

A STUDY TO REVEAL THE EFFECT OF DIFFERENT FACTORS ON PEAK BONE MASS

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ABSTRACT: OBJECTIVES: To collect data of bone mineral density of young Indian adults and to assess the effect of different factors on bone mineral density in them. **METHODS:** The study design in which T-score data of 304 athletes and 300 sedentary young Indian adults of age 18-30 yrs was collected. Recorded of their per capita income and three days meal pattern, to assess calcium intake, was collected. **RESULTS:** This study depicts that sedentary young adults fail to acquire adequate peak bone mass and become osteopenic as early as age 25, especially females while athletes achieve much higher values of bone mineral density as compared to their Caucasian counterparts. Per capita Income <1000rs./mth results in lower bone mineral density, affecting sedentary ones more than the athletes. Calcium intake <500mg/day negatively affects bone mineral density. However, levels above this value do not have any direct relationship with positive effect on bone mineral density. **CONCLUSION:** Indian young adults achieve much less peak bone as compared to their western counterparts. That is why the prevalence of osteoporosis is much higher amongst Indians. Though, Indian are not genetically predisposed to have low peak bone mass. Rather, it is the lack general adults awareness reflected through lack of exercise and low socio economic status (secondarily affecting the dietary calcium), which results in poor bone health among young Indian adults. These young individuals can attain peak bone mass higher than their western counterparts with regular exercise program.

KEYWORDS: BONE MASS – ATHLETES – SEDENTARY YOUNGS.

INTRODUCTION: Osteoporosis is a major public health threat worldwide. Based on 2001 census, approximately 163 million Indians are above the age of 50, this number is expected to increase to 320 million by 2015. Even conservative estimates suggest that of these, 20 percent of women and about 10-15 percent of men would be osteoporotic.¹ Studies have reported that Asian women are more predisposed to osteoporosis as compared to their Caucasian counterparts.^{2,3} It is matter of further research that what makes more predisposed to poor bone mineral health. Is it general ethnic physical characteristics or the lifestyle differences or the socioeconomic status? We still lack adequate data of Indian population to understand this high predisposition to osteoporosis or poor bone health.

Poor bone health can be explained in terms of bone mineral density and micro-architecture of bone. Osteoporosis is usually considered a disease of old age. In early of life bone mass is gained and after a certain age, bone mass starts losing, at a certain pace in physiological conditions.^{4,5} Hence, bone health at old age is determined by the bone health at young age.

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Peak bone mass refers to genetic potential for bone mass. Peak bone mass is achieved mostly by the age 30. To add this, 90 percent of peak bone mass in young girls is achieved by the age 20.⁶ After achieving peak bone mass, bone mineral density declines. Therefore, accretion of higher bone mass at younger age is decisive factor for late development of osteoporosis.⁵

This study is attend to collect a data of bone mineral density (BMD) of young Indian adults, to assess the peak bone mass achieved by them, to know whether Indian young adults are physically at disadvantage in achieving higher peak bone mass as compared to their Caucasian counterparts and how much the physical exercise, calcium intake and socioeconomic status in terms of per capita income, affect the accrual of peak bone mass in them, so as to show the general trends of bone health in young Indian adults.

MATERIAL AND METHOD: This study is conducted at Department of Orthopaedics (People's College of Medical Sciences and Research Centre, Bhopal). The data collected from different health camps organized by Hospital (March 2013 to Feb 2014) comprised total 704 young individuals of the age 18 to 30 years. Out of these 304 (166 male and 138 females) were dedicated athletes from various physical training institutes at Bhopal, India from Jul 2014 to December 2014, and 300 (170 male and 130 females) were sedentary young individuals, selected to meet the definition as:

ATHLETES: young individual practicing high impact sport activity for at least six hour in a week since at least 6 months.

SEDENTARY: young individuals, who never did physical training of any kind in last 2 yrs.

Individuals having any pre-existing condition known to affect bone mineral density were discarded from the data.

A questionnaire was provided to every individual detailing about physical training, per capita income and last three days meal pattern to determine the average daily calcium intake.

Bone mineral density of every individual was measured using ultrasonic bone density meter (Hologic) (Quantitative ultrasound (QUS) Calcaneus) in terms of T-score, using the reference of young active adult Caucasian population as the purpose of the study was to compare the reference not to measure the absolute bone density QUS had been proven to be equally efficient to DXA (statistically significant) in evaluating the risk of osteoporosis.^{7,8,9} T-score values were used for analysis) T-score was implemented as >0 = bone density more than the reference. 0 to 1 = bone density equivalent to reference up to one SD below the reference, considered as normal bone mineral density (BMD).

-1 to -2.5 = bone density between -1 SD and 2.5 SD, below reference, considered as osteopenia.

< -2.5 = bone density less than 2.5 SD below reference considered as osteoporotic.

RESULTS: Sedentary young individuals start losing bone mass as early as age 20. Rate of loss is more to females, as compared to male, so as to bring them in the range of osteopenia as early age 25 had score <-1 , while 67% of those < 25 yr age had score <-1). While in general males

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are in normal BMD range up till the age 30, though gradually losing bone mineral density, 38% up to the age of 30 had t-score <-1 (Table-1).

