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ASSOCIATION OF BODY MASS INDEX AND BONE MINERAL DENSITY IN PRE AND POST-MENOPAUSAL WOMEN OF KARACHI

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ABSTRACT

Background: Menopause and obesity are associated with hypo-vitaminosis D and osteopenia.
Low body mass index (BMI) is a recognized risk factor for fragility fracture, whereas obesity is widely believed to be protective. The mechanisms by which increased body weight influences bone mass density (BMD) are still unknown. We investigated the impact of body mass index (BMI) status on the serum levels of vitamin D concentration and bone mineral density in pre and post-menopausal women.
Design: This cross-sectional study enrolled 94 healthy subjects. The participants were divided into two groups based on pre menopause and post-menopause.
Results: Females who were on the higher side of weight and BMI also had a higher BMD. Age, weight, serum calcium, BMI and BMD correlated significantly with each other while no relation was found between serum total vitamin D.
Conclusions: We observed stronger associations of weight, age, calcium and BMI with bone mineral density.

Keywords: menopause, obesity, bone mineral density, body mass index.

INTRODUCTION:

Osteoporosis is the most common clinical disorder of bone metabolism. It occurs when there is an increase in bone breakdown relative to bone formation and is characterized by micro architectural deterioration, low bone mass and increased risk of fractures. Osteoporosis is now widely recognized as a progressive systemic disease which causes remarkable decrease in the bone mineral density and reduction in the micro architecture of bone tissue. This predisposes the patients to increased bone fragility and fractures, thus greatly affecting the quality of life , by easy fractures and unable those to even lift slightest of weight. [1,2]

According to the study done by the National Osteoporosis Risk Assessment (NORA) on more than 200,000 healthy postmenopausal women revealed an unexpectedly high prevalence of osteopenia and osteoporosis, resulting in increased risk of fractures.[3]

Menopause refers from the Greek word 'MENOS' meaning month and 'PAUSIS' is Cessation.[4] Natural menopause is recognized to have occurred after twelve consecutive months of amenorrhoea for which no other obvious pathological or physiological cause is present. Premenopause is a term currently recommended to be used as whole of the reproductive period before the menopause.[5] In Pakistan,the mean age at menopause has been found to be 47 years in three socioeconomic urban groups in Karachi while according to data collected by the NHSP (National Health Survey of Pakistan) mean age of menopause was found to be 47.76 + 5.14 years.[6,7]

Each year large numbers of postmenopausal women are diagnosed with osteoporosis

and begin treatment to prevent fragility fractures. Most women are diagnosed by the discovery of low bone density detected by dual energy x-ray absorptiometry. Bone mineral density (BMD) test measures the density of minerals present in the bones using a special scan. This can be used to assess the strength of bones.[8,9] Prospective studies by Ravn et al., Bjarnason and Christiansen indicates that early postmenopausal women who have low BMI lose more bone compared to those with higher BMI tertiles. [10,11] Studies conducted by Van der Voort et al. illustrates that thinness is related to both osteoporosis and increased fracture risk; hence, low BMI was included in the risk assessment tools for evaluation of osteoporosis and osteoporotic fracture risk as suggested by Eddy et al. ,National Osteoporosis Foundation and Black et al. [12,16,] Aside from the classic actions of vitamin D on bone metabolism and calcium homeostasis, experts postulate that it may play an important role in cellular proliferation and differentiation and survival of cells in disorders of immunity, as well as in cancer.[17,18] In addition, vitamin D deficiency is a risk factor for metabolic syndrome, mainly abdominal obesity, hypertriglyceridemia and hyperglycaemia.[19]

Obese individuals are at risk for a number of metabolic and endocrine abnormalities. BMI is inversely related with the risk of osteoporotic hip fracture, although it relationship with other limb fragility fractures is still debated.[20,21]

MATERIALS AND METHODS:

A cross sectional study recruiting of 94 apparently healthy women from the local population, divided in two equal groups as per the inclusion criteria of Premenopausal women (age 30-47 years) and Postmenopausal women (age 48-65 years). Males, patients on Anti-resorptive therapies i.e. Bisphosphonate therapies, Hormone Replacement Therapies,(HRT) with hormones and hormone like drugs ,History of total hysterectomy, pregnant and lactating mothers, or with any chronic illness in the last six months were excluded from this study. After obtaining a written and informed consent, the biophysical parameters were measured. Bone Mineral Density (BMD) of the heel bone calcaneus was done by ultrasound bone densitometer (Osteosys Sonost 3000 Bone Densitometry). The serum assays for vitamin D total were performed by using 25-Hydroxyvitamin D using Elecsys Vitamin D total CaiSet and

Table 1:
Comparison of parameters among pre and post menopausal group:

Variables	Pre-menopausal (n=47) Mean ± S.D	Post-menopausal (n=47) Mean ± S.D	P-value
Age in years	36.7 ± 4.67	57.9 ± 8.18	0.001 *
Weight kg	65.2 + 13.9	72.4 + 13.47	0.012*
Height cm	1.59+ 0.04	1.61+ 0.05	0.250
Calcium	8.71 ± 0.36	9.01 ± 0.61	0.005 *
Vitamin D level	16.1 ± 10.54	20.7 ± 12.0	0.076
BMD _value	-1.05 ± 0.83	-1.60 ± 0.75	0.001*
BMD in %	80.6 ± 15.37	72.0 ± 14.11	0.006*
BMI	25.71 + 5.05	28.83+ 4.81	0.012*

