"Prevalence of Vitamin D Deficiency and its Association with Bone Mineral Density among Post-Menopausal Rural Women Population"

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ABSTRACT

Background: The reduction of bone density in postmenopausal women has been related to a subclinical vitamin D deficiency, which is considered a risk factor for fractures due to this population's sensitivity to falls and improper neuromuscular responses. The present study aimed to study the Prevalence of Vitamin D Level Deficiency and its association with Bone Mineral Density in post-menopausal women.

Material and Method: This prospective observational study was conducted among the females attending to hospital with complain of pain over lower back and hip pain to Father Muller Medical College & Hospital, Mangalore. The participants were enrolled during the period of Jan 2018 to July 2018, among females attending to hospital. Females more than 45yrs of age, with menopause of more than 2yr history and patients willing to be part of study were included in study. the participants less than 45yrs of age, patients with liver disease, kidney disease, malignancies, on steroid therapy, on vitamin D supplementation and patients not willing to be part of study were excluded from the study. The study was approved by institutional ethics committee and patients were enrolled in study after obtaining the informed consent. the patients underwent physical and biochemical examination. The vitamin D levels

were measure and the bone mineral density was measure by DEXA scan. The data were entered in excel sheet and analysed using SPSS v26.0 operating on windows 10 and a p-value of <0.05 was considered statistically significant.

Result: The present study included a total of 186 post-menopausal women with mean age of 58.71±6.53yrs. The sunlight exposure was significantly related with vitamin D status among participants. , there is significant higher incidence of osteoporosis and Osteopenia among the patients with vitamin D deficiency and insufficiency compared to the normal level of vitamin D.($p<0.05$) There is significant positive correlation of the serum vitamin D levels with BMD among the patients measured at spine and femur levels.($p<0.05$)

Conclusion: The present study documented a prevalence of vitamin D deficiency of 54.8% among the women in post-menopausal age. The study also documented a significant positive association of the bone mineral density with vitamin D levels. There is significant higher incidence of osteoporosis among the patients with inadequate vitamin D levels, with higher risk of fracture in them.

Keywords: Vitamin D, Deficiency, DEXA scan, Bone Mineral Density, Osteoporosis, Post-Menopausal.

Introduction:

The reduction of bone density in postmenopausal women has been related to a subclinical vitamin D deficiency, which is considered a risk factor for fractures due to this population's sensitivity to falls and improper neuromuscular responses. In confined elderly patients and inpatients with chronic conditions, vitamin D deficiency can develop from dietary deficiencies and/or lack of sun exposure.[1]

Vitamin D is essential for maintaining proper blood calcium and phosphate concentrations as well as bone health. Vitamin D insufficiency can cause secondary hyperparathyroidism, which increases bone turnover and bone loss and is thus a key risk factor for osteoporosis.[2,3] Nonetheless, the relationship between blood 25-hydroxyvitamin D (25(OH)D) levels and bone mineral density (BMD) remains disputed among research undertaken in various groups and locations. There was a strong relationship between 25(OH)D and bone mineral density in young participants.[4]

It was estimated that the number of patients worldwide with osteoporotic hip fractures is more than 200 million.[5] It was reported that in both Europe and the United States, 30% women are osteoporotic, and it was estimated that 40% post-menopausal women and 30% men will experience an osteoporotic fracture in the rest of their lives.[6,7] In India, the number of women suffering from osteoporosis, defined as decreased bone mass and disturbance of

bone architecture, is rising. While statistics on the prevalence of osteoporosis among women in India come from small-group studies done across the nation, estimates imply that 20%, or 46 million, of the 230 million Indians anticipated to be over the age of 50 in 2015 are women with osteoporosis. As a result, osteoporosis is a serious public health issue among Indian women. Low calcium intake along with a high incidence of vitamin D insufficiency, rising longevity, sex disparity, early menopause, genetic susceptibility, a lack of diagnostic facilities, and a lack of education about bone health have all contributed to the high prevalence of osteoporosis.[8]

Despite being a sun-drenched country, vitamin D deficiency has been identified in persons of all ages in India. Some of the causes of hypovitaminosis D include avoiding sunlight exposure for socio-cultural reasons, insufficient calcium intake, environmental pollution, and Asian Indians having a higher 25(OH)-d-24-hydroxylase enzyme.[8,9]

The present study aimed to study the Prevalence of Vitamin D Level Deficiency and its association with Bone Mineral Density in post-menopausal women.

