

## ORIGINAL ARTICLE

# HIGH FREQUENCY OF OSTEOPENIA IN YOUNG ADULTS OF KARACHI

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### ABSTRACT

**Background:** Osteopenia or low bone density, generally considered the disease of the old, is now sneaking around the younger generation. The increase in frequency of low trauma fractures is raising an alarm. This study was aimed to explore the frequency of osteopenia amongst young adults in Karachi, Pakistan.

**Methods:** Non-probability consecutive sampling was used to choose 116 subjects at Ziauddin University, Karachi, in January 2018. After informed consent participants underwent bone scans for measurement of bone mineral density on their calcaneus (bone in heel). To categorize osteopenia T-score between -1.0 and -2.5 was evaluated. All participants with T-score of -2.5 or below were identified as osteoporotic. The data were entered on IBM SPSS statistics version 20.0 and descriptive analysis was done.

**Results:** Osteopenia was detected in 57 (49.1%) of the participants [42 (36.2%) male and 15 (12.9%) female] of which 38 (32.8%) belonged to aged 21 to 35 years. Osteoporosis was found in 20 (17.2%) of this group. In the older participants' frequency of osteopenia and osteoporosis was 12.2% and 42.9% respectively. Chi square test indicated no significant association between age and bone scan results ( $p=0.432$ ). Frequency of osteopenia was higher in males (56%) compared to females (36.6%) whereas, osteoporosis was higher in females (53.7%) than males (12%). Results showed statistically significant association ( $p>0.01$ ) with gender and bone scan results.

**Conclusion:** Almost half the young adults in our study classified for osteopenia. Lifestyle modification factors are hypothesized to play an important role towards this high frequency. Further studies should evaluate risk factors for osteopenia in younger population.

**Keywords:** Osteopenia; Osteoporosis; Bone Mineral Density.

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### INTRODUCTION

Osteopenia, a pre-osteoporotic condition, is defined as lower-than-normal bone mass and bone mineral density, which often precedes more severe bone loss called osteoporosis. Through bone densitometry WHO defines osteopenia as a T score of -1 to -2.5<sup>1</sup>. According to BMD, outcome measurements such as risk of subsequent fracture and mortality, T-score < -1 is categorized as normal, T-score  $\leq$  -1 and > -2.5 as osteopenia and T-score  $\leq$  -2.5 as osteoporosis. The decrease in bone density leads to decreased bone mass, micro-architectural deterioration, reduced mechanical strength, due to which the skeleton is more likely to fracture<sup>2</sup>. It has been estimated that in Pakistan, out of 171 million subjects, 40.18 million subjects have osteopenia

and 9.91 million have osteoporosis. By 2020, this number is estimated to rise to 11.3 million and 12.91 million by 2050<sup>3</sup>. It develops almost four times less in male than in females because male have large skeletons, their bone loss starts later and develops slowly, and they do not experience periods of speedy hormonal change and bone loss. However, in men, compared to women, post-fracture morbidity and mortality is high since they are less likely to receive treatment<sup>4</sup>.

Postmenopausal and age-related osteoporosis are the most common and major forms of bone loss seen in routine clinical practice. However, younger people can also be affected by this disease<sup>5</sup>. Early detection of osteopenia becomes important with the realization that roughly 90% of adult bone mass

in both genders is gained in the first two spans of life<sup>6</sup>. An appreciation of the frequency of osteopenia along with its association with risk factors will provide the basis for establishing stronger and more cost-effective programs of prevention, and guard against the consequences of osteoporosis. This study was conducted to evaluate the frequency of osteopenia in young adults from a segment of Karachi's population.