* Statistically significant p<0.01

Table 2:
Comparison according to BMD

	Pre-menopausal group			Post-menopausal group		
Variables	**BMD Normal (n=23)**	**BMD Abnormal (n=23)**	**P-value**	**BMD Normal (n=23)**	**BMD Abnormal (n=23)**	**P-value**
	Mean ± S.D	**Mean ± S.D**		**Mean ± S.D**	**Mean ± S.D**	
Age in years	36.3 ± 4.44	37.1 ± 4.94	0.532	53.80 ± 4.89	59.03 ± 8.58	0.073
Weight kg	70.3 + 16.87	60.3 + 7.96	0.012*	78.8 + 14.92	70.6 + 12.7	0.067
Height cm	1.58 + 0.04	1.60 + 0.03	0.089	1.6 ± 0.03	1.6 ± 0.05	0.593
Calcium	8.66 ± 0.41	8.76 ± 0.30	0.356	9.29 ± 0.66	8.93 ± 0.59	0.102
Vitamin D level	16.11 ± 8.36	16.04 ± 12.73	0.985	20.10 ± 9.48	20.88 ± 2.68	0.865
BMI	22.9 + 5.73	23.6 + 3.20	0.003*	31.2 + 5.66	27.6 + 4.41	0.038*

BMD Normal (> - 1.0) and Abnormal (<= - 1.0)

* Statistically significant p<0.01

Table 3:
Correlation of BMD

Biochemical parameters	Pre-menopausal women	Post-menopausal women
Age in years	-0.016	-0.446**
Weight kg	0.422**	0.343*
Height m	-0.099	0.254
Calcium	0.094	0.106
Vitamin D level	0.180	0.003
BMD in %	0.970**	0.321*
BMI	0.452**	0.326*

* statistically significant p<0.05
** statistically significant p<0.01

calcium by kit on Roche automated clinical chemistry analyzers.

***Statistical Analysis*:**

Individual comparisons between the 2 groups were performed with Student's *t* test and ANOVA, correlations were performed using Pearson correlation coefficients Results were considered significant if *P* values were < 0.05. All results expressed as Mean + Standard Deviation

RESULTS:

The results of this study reveal that positive correlation exists between weight, BMI and BMD while BMD negatively relates to age especially in post-menopausal females (Table 3)

Table 1 shows the normal distribution of the study parameters, as mean and SD. where age, Calcium levels, BMD values and BMI depict a significance relation.

Table 2 shows the bone health status among pre and post-menopausal groups, which shows significant association of weight with bone health in premenopausal group and with BMI in both groups, whereas non-significant changes were observed for other parameters when compared according to the BMD of the study population.

DISCUSSION:

Osteoporosis is the most common clinical disorder of bone metabolism. It occurs when there is an increase in bone breakdown relative to bone formation and is characterized by micro architectural deterioration, low bone mass and increased risk of fractures and is becoming increasingly prevalent with the aging of the world population. Osteoporotic disease is a major public health problem associated with increased mortality and morbidity rates.[22]

Our study reveals an inverse relation between age of women and BMD value especially in post-menopausal group. When considering the BMI, weight and BMD values all correlated positively in both groups with younger women being more overweight and obese. This could be linked to the finding that high BMI can act against the activity of bone demineralization that is osteoporosis as premenopausal women had a better BMD score. Similar results were also observed by Andreoli et al who stated that obesity significantly decreased the risk for osteoporosis but did not decrease the risk for osteopenia.[23] This BMD protective effect of increasing BMI and obesity is similar to the findings of other studies including the NORA study.[3] Gnudi et al. suggested that there are no BMI categories that protect against these fragility fractures compared with that of normal BW after adjusting for bone mineral density (BMD) and age.[24] Beck et al. showed that traumatic forces increase with BW, but fracture rates at the hip and central body were less frequent with increasing BMI, possibly due to greater soft-tissue padding.[25]

Our data also showed non-significant changes in serum calcium and vitamin D levels in all groups. This could be due to the high prevalence of vitamin D and calcium deficiency in our population. Several changes in body composition may occur with ageing, including reduced fat-free tissue mass and increased fat mass, leading to a higher percentage of body fat at any given BW in older adults. A decrease in height will increase BMI without an increase in fat mass.

The social problem of obesity is becoming better understood, but the endocrine function and the role of adipose tissue is still one of the main subjects of study and debate. Hence, body composition analysis may provide an important contribution to understanding "how fat is fat" and the function and physiopathology of adipose tissue.[26, 27]

Our data showed that obesity significantly decreased the risk for osteoporosis but did not decrease the risk for osteopenia. An overall examination of our results therefore suggests that both fat and lean body mass can influence bone mass and that their relative effect on bone could be modulated by their absolute amount and ratio to total body mass weight.

CONCLUSION:

The debilitating effects of osteoporosis and osteopenia are increasing in our society, whether due to environmental, dietary or sedentary life styles needs to be elucidated. Our findings among the most susceptible group suggest that it could have an important impact on public health and may lead to the awareness about bone health status in healthy women. An important aspect will be to evaluate and calculate the reference values of body composition by DXA in our population.

Limitations:

The limitation of this study would be the study design, cross sectional with a small sample size, so inferring this result on the population will be difficult.

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