In contrast, athletes maintain their BMD above that of reference (i.e. >0) throughout the study's age range (up to age 30) (Table 2) 91% of athlete females upto the age 30 had t-score >-1, while 86% of athlete male had t-score>-1.

Calcium intake seems to affect BMD when Intake is very low. Athletes maintain their bone mass in bone reference in spite of low calcium intake upto 500mg/day), in comparison to recommended 1000mg/day (chart 1), as all athletes had their calcium intake below recommended. Effect of further low calcium intake could not be assessed in athletes, as all were institutional athletes and had somewhat regulated dietary plan.

Bone mass decreased rapidly in sedentary Indian adults when the calcium intake was below 500mg/day. 73% of sedentary individuals who had calcium intake below 500mg/day had t-score <-1, in comparison to sedentary individual having calcium intake >500 mg/day, among whom when 38% had t-score <-1.

Low income group seemed to affect the bone mass both in athletes and sedentary individual. Per capita income group <1000rs/mth had 25% athletes osteopenic and 8% osteoporotic, while 65% sedentary individuals were osteopenic and 9% were osteoporotic in this group.

Age	Male	Female	Total
18	-	0.77 (n=2)	0.77 (n=2)
19	-	0.17 (n=4)	0.17 (n=4)
20	-0.45 (n=8)	-0.75 (n=4)	-1.08 (n=12)
21	-0.40 (n=4)	0.06 (n=10)	-0.07 (n=14)
22	-0.53 (n=6)	-1.04 (n=14)	-0.89 (n=20)
23	0.37 (n=10)	-0.78 (n=6)	-0.46 (n=16)
24	0.54 (n=14)	-0.55 (n=14)	-0.55 (n=28)
25	0.74 (n=20)	-1.47 (n=6)	-0.91 (n=26)
26	0.110(n=24)	-1.46 (n=16)	-0.68 (n=38)
27	0.169 (n=20)	-2.33 (n=6)	-1.07 (n=26)
28	0.190 (n=34)	1.43 (n=20)	1.07 (n=54)
29	-0.71 (n=14)	-1.80 (n=4)	-0.95 (n=18)
30	-0.97 (n=18)	-1.27 (n=24)	-1.15 (n=42)
	N= 170	N=130	N= 300

Table 1: Age wise average t-score of sedentary individuals

Age	Male	Female	Total
18	-	-0.03(n=4)	-0.03 (n=4)
19	0.5 (n=2)	1.20 (n=14)	1.12 (n=16)
20	1.40 (n=2)	0.26 (n=14)	0.51 (n=18)

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21	0.08 (n=24)	-0.19 (n=24)	-0.06 (n=48)
22	-0.05 (n=18)	0.48 (n=36)	0.30 (n=54)
23	0.68 (n=32)	0.74 (n=16)	0.70 (n=48)
24	0.70 (n=20)	0.60 (n=8)	0.67 (n=28)
25	0.50 (n=34)	0.82 (n=10)	0.57 (n=44)
26	1.23(n=14)	-0.2 (n=4)	0.91 (n=18)
27	0.03 (n=8)	0.56 (n=6)	0.25 (n=14)
28	0.67 (n=6)	0.2 (n=2)	0.55 (n=8)
29	1.2 (n=2)	-	1.2 (n=2)
30	1.8 (n=2)	-	1.8 (n=2)
	N= 166	N=138	N= 304

Table 2: Age wise average t-score of athletes

DISCUSSION: It is imperative from the data that young, physically non-active Indian adults, fail to develop adequate bone mass in the golden years of bone mass development.¹⁰ However, physically active young ones achieve bone mass higher than their Caucasian counterparts,¹¹ explaining that genetic predisposition does not seem to inhibit the accrual of higher bone mass.³ Simultaneously, low per capita income and its consequences on socioeconomic status,^{12,13} may be acting through lack of general health awareness, affect the bone health negatively. As observed from data that most of individuals from low per capita income group were sedentary and lowest calcium intake was also observed in them.

Low daily calcium intake is not an inhibitor of bone mineral density, provided it is not very much low (<500mg/day), nor increasing the calcium intake has direct correlation with higher BMD.¹⁴ However, the importance of adequate intake of calcium (recommended allowance), cannot be ignored in early years of growth (pre-pubertal and pubertal).¹⁵

CONCLUSION: Definitely there is higher prevalence of osteoporosis amongst Indians as compared to the individuals from more developed countries. Largely, this prevalence is the result of poor health awareness in early growth years of life.

Lack of physical training in youth is responsible for the large share of this prevalence. Physical training need not to be an institutional one (which keeps the BMD above reference range), can be a general fitness schedule at home. All this can be achieved by seeding the concept of health awareness in young individuals, which has to be associated with improvement of the socioeconomic status. To fight with osteoporosis, physical training has to be stressed more in youth than mere calcium supplementation.

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