Material & Method:

This prospective observational study was conducted among the females attending to hospital with complain of pain over lower back and hip pain to Father Muller Medical College & Hospital, Mangalore. The participants were enrolled during the period of Jan 2018 to July 2018, among females attending to hospital. Females more than 45yrs of age, with menopause of more than 2yr history and patients willing to be part of study were included in study. the participants less than 45yrs of age, patients with liver disease, kidney disease, malignancies, on steroid therapy, on vitamin D supplementation and patients not willing to be part of study were excluded from the study. The study was approved by institutional ethics committee and patients were enrolled in study after obtaining the informed consent. the patients underwent physical and biochemical examination. The serum Vitamin D level were measured chemiluminescent assay and other biochemical parameters using spectrophotometric analysis. Then patients underwent DEXA scan for determining the bone mineral density status. WHO classification was used for categorisation as Osteopenia, osteoporosis or normal BMD based on T-scores. BMD was estimated by using DEXA at 3 sites such as lumbar spine right and left hip. The DEXA helps to identify the bone mineral density and there by detection of the patients with osteoporosis and also risk of developing the osteoporosis. Normal BMD: T scores not more than 1 SD below the adult mean. Osteopenia: T score between -1.0 and- 2.5. Osteoporosis: T score <- 2.5 with or without fragility fracture. Sunlight exposure: was

considered adequate if the sun exposure was greater than 2hr per day and insufficient if the sun exposure was less than 2hr per day.

Statistical analysis: The data were entered in excel sheet and analysed using SPSS v26.0 operating on windows 10. The data were summarised as mean, standard deviation, frequency and percentage. The summarised data were correlated with Pearson's correlation and the categorical data were compared using chi-square test. a p-value of <0.05 was considered statistically significant.

Result:

The present study included a total of 186 post-menopausal women with mean age of 58.71±6.53yrs.

Table 1: Demographic details of patients included

		Frequency	Percent
Socioeconomic Status	Lower	66	35.5
	Middle	57	30.6
	Upper	63	33.9
Occupation	Manual labour	57	30.6
	others	24	12.9
	sedentary	105	56.5
Diet	Vegetarian	111	59.7
	Non Vegetarian	75	40.3
Sunlight exposure	In-adequate	117	62.9
	Adequate	69	37.1
Vitamin D Status	Deficiency	102	54.8
	Adequate	84	45.2

In present study, 35.5% belonged to lower SES, 33.9% in upper class and 30.6% in middle socioeconomic status. 56.5% of the patients were having sedentary lifestyle at occupati0n, 30.6% were labours. On assessment 0f diet, 59.7% were vegetarian and 40.3% were n0n-vegetarian. On assessment of exposure to sunlight, 37.1% of the patients had the adequate and 62.9% with in-adequate exposure. On assessment of the vitamin D status among the patients, 11.3% had the adequate vitamin D, 33.9% with insufficient and 54.8% with inadequate of vitamin D

Table 2: Bone mineral density status among patients			
		Frequency	Percent
Spine T score	Normal	12	6.5
	Osteopenia	57	30.6
	Osteoporosis	117	62.9
Femur T score	Normal	27	14.5
	Osteopenia	54	29.0
	Osteoporosis	105	56.5

The osteoporosis was seen in 62.9% on spine T-score and 56.5% based on femur T-score.

Table 3: Comparison of BMD distribution with diet of participants						
		Diet				p-value
		Non-vegetarian		Vegetarian		
		Count	N %	Count	N %	
BMD	Normal	3	4.0%	9	8.1%	0.15
	Osteopenia	27	36.0%	30	27.0%	
	Osteoporosis	45	60.0%	72	64.9%	

No significant distribution was noted with spine T-score with diet of participants.($p>0.05$)

Table 4: Comparison of BMD with sunlight exposure.						
		Sunlight				p-value
		Adequate		Inadequate		
		Count	N %	Count	N %	
BMD	Normal	9	13.0%	3	2.6%	0.03*
	Osteopenia	30	43.5%	27	23.1%	
	Osteoporosis	30	43.5%	87	74.4%	

There is significant association of the incidence of osteoporosis and Osteopenia among the participants with inadequate sunlight exposure compared to participants with adequate sunlight exposure.($p<0.05$)

Table 5: Comparison of sunlight exposure with vitamin D status among participants								
		Vitamin D Status						Chi-square test
		Adequate		Insufficient		Inadequate		
		Count	N %	Count	N %	Count	N%	
Sunlight	Adequate	15	71.4	21	33.3	33	32.4	4.133

	Inadequate	6	28.6	42	66.7	69	67.6	(0.042)*
*p-value <0.05 is c0nsidered statistically significant.								

The sunlight exposure was significantly related with vitamin D status among participants. The participants with inadequate sunlight exposure had the higher incidence of inadequate and insufficient vitamin D level in them compared to the participants with adequate sunlight exposure.($p<0.05$)

Table 6: Comparison of the BMD status with vitamin D status among participants

BMD		Vitamin D Status						Chi-square test
		Adequate		Insufficient		deficiency		
		Count	N %	Count	N %	Count	N %	
Spine T score	Normal	3	14.3	6	9.5	3	2.9	6.821 (0.03)*
	Osteopenia	9	42.9	18	28.6	30	29.4	
	Osteoporosis	9	42.9	39	61.9	69	67.6	
Femur T score	Normal	9	42.9	12	19	6	5.9	7.036 (0.03)*
	Osteopenia	6	28.6	15	23.8	33	32.4	
	Osteoporosis	6	28.6	36	57.1	63	61.8	
*p-value <0.05 is c0nsidered statistically significant.								

