

# Assessment of Correlation of Bone Mineral Density and Vitamin D Status In Patients with Osteoarthritis of the Knee: A Clinical Study

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## ABSTRACT

**Background:** Vitamin D deficiency can be an important risk factor for osteoporosis. On the other hand, an adequate vitamin D level has been shown to prevent osteoporotic fractures. Bone mineral density (BMD), which measures the quantity of the calcified bone, at present is the gold standard technique for the diagnosis of osteopenia and osteoporosis. Hence; we assessed the correlation of bone mineral density & vitamin D status in patients with osteoarthritis of the knee.

**Materials and Methods:** The study was conducted in the Department of Orthopedics, Dr. Suresh Bandil Memorial Orthopaedic and Maternity Research Centre, Gwalior, Madhya Pradesh, India. For the study, we selected patients from the OPD patients at the Orthopedics departmental for knee Pain Assessment and treatment. Patients taking osteotropic medication, with rheumatoid disease, plasmacytoma, nicotine or alcohol abuse, hypercortisolism, hyperthyreosis, primary hyperparathyroidism, hypogonadism were excluded from the study. A total of 50 patients were included in the study.

**Results:** A total of 50 patients were included in the study. The number of male patients were 21 and number of female patients were 29. The mean age of the patients was 72.02 years. The number of patients in group 1 was 16, in group 2 were 19 and in group 3 were 15. The mean age of the patients in group 1, 2 and 3 were 66.37, 71.55, and 78.14

years respectively. In Group 1, nine patients had serum 25(OH)D level at <30 ngml<sup>-1</sup> and seven patients at >30 ngml<sup>-1</sup>. In Group 2, eleven patients had serum 25(OH)D level at <30 ngml<sup>-1</sup> and eight patients at >30 ngml<sup>-1</sup>. In Group 3, ten patients had serum 25(OH)D level at <30 ngml<sup>-1</sup> and five patients at >30 ngml<sup>-1</sup>.

**Conclusion:** Within the limitations of the study we conclude that we should screen patients for osteoporosis in knee pain patients and start treatment early, and thereby reduce the risk of fractures.


**Keywords:** Bone Mineral Density, Vitamin D, Osteoarthritis, Osteopenia.

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## INTRODUCTION

Vitamin D deficiency is one of the most common and under-diagnosed medical conditions in the world, since a significant proportion of the population in many countries and regions around the world have low vitamin D levels.<sup>1</sup> The 25-hydroxyvitamin D level depends on various parameters, including the amount of solar ultraviolet B (UVB) irradiation (determined by the time of day, season latitude, skin pigmentation, and use of sunscreen), age, dietary habits, gender, obesity, and many others. Adequate levels of vitamin D have an important effect on bone mass in the young and old.<sup>2</sup> Hypovitaminosis D adversely affects calcium metabolism, osteoblastic activity, matrix ossification, bone remodeling, and hence bone density. Low 25-hydroxyvitamin D (25OHD) was also reported to be associated with secondary hyperparathyroidism and increased bone turnover.<sup>3-5</sup>

In general, serum 25OHD is a robust and reliable marker of vitamin D status, and although there is no consensus on the definition of an optimal serum 25OHD level, vitamin D deficiency is defined by most experts as a serum 25OHD level <50 nmol/L (<20 ng/mL), whereas a serum 25OHD level of >75 nmol/L (>30 ng/mL) is considered to be normal, and a level of 50-75 nmol/L (20-30 ng/mL) defines vitamin D insufficiency.<sup>6</sup> Hence, we planned the study to assess correlation of bone mineral density (BMD) and vitamin D status in patients with osteoarthritis of the knee.

## MATERIALS AND METHODS

The study was conducted in the Department of Orthopedics, Dr. Suresh Bandil Memorial Orthopaedic and Maternity Research Centre, Gwalior, Madhya Pradesh, India.

For the study, we selected patients from the OPD patients at the Orthopedics department for knee pain assessment and treatment. Patients taking osteotropic medication, with rheumatoid disease, plasmacytoma, nicotine or alcohol abuse, hypercortisolism, hyperthyreosis, primary hyperparathyroidism, hypogonadism were excluded from the study. A total of 50 patients were included in the study. Preoperatively, BMD was assessed at the lumbar spine in anteroposterior (AP) and lateral projections. Patients were divided into 3 groups based on their BMD scores:

