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Impact of Llifestyle and Physical Activity on Bone Mineral Density in Adults

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Author`s Contribution

[1]Conception of design and work, [2]Final approval of version, [3]Acquisition, analysis of data, [4]Drafting of work, [5]analysis, or interpretation of data for the work, [6]Design of work

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A B S T R A C T

Objective: To determine the Effects of physical activity on bone mineral density in young adults.

Methodology: Descriptive Cross-sectional Study was used in the study and data was collected through leading government, private, semi private Hospitals of Rawalpindi and Islamabad from September 2018 to February 2019. A cross sectional study was conducted on 387 young adults of age ranging 18-35 years from different private and public sector hospitals of twin cities of Pakistan. Consent taken from every subject and self-structured questionnaire was filled by all the participants that include demographics information and physical activity questions.

Results: The total n= 229 subjects had normal body mass index; (18.5-24.9Kg/m2), 65 subjects are over-weighted (25-29.9Kg/m2). The major frequency of young adults has similar BMD level compared to WHO classification for BMD. Lower physical activity levels attribute an adverse influence on bone health. There is positive correlation between physical activity and bone mineral density (r=0.015)

Conclusion: The findings indicate that physical activity during growth plays positive role in increasing BMD. In young athletes the physical activity and nutritional factors influence the BMD.

Keywords: Adults, Bone Density, Physical activity

Introduction

The skeletal system is composed of 206 bones and forms a structural framework. The function of this framework is to provide support, shield the internal organs and play important role during body movement. Low bone mineral density is considered strong indication for osteopenia in adults. [1]

The early skeleton is the site for ossification and this initial bone formation start at the age of 6 weeks after fertilization. [2] The phases of ossification start after birth and continue throughout life. Bones have capability to adapt stress against mechanics. [3] During childhood, the appendicular growth rate is twice the rate of axial growth and at puberty the axial growth rate increases as compared to appendicular growth rate.[4] Onset of puberty is approximately 2 years earlier in girls; this gives the boys two additional years of appendicular growth resulting in different morphology.[4] The greater periosteal expansion in boys compared to girls has been attributed to higher pubertal levels of androgens in female. [5]

At the end of puberty, high levels of estrogens promote closure of the epiphysis and the longitudinal growth slows down. Cortical porosity decreases as bone formation increases at the trabecular surface. [4] The strength of the bone is the amount of bone mass, by external size and shape (elliptical, external diameters), as well as the internal structure of the cortical and trabecular bone. [4-6]

Several non-surgical techniques is used for prediction of bone strength in research as well as clinical purposes. Quantitative computed tomography (QCT) technique provides robust measurements of geometry and volumetric bone density

in trabecular and cortical compartment. [7,8] Despite these ability to perform structural images of high quality, the techniques are not widely used. The DEXA approach is recognized as the valid for assessment of osteoporosis, as reference values based on DEXA measurements define the diagnostic criterion.[9] However, the World Health Organization (WHO) diagnostic categories for normal BMD values, osteopenia, and osteoporosis, based on BMD T-scores are not recommended used before the age of 20, as they are not accurate to children and adolescents who have not reached peak bone mass.[10-11]

Peak bone mass (PBM) is defined as the presence of bone tissue occurrence at the complete bone maturation. [12] To gain maximum capability for bone strength, sufficient nutrients and optimal skeletal loading are needed.[13] The positive influence of body mass index (BMI) on bone mass is well established in adults as well as in youths. ([14-16]), and weight maintenance has been regarded as protective of future fracture risk.[17] Specific amount of key nutrients such as calcium, vitamin D and proteins, must be present in adequate levels for the collagen synthesis. [18]

According to the study conducted a systematic review by Renata M Bielemann et al in 4 March 2013 and concluded that strong associations found in physical activity and bone mass in females than males, there is strong association during growth duration. [19]

According to the study conducted by Ahmad H et al on 11 March 2015 to determine the role of Physical activity and lifestyle effects on bone density in young adults' and stated that Physical activity was significantly correlated with BMD and bone metabolism markers.[20] According to the study conducted Langsetmoa C.L et al on 11 Nov 2011 on stated that increased Physical Activity is strongly associated with Bone Mineral Density and a concomitant decrease in BMI. These findings suggest that population-level interventions to increase PA would favorably impact bone and other health outcomes. [21]

A study conducted by M. CallréusF. Et al on 13 January 2012 on recreational exercises impact to increase bone mineral density in females and concluded that involvement in physical activity with any recreational sports shows increase in BMD in adult women but regular impact exercises with high intensity are essential to increase gain in BMD. Enjoyment of exercise also related to regularity of exercising which has short- and long-term application for bone health. [22]

There is very limited literature available that identify the role of physical activity on bone mineral density in adults so the aim of this study is to determine the impact of physical activity on bone mineral density in adults.