In present study, there is significant higher incidence of osteoporosis and Osteopenia among the patients with vitamin D deficiency and insufficiency compared to the normal level of vitamin D.($p<0.05$)

Table 7: Pearson's correlation of BMD based on T-score with vitamin D level among participants

		Vitamin D
Spine T-score	r	.324*
	p-value	.010
Femur T-score	r	.391**
	p-value	.002

There is significant positive correlation of the serum vitamin D levels with BMD among the patients measured at spine and femur levels.($p<0.05$)

Discussion:

Vitamin D is a fat-soluble vitamin that is found in just a few naturally occurring foods, such as fatty fish liver, and its primary natural source is dermal synthesis. Dietary or cutaneous vitamin D is physiologically inert and requires enzymatic modifications in its structure to be

converted into an active metabolite. The serum concentration of 25-hydroxyvitamin D that decreases serum parathyroid hormone the most is considered to be the ideal serum c0ncentrati0n, which only takes bone health into consideration.[10] Most experts define vitamin D deficiency as a Calcitriol level of <20 ng/mL and insufficiency as 21–29 ng/mL. Vitamin D is sufficient if >30 ng/mL, and vitamin D intoxication is considered if >150 ng/mL.[8,9]

The present study included a total of 186 post-menopausal women with mean age of 58.71±6.53yrs. In study by Kadam NS et al., documented the average age of the study population was 53.3 ±8.4 years. 44.3percent of the women were postmenopausal, with a mean age at menopause of 49.2 ±3.5 years. [11] In study by Kaushal N et al., 524 participants (aged 50.0 ±12.4 years) were studied.[12]

The present study documented a prevalence of vitamin D deficiency in 54.8% of post-menopausal rural women. In similar to present study Bachhel R et al., the research participants had a high overall frequency 0f vitamin D deficiency (90percent). The prevalence of vitamin D insufficiency differed significantly between rural and urban subjects (P <0.05) and between subjects with different occupati0ns (P <0.001). Also stated that subjects with more opportunities for sunlight exposure, such as rural residents, farmers, and housewives, have a lower prevalence. [13] Bandeira F et al., Study found a high prevalence 0f hypovitaminosis D in postmenopausal women. Age, years elapsed since menopause and low BMD in the FN were associated with deficiency.[14]

In present study, there is significant higher incidence of osteoporosis and Osteopenia among the patients with vitamin D deficiency and insufficiency compared to the normal level of vitamin D.($p<0.05$) Also there is significant positive correlation of the serum vitamin D levels with BMD among the patients measured at spine and femur levels.($p<0.05$)

In study by Kaushal N et al., documented Osteoporosis was found in 6.9percent 0f the participants (11.1percent 0f the females and 4.2percent of the males) and osteopenia in 34percent of the subjects (40.3percent of the females and 29.9percent of the males). Male patients had greater absolute BMD (P<0.001) than female subjects at all bone locations. In female patients, the prevalence 0f osteoporosis rose with age, but not in male subjects. [12] In study by Paul TV et al., documented the prevalence of osteoporosis in the lumbar spine was 48percent, 16.7percent in the femoral neck, and 50percent overall. [15]

In study by Kaur S et al., documented a very high incidence of vitamin D deficiency in the urban aged population of Jammu, necessitating intervention through public awareness, food

fortification, appropriate exposure to sunlight, and greater mobility of the elderly. [16] in study by Suryanarayana P et al., on multiple logistic regression analysis found that hypertension was a strong predictor of vitamin D deficiency, and the risk of VDD was twice as high in the elderly with hypertension. The prevalence of VDD was significant among the urban senior population in Hyderabad, India. High BMI, MS, HT, and education are all important risk factors for VDD. [17]

The current study found a 54.8% incidence of deficiency of vitamin D among postmenopausal women. The study also found a substantial beneficial relationship between bone mineral density and vitamin D levels. Patients with low vitamin D levels have a much greater frequency of osteoporosis and a higher risk of fracture. The study also discovered a greater frequency of deficiency of vitamin D among people who had less sunlight exposure time. The study strengthen the findings that post-menopausal women are at higher risk of lower BMD and higher risk of fracture related to low BMD which is related with lower vitamin D level in them.

Conclusion:

The present study documented a prevalence of vitamin D deficiency of 54.8% among the women in post-menopausal age. The study also documented a significant positive association of the bone mineral density with vitamin D levels. There is significant higher incidence of osteoporosis among the patients with inadequate vitamin D levels, with higher risk of fracture in them. The study also showed higher incidence of the vitamin D deficiency among the participants with lower sunlight exposure time. Hence the present study documented higher risk of osteoporosis and Osteopenia among the post-menopausal women in rural setting, hence recommend for screening and educating the women.

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