32(17.78)	148(82.22)	180(67.42)	
	Supporting Staff (Nurse, Ward Boy, Cleaners, etc.)	18(36.73)	31(63.27)	49(18.35)	
Total			77(28.84%)	190(71.16%)	267 (Grand Total)

Table 2: *T- Score distribution (n=267)*

T score category	BMD status	Participant n (%)
T-score between 0 –1.0 SD	normal	194(72.66)
T-score between –1.0& –2.5SD	Osteopenia	73 (27.34)
T-score lower than -2.5 SD	Osteoporosis	00(0)
Total		267 (100)

Table-2: *BMD status showed as per demographic correlates.*

Variables		Normal	Osteopenia	Osteoporosis	Total	P-value
		No (%)	No (%)	No (%)	No (%)	
Age distribution	Above 45 years	16 (53.33)	14(46.67)	0 (0%)	30(11.24)	0.011.
	Below 45 years	178(75.11)	59(24.89)	0 (0%)	237(88.76)	*Total*
		194	73	0 (0%)	267(Grand Total)	
Sex distribution	Male	62(80.52)	15(19.48)	0 (0%)	77(28.84)	0.066.
	Female	132(69.47)	58(30.53)	0 (0%)	190(71.16)	
Total		194	73	0 (0%)	267(Grand Total)	
Calcium and	Yes	49(60.49)	32(39.51)	0 (0%)	81(30.34)	
Vitamin-D intake	No	145(77.96)	41(22.04)	0 (0%)	186(69.66)	0.003.
Total		194	73	0 (0%)	267(Grand Total)	
Exercise	Yes	83 (69.17)	37(30.83)	0 (0%)	120(44.94)	
	No	111 (75.51)	36(24.49)	0 (0%)	147(55.06)	0.247.
Total		194	73	0 (0%)	267(Grand Total)	

In this study, out of 30 participants above 45 years old, about 14(46.67%) participants were osteopenic. On the other hand below 45 years old participants (237), only 59(24.89%) health professionals were osteopenic with significant p-value= 0.117.Out of 77(28.84%) male participants , 15(19.48%) were osteopenic and out of 190(71.16%) female participants, 58(30.53%) were osteopenic .Out of the total 267 study people, only 81(30.34%) agreed to take calcium and vitamin-D supplementation with significant p-value = 0.003 whereas 32(39.51%) participants were in the osteopenic stage and 49(60.49%) had healthy bony status. In our study 120(44.94%) participants did exercise but mostly irregularly, and 147(55.06%) did not do exercise, out of 120(44.94%) participants doing regular exercise 37(30.83%) were osteopenic and the rest of 83 (69.17%) health professionals were in normal BMD. Similarly in 147(55.06%) participants not doing regular exercise, 36(24.49) were suffering from osteopenia with p-value=0.247. (Table 3).

Discussion

This study showed that out of 267 health professionals, 73 (27.34%) were in an osteopenic condition but had no osteoporotic stage. This was lower than the prevalence of the Bangladeshi general adult population[10]. Previous studies done on female doctors in Bangladesh showed osteopenia in 11.25% of women and they also did not find osteoporosis[11]. This may be due to a higher level of knowledge among doctors about good nutrition, fewer suffering from chronic diseases, better economic solvency, a physically active life, and enough sun exposure. Both gender and age have a pivotal role in decreasing bone mass i.e. in developing osteoporosis. This study also, showed that the prevalence of osteopenia increased with aging. The prevalence of osteopenia was significantly high (about twofold) in the age group above 45 years old health professionals. The main predictor of osteoporosis risk is age which is proved by many studies[9,12]. A study conducted in Asia also observed that the prevalence of osteoporosis increased with aging among Asian males and females[13].

In the study, participants were asked about their minerals, particularly calcium and Vitamin-D supplementation status. In this study, only one-third of health professionals agreed to take calcium and vitamin-D supplementation with a significant p-value = 0.003 where osteopenia was more in those who did not take Calcium and Vitamin-D supplementation. Many epidemiological study reports failed to show a linear relationship between calcium supplementation and the development of osteoporotic fracture[14,] But it is a myth that calcium intake has a pivotal role in developing optimal peak bone density[15]. The combined supplementation of vitamin D and calcium showed a positively increased BMD[16]. Many studies revealed that regular calcium and vitamin D has the ability to prevent reduced bone density and thereby fracture[17, 18].

In our study, less than half of the health professionals did exercise but the majority do irregularly. This study also showed that osteopenia was more in not doing physical exercise for health professionals than doing exercise. One study done on female medical students in Pakistan showed that only one-fourth of participants did regular exercise, and three-fourths of female students did not do regular exercise, out of one-fourth of participants doing regular exercise nearly one-third had osteopenia[18, 19].

Conclusion

The study revealed a definite trend toward reduced bone density in health professionals. Moreover, In addition to daily physical activity, regular exercise practice and rational Calcium and vitamin-D supplementation may be preventive for osteoporosis thereby fracture.

Recommendation

By adopting regular exercise and consuming Calcium and Vitamin-D-enriched diet, health professionals can improve their BMD. To detect a better prevalence of osteopenia and osteoporosis in Bangladesh, further research, including a longitudinal study, is recommended.

Limitation

Currently, dual-energy X-ray absorptiometry (DEXA) of the hip and spine is the gold standard for the diagnosis of bone mineral density (BMD). We did not use a DEXA scan to measure the BMD because it was unavailable, costly, and radiation hazards. Screening with heel ultrasound should always be confirmed with BMD by DXA. Moreover, it was a single-center study, therefore, study results may not be applicable to the total health professionals of Bangladesh.

Conflict of interest

All authors disclose no conflict of interest.

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