Methodology

A Descriptive Cross-sectional Study design was conducted and sampling technique of non-probability convenience sampling was used in the study. The objective of this study was to determine the effects of physical activity on bone mineral density in young adults of twin cities. The study duration was 6 months from September 2018 to February 2019. Sample size of 387 subjects participated in the study which is calculated through Raosoft. The data was collected from Pakistan Railway General Hospital (PRH), Holy Family Hospital, Hanif Hospital, and Friends Hospital of Rawalpindi and Islamabad. Permission was taken from the hospital administration and written consent was taken from every subject before including the study. Sample was selected on the basis of inclusion and exclusion criteria. The inclusion criteria of the study were age 18-35 years and both male and female students. The exclusion criteria were individuals with any musculoskeletal impairment, individuals with any neurological problem, individuals with communication problems and Individuals with any co-morbidity. The data were collected through self-structured questionnaire for physical activity and bone densitometer for bone mineral density (CM-300). Data entry and analysis were done by IBM-SPSS version 23. Results of study were presented in frequency and percentages.

Results

The result of the study shows mean age ± SD of the subjects was 23 ± 4.14 in years. The mean height and weight of the subjects were 65 ± 4.19 heights in inches and 62.62 ± 13.89 weight in Kg respectively. The Body Mass Index of the selected subjects was 22.60 ± 4.82. The 268 participants was under-graduate, 97 was graduated and 22 adults had post-graduate degree.

Table No I: Shows the demographics of subjects

	Variable	Mean ± SD
1	Weight	62.62 ± 13.89
2	Height	65 ± 4.19
3	Body Mass Index	22.60 ± 4.82
4	Bone Mineral Density	-0.13 ± 0.7

Table No II: Shows the frequency of BMI and BMD categories of the participants

		BMI Categories (kg/m²)			
		Underweight (<18.5)	Normal (18.5- 24.9)	Overweight (25-29.9)	Obese (>30)
BMD	Normal	22 (5.69%)	229 (59.17%)	65 (16.79%)	23 (5.94%)
	Osteopenia	32 (8.3%)	15 (3.85%)	0	1 (0.26)

Table No II: Shows frequencies of Physical Activity of subjects

	No activity	Once a Week	3 to 5 days a week	Everyday
Mild Physical Activity	200 (51.67%)	128 (33.07%)	37 (9.56%)	22 (5.7%)
Moderate Physical Activity	232 (59.94%)	101 (26.1%)	34 (8.81%)	20 (5.15%)
Vigorous Physical Activity	107 (27.65%)	140 (36.17%)	62(16.02%)	78 (20.16%)

Discussion

The result of the study concluded that subjects with low Body Mass Index have more frequency of osteopenia. Study conducted by the Jouanny P et al concluded that bone mineral density is correlated with body weight, height and body mass index of subjects. [23] Jenifer et al conducted a study and concluded that there was strong correlation between body mass index and bone mineral density in older adults.[24] Another study conducted by P ravn et all on early post-menopause women and concluded that low body mass index is considered as strong risk factor in reducing low bone mineral density. [25]

The result of the study shows that physical activity that physical activity is directly related to the body mass index and bone mineral intensity. The results of study by Callréus et al concluded that physical activity is strongly associated with the bone mineral density in adolescent and childhood during bone loading phase. [23-25] Our results also indicate that current physical activity–associated bone loading is a positive predictor.

The results of study conducted by Yong Hawn Kim et al in 2017 shows that bone mineral deposition occurs mostly in the period of adolescence, but it reaches its peak in the mid-20. [6,26] Our study also shows that individuals of age between 18-30 have a peak of bone mineral density. Out of 387, 336 individuals have a normal BMD score

Conclusion

The study concluded that among young adults, bone mineral density was affected by physical activity. Regarding physical activity level, high intensity and strength exercise have more positive effects.

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