**Group 1:** T-score: 0 to -1 - Physiological BMD

**Group 2:** T-score: -1 to -2.5 - Osteopenia

**Group 3:** T-score: -2.5 to -6 - Osteoporosis

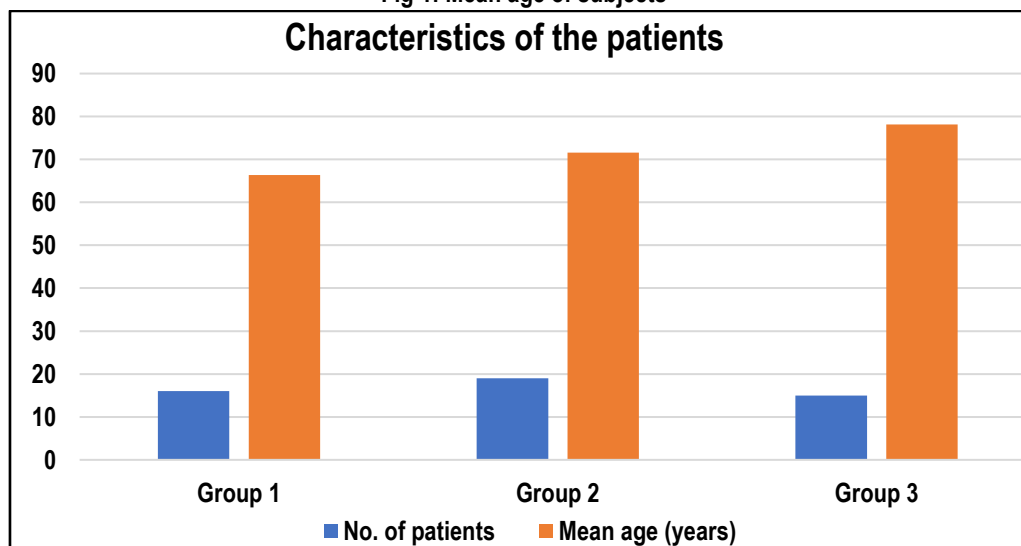
**Statistical Analysis**

The statistical analysis of the data was done using SPSS version 20.0 for windows. The Student’s t-test and Chi-square test were used to check the significance of the data. The p-value less than 0.05 were predetermined as statistically significant.

**Table 1: Characteristics of the patients**

Parameters	Group 1	Group 2	Group 3
No. of patients	16	19	15
Mean age (years)	66.37	71.55	78.14

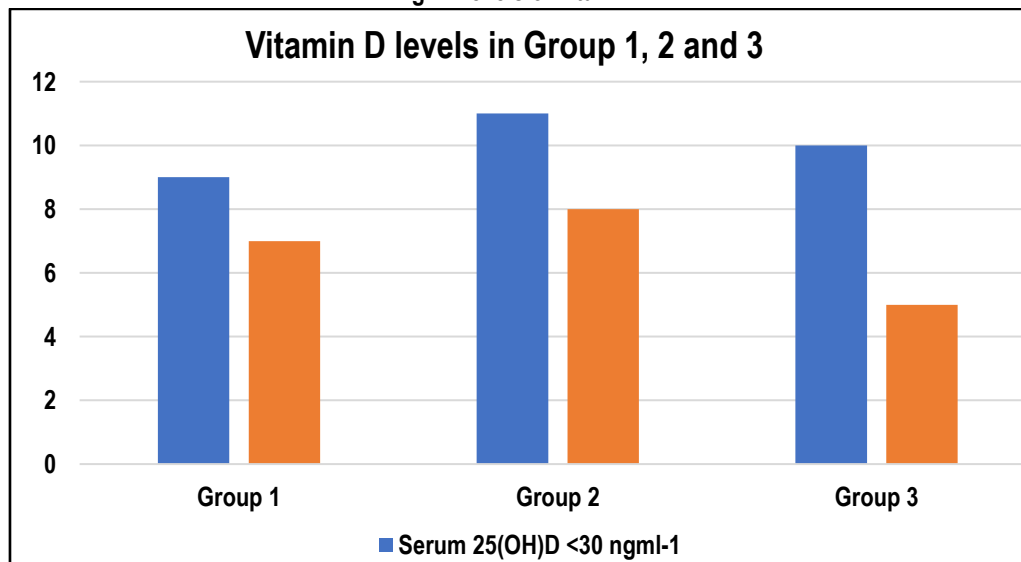
**Fig 1: Mean age of subjects**



**Table 2: Vitamin D levels in Group 1, 2 and 3**

Groups	Serum 25(OH)D	
	<30 ngml <sup>-1</sup>	>30 ngml <sup>-1</sup>
Group 1	9	7
Group 2	11	8
Group 3	10	5

**Fig 2: Levels of vitamin D**



## RESULTS

A total of 50 patients were included in the study. The number of male patients were 21 and number of female patients were 29. The mean age of the patients was 72.02 years.

Table 1 shows the characteristics of the patients. The number of patients in group 1 was 16, in group 2 were 19 and in group 3 were 15. The mean age of the patients in group 1, 2 and 3 were 66.37, 71.55, and 78.14 years respectively. [Fig 1]

Table 2 shows the vitamin D levels in group 1, 2 and 3. In Group 1, nine patients had serum 25(OH)D level at <30 ngml<sup>-1</sup> and seven patients at >30 ngml<sup>-1</sup>. In Group 2, eleven patients had serum 25(OH)D level at <30 ngml<sup>-1</sup> and eight patients at >30 ngml<sup>-1</sup>. In Group 3, ten patients had serum 25(OH)D level at <30 ngml<sup>-1</sup> and five patients at >30 ngml<sup>-1</sup>. The results were statistically non-significant.[Fig 2]

## DISCUSSION

In the present study we assessed correlation of bone mineral density and vitamin D status in patients with osteoarthritis of the knee.