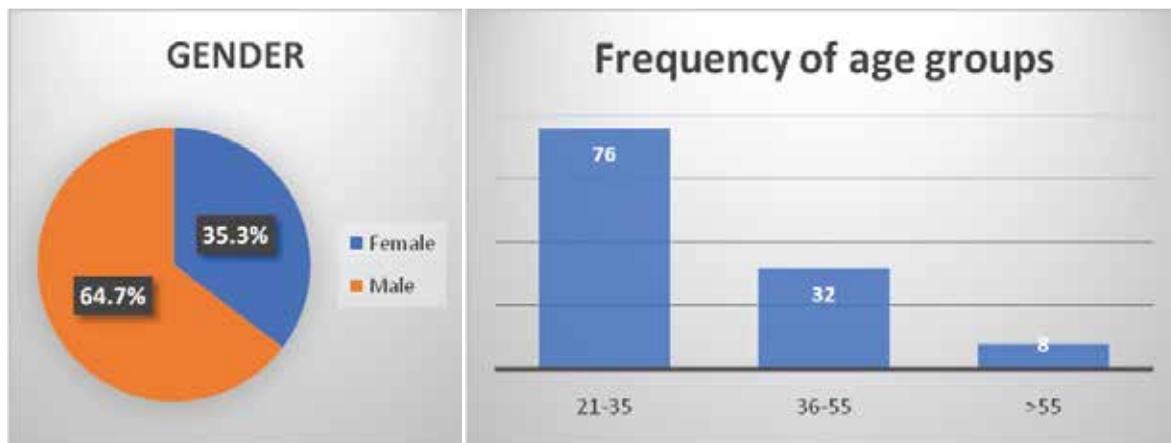
**METHODS**

A total of 116 subjects were chosen through non-probability consecutive sampling for a bone scan at Ziauddin University, Karachi, in January 2018. Approval was obtained from the Institutional Review Board (IRB). A free of cost bone mineral density (BMD, g/cm<sup>2</sup>) scan was performed on the participants, after informed consent, on the bone of the heel (calcaneus). It is done by scan system ultrasono-meter device. It is quantitative ultrasound technique. Measurement was performed with left foot placed in the device. A transducer at a fixed

distance on the opposed side of the heel received the sound wave and converted it to an electrical signal that was analyzed by the ultrasono-meter machine. The participant's T-score and Z-score were recorded along with their demographic information regarding age, sex, socioeconomic status, diet and any history of fracture or surgical intervention. A T-score between -1.0 and -2.5 was used to classify low bone density or osteopenia, and a T-score of -2.5 or below was used to diagnose for osteoporosis. The data were entered on IBM SPSS statistics version 20.0 and descriptive analysis was done. Chi square test was used to find association between age and bone scan.

**RESULTS**

Out of a total of 116 participants, males were 75 (64.7%) and females were 41 (35.3%). Participants were categorized by age into young adults (ages 21-35 years; n = 76), middle-aged adults (ages 36-55 years, n = 32) and older adults (aged older than 55 years and above, n = 8) (Figure 1).



**Figure 1: Frequency of participants segregated by gender and age.**

Osteopenia was detected in 57 (49.1%) of the participants, 42 (36.2%) were male and 15 (12.9%) were female of which 38 (32.8%) belonged to young adults aged 21 to 35 years. Osteoporosis was detected in 26.7% of the participants of which the majority were female (19%) and only 7.8% were

male. Frequency of osteopenia was higher in males (56%) as compared to females (36.6%) whereas osteoporosis was seen to be much higher in females (53.7%) than males (12%). Chi square test showed a significant association between sex of participant and bone scan results with  $p > 0.01$  (Table 1).

**Table 1: Association between gender and bone scan.**

		Bone Scan			p - value
		Osteopenia	Osteoporosis	Normal	
		n (%)	n (%)	n (%)	
Gender n (%)	Male	42 (36.2)	9 (7.8)	24 (20.7)	>0.01*
	75 (64.7)				
	Female	15 (12.9)	22 (19.0)	4 (3.4)	
	41 (35.3)				
Total	57 (49.1)	31 (26.7)	28 (24.1)		
116 (100)					

Chi square ( $\chi^2$ ) = 24.68, DF=2

Of the 75 young adults belonging to the 21-35 age group, more than half (50.7%) were diagnosed with osteopenia. Osteoporosis was diagnosed in 26.7% of the young adults. Amongst the 34 middle-aged adults, 18 were diagnosed with osteopenia showing the frequency of osteopenia within that age group to be 48.6%. Osteoporosis within that age

group was seen to be at 23.5%. The older adults aged above 55 years showed a 12.2% frequency of osteopenia and a much higher osteoporosis frequency of 42.9%. There was no significant association found between age and bone scan results  $p=0.439$  (Table 2).

**Table 2: Association of osteopenia with age according to bone scan.**

		Bone Scan			p-value
		Osteopenia	Osteoporosis	Normal	
		n (%)	n (%)	n (%)	
Age n (%)	21-35	38 (32.8)	20 (17.2)	17 (14.7)	p=0.439
	75(64.7)				
	36-55	18 (15.5)	8 (6.9)	8 (6.9)	
	34(29.3)				
	≥55	1 (0.9)	3 (2.6)	3 (2.6)	
7(6.0)					