We observed that mean age of the patients in group 3 were more as compared to other groups. Also, Group 2 and Group 3 had comparatively almost equal no. of patients with decreased vitamin D level. But the results were statistically non-significant. The results were compared with previous studies and results were consistent with previous studies.

Brejawi N et al investigated the association between bone mineral density (BMD), vitamin D and OA in patients undergoing total hip or knee replacements. In total, 82 women and 35 men with mean ages of 70 and 68 years, respectively, were recruited for the study. The BMD of the lumbar spine and the proximal femur were measured by dual-energy X-ray absorptiometry. The vitamin D status was assessed by 25(OH)D levels, with a cut-off of <or=30 ng x ml(-1). In total, 84.7% of the patients had a vitamin D deficiency; 20% of the men had a T-score below -2.5; 23.2% of the women were affected by OP. Furthermore, 37.1 and 42.7% of the male and female patients, respectively, had osteopenia. They concluded that OP and osteopenia were not due to immobility. The average age, rather than the frequency of OP, in cases with OA of the hip or knee differed from the general population. The incidence of low BMD in the male cohort was notably higher than expected. We detected a high prevalence of vitamin D deficiency, independent of the BMD.

Laslett LL et al investigated whether serum vitamin D predicts change in knee and hip pain in older adults. Longitudinal population-based cohort study of randomly selected older adults (n=769) aged 50-80 years (mean 62 years); 50% were male. Serum 25-hydroxyvitamin D (25-OHD) was assessed at baseline by radioimmunoassay, and pain at baseline, 2.6 and/or 5 years using the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) questionnaire. They used linear regression with adjustment for age, sex, body mass index and season, then further adjusted for potential structural mechanisms (radiographic osteoarthritis, bone marrow lesions, chondral defects and muscle strength).

Mean total knee WOMAC score was 3.2 (range 0-39). 4.2% of participants had moderate vitamin D deficiency at baseline (25-OHD 12.5-25 nmol/l). 25-OHD <25 nmol/l predicted change in knee pain (using total WOMAC score) over 5 years ( $\beta=2.41$ ,

$p=0.002$ ) with a similar effect size for hip pain over 2.4 years ( $\beta=2.20$ ,  $p=0.083$ ). Results were consistent within pain subscales, and the association was independent of demographic, anthropometric and structural covariates. No association was present when 25-OHD was analysed as a continuous measure. They concluded that moderate vitamin D deficiency independently predicts incident, or worsening of, knee pain over 5 years and, possibly, hip pain over 2.4 years.<sup>7,8</sup>

Cao Y et al compared over a 2- year period, the effects of vitamin D supplementation versus placebo on knee structural changes, knee pain, and lower limb muscle strength in patients with symptomatic knee OA. Randomised, placebo-controlled, and double-blind clinical trial aiming to recruit 400 subjects (200 from Tasmania and 200 from Victoria) with both symptomatic knee OA and vitamin D deficiency (serum [25-(OH)D] level of >12.5 nmol/liter and <60 nmol/liter). Participants were randomly allocated to vitamin D supplementation (50,000 IU compounded vitamin D3 capsule monthly) or identical inert placebo group for 2 years. The primary endpoint is loss of knee cartilage volume measured by magnetic resonance imaging (MRI) and Western Ontario and McMaster Universities Index of OA (WOMAC) knee pain score. The secondary endpoints will be other knee structural changes, and lower limb muscle strength. Several other outcome measures including core muscle images and central blood pressure will be recorded. Linear and logistic regression was used to compare changes between groups using univariable and multivariable modeling analyses. Both intention to treat and per protocol analyses will be utilized. The trial is designed to test if vitamin D supplementation will reduce loss of knee cartilage volume, prevent the progression of other knee structural abnormalities, reduce knee pain and strengthen lower limb muscle strength, thus modify disease progression in knee OA.

Lee YH et al evaluated the relationship between the 25-hydroxyvitamin D [25(OH)D] level and rheumatoid arthritis (RA) and the correlation between serum vitamin D level and RA activity. They searched the PUBMED, EMBASE, and Cochrane databases and performed a meta-analysis examining the vitamin D level and prevalence of vitamin D deficiency in patients with RA compared to healthy controls and the correlation coefficients between the vitamin D level and disease activity score 28 (DAS28) in RA patients.

Fifteen studies that included a total of 1,143 RA patients and 963 controls were available for this meta-analysis. The meta-analysis showed that the serum vitamin D level in the RA group was significantly lower than that in the control group. In addition, the prevalence of vitamin D deficiency was significantly higher in the RA group than in the control group. Thirteen studies evaluated the correlation between the vitamin D level and its activity in 924 RA patients. Meta-analysis showed a significant inverse correlation between the vitamin D level and DAS28. Their meta-analysis demonstrated that serum vitamin D level is significantly low in patients with RA, vitamin D deficiency is prevalent in RA patients compared to controls, and the vitamin D level correlates inversely with RA activity.<sup>9,10</sup>

## CONCLUSION

Within the limitations of the study we conclude that we should screen patients for osteoporosis in knee pain patients and start treatment early, and thereby reduce the risk of fractures.

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