Chi Square ( $\chi^2$ ) =3.766, DF=4,

**DISCUSSION**

Our study showed an alarming high frequency of osteopenia in 38 (32.8%) of young adults aged 21 to 35 years. An overall 49.1 % of participants had osteopenia and 26.7% were diagnosed with osteoporosis. Older adults aged 55 and above showed less osteopenia (12.2%) and higher incidence of osteoporosis (42.9%). A previous study conducted amongst young female students at a medical university in Karachi, Pakistan showed a 70% frequency of osteopenia<sup>7</sup>. Though diseases like celiac disease and anorexia and prolonged used of certain medications like glucocorticoids and diuretics play a role in decreasing bone mass, this does not account for the high prevalence of osteopenia found in young adults<sup>8,9</sup>. Other factors need to be examined such as the lack of public awareness on osteopenia and osteoporosis<sup>10</sup>. Decreased bone mass in younger generation reflects an imbalance between bone resorption (osteoclastic activity) and bone formation (osteoblastic activity) in favor of the former. In healthy individuals there is a proper balance between these two activities controlled by tightly regulated mechanism to keep bones healthy and strengthened.

In spite of alarming statistics, osteopenia is not recognized as a major health issue in Pakistan and the poor economic conditions of the country discourage many people from prioritizing their health<sup>11</sup>. According to the National Nutrition Survey 2011, 66.2% of non-pregnant and 68.5% of pregnant mothers were found D deficient in Pakistan. Despite ample sunshine, Pakistan has the highest rates of vitamin D deficiency worldwide<sup>12</sup>.

Certain lifestyle habits embedded in Pakistani culture also play a part in the high osteopenia prevalence, as one study found; even having the knowledge and awareness about the condition may not necessarily motivate people to make changes for improved health<sup>13</sup>. The relationship between osteopenia and hormonal imbalances is well documented. In particular, androgen deficiency has been linked to reduced bone formation and negative bone balance at the basic multicellular unit<sup>14</sup>. Known methods to combat bone resorption include fortification of diet via supplementation. Calcium and Vitamin D3 in particular have shown to be effective in the reduction of fractures in specific subgroups<sup>15</sup>. However, the Vitamin D status in younger people and the elderly differs broadly with the residence of the country with a marked deficiency seen in the Pakistani population. Amongst a sample of 4830 randomly selected citizens, vitamin D deficiency percentage is 53.5%, 31.2% had insufficient vitamin D, and 15.3% normal levels of vitamin D<sup>16</sup>. Women in our study had almost 4.5 times higher frequency of osteoporosis than men, which reflects on osteoporosis as a 'women's disease'. According to the report of national osteoporosis foundation (NOF) in the U.S., there are 9.1 million females with osteoporosis and 2.8 million males with osteoporosis<sup>17</sup>.

However, surprisingly men in our study had a higher frequency of osteopenia at 56% compared to females at 36.6%. Although, females have a four-fold higher overall prevalence of osteopenia compared to males, yet males are more likely to demonstrate secondary causes of decreased bone

mass<sup>18</sup>. Male hypogonadism is an important cause of osteopenia and osteoporosis, which can be treated with testosterone replacement therapy<sup>19</sup>. A study from Karachi showed a strong association of low testosterone with osteoporosis, odds ratio came out to be 5.70 (2.70-21.63, p-value 0.00001), with 36.4% subjects having low testosterone levels<sup>20</sup>. Other secondary factors that may induce osteopenia are low bodyweight and a sedentary lifestyle<sup>21</sup>. Smoking is also linked with reduced bone mineral density and increased fracture risk<sup>22</sup>. The younger demographic should be made aware of lifestyle factors that affect bone health and the repercussions of not prioritizing their health. Osteopenia is a major risk factor for osteoporosis and chances of fractures keep increasing with age<sup>23</sup>. Fractures are most common in the spine, wrist and hip and these fractures have further associated complications such as back pain and disability associated with spine fracture<sup>24</sup>. Prolonged bed rest due to fractures can even lead to pneumonia and/or pulmonary embolism<sup>25</sup>. Anxiety and depression are also reported to increase in patients of osteopenia<sup>26</sup>.

### CONCLUSION

Almost half of the young adults in our study classified for osteopenia. Lack of exercise or repeated dieting or nutritional not bone friendly choices may be some of the many reasons that make for low bone density. Lifestyle modification factors are likely to play an important role towards this high frequency. Further studies should be conducted to associate these factors with the risk of osteopenia in our younger population.

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### CONFLICT OF INTEREST

Authors declare that they have no competing interests.

### ETHICS APPROVAL

Approval was obtained from the Institutional Review Board (IRB).

### PATIENTS CONSENT

The informed consent was taken from all participants included in the study.

### AUTHORS CONTRIBUTIONS

This work was carried out in collaboration between all authors. MAS and ANK designed the study, collected the samples, did the bench work, MN wrote the protocol and wrote the first draft of the

manuscript. Author SB facilitated in bench work, literature search and finalization of manuscript, MAS helped in research protocol and assisted in analyses of the data. All authors read and approved the final manuscript.

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