

# An observational study to assess the serum Vitamin D levels and Kellgren-Lawrence grading in patients of primary osteoarthritis

<sup>1</sup>Dr. Sangeeta Khyalia, <sup>2</sup>Dr. Ravinder Kumar Lamoria, <sup>3</sup>Dr. Rahul Dhaka,  
<sup>4</sup>Dr. Pramod Singh Chahar

<sup>1</sup>Assistant Professor, Department of Biochemistry, SMS Medical College and Hospital, Jaipur, Rajasthan, India

<sup>2</sup>Associate Professor, Department of Orthopedics, SMS medical college and Hospital, Jaipur, Rajasthan, India

<sup>3</sup>Intern, RUHS medical college and Hospital, Jaipur, Rajasthan, India

<sup>4</sup>Senior Resident, Department of Orthopedics, SMS Medical College and Hospital, Jaipur, Rajasthan, India

**Corresponding Author:**  
Dr. Sangeeta Khyalia

## Abstract

**Aim:** To assess the serum Vitamin D levels and Kellgren-Lawrence grading in patients of Primary Osteoarthritis.

**Materials and Methods:** The present observational study was carried out on the patients coming to the OPD of the Department of Orthopedics, SMS Medical College and Hospital, Jaipur. All patients complaining of Osteoarthritis of the knee joint and willing to participate in the study were interviewed for age, sex, history of inflammatory arthritis or any rheumatic disease, complain of celiac disease & malabsorption syndrome or any history of intake of any drug that might affect serum Vit D levels. After the successful running of Quality Controls the clear serum obtained from patient's serum was analyzed on Advia Centaur XP (for Vitamin D & PTH) & fully automated chemistry analyzer Beckman Coulter AU 680 (for routine biochemical parameters). Based on the serum biochemistry results, patients with deranged RFT & LFT were excluded from the study & the Serum Vitamin D, PTH, Calcium and Phosphorus levels of the patients with normal RFT & LFT were documented.

**Results:** In our study maximum number of patients (109, 41.44%) fell in the age group 51-60 years with age ranging from 37-70 years. Mean age is  $55.37 \pm 8.04$  years. Male female ratio was 0.81:1. Mean serum Vitamin D level is  $18.27 \pm 8.34$  ng/ml with range from 4.2-44.34 ng/ml. Maximum no. of patients were in the Vitamin D deficient group (148, 56.27%), 96 (36.5%) patients were Vitamin D insufficient while only 19 (7.23%) patients had Vitamin D levels above normal range. Maximum number of cases were of grade 3 (90, 34.22%), followed by grade 2 (82, 31.18%). Minimum no. of cases are of grade 0 (7, 2.66%) followed by grade 1 (22, 8.36%). The mean Kellgren- Lawrence grading for the cases is  $2.68 \pm 1.01$ .

**Conclusion:** There is high prevalence of Vitamin D deficiency in Osteoarthritis patients. But this prevalence needs to be compared with the prevalence in general population by including age & sex-matched healthy controls. The present study could be further taken in this direction.

**Keywords:** Vitamin D, osteoarthritis, Kellgren-Lawrence grading

## Introduction

Osteoarthritis is the most prevalent disease of the articulating joints associated with extracellular matrix degradation and is characterized by pain, tenderness, movement limitation, crepitus, and a variable degree of inflammation without systemic effects <sup>[1]</sup> Osteoarthritis can occur in every synovial joint, but the most common sites are hip, knee, hand, foot, and spine <sup>[2]</sup>.

Knee osteoarthritis (OA) is a major public health issue that causes chronic pain & disability <sup>[3-5]</sup>. Knee OA is likely to become the fourth most important global cause of disability in women and eighth most important in men <sup>[6]</sup>. The principal clinical symptom of knee OA is pain <sup>[7]</sup>. Fewer studies have addressed factors which might influence knee pain; among these, older age, female gender, and physically demanding work, have all been proposed <sup>[8-13]</sup>.

Vitamin D has been shown to stimulate synthesis of proteoglycan by mature articular cartilage *in vitro*, and this suggests that vitamin D may directly affect particular cartilage metabolism <sup>[14]</sup>. Previous studies discussed some different roles for 25-hydroxy vitamin D (25-OHD) and its relationship to pain <sup>[15]</sup>, cartilage metabolism <sup>[16]</sup>, in-vitro synthesis of proteoglycan by mature articular cartilage, and metalloproteinase production and modulating the degradative capacity of the tissue macrophage <sup>[17]</sup>, and great debate aroused about the role of 25-OHD as a contributing factor to osteoarthritis <sup>[18-20]</sup> Also OA co-exists frequently with Vitamin D deficiency.

Therefore this study was undertaken at our centre, SMS Medical College, Jaipur in order to assess serum Vitamin D level in osteoarthritis patients.

## Materials and methods

The study was carried out on the patients coming to the OPD of the Department of Orthopedics, SMS Medical College and Hospital, Jaipur.

## Methodology

All patients complaining of Osteoarthritis of the knee joint and willing to participate in the study were interviewed for age, sex, history of inflammatory arthritis or any rheumatic disease, complain of celiac disease & malabsorption syndrome or any history of intake of any drug that might affect serum Vit D levels.

After a thorough history and ruling out any interfering factor patients were examined for clinical signs & symptoms. After that general & local examination of the patients was done by a certified Orthopedician.

## Vitamin D estimation

The blood samples of all such patients were taken after overnight fasting from ante-cubital vein with proper precautions in plain vial. The blood sample was left standing for one hour so that a proper clot was formed and clear serum separated on the top. The samples were then centrifuged at 2500 rpm in centrifuge machine for 5 minutes. The clear serum which separated after centrifugation was pipetted in a clean tube without disturbing the clot at the bottom so that there is no interference with any fibrin.

Quality Controls were then run for Vitamin D & PTH on Advia Centaur XP and for routine biochemical parameters on fully automated analyzer Beckman Coulter AU 680. After the successful running of Quality Controls the clear serum obtained from patient's serum was

analyzed on Advia Centaur XP (for Vitamin D & PTH) & fully automated chemistry analyzer Beckman Coulter AU 680 (for routine biochemical parameters). Based on the serum biochemistry results, patients with deranged RFT & LFT were excluded from the study & the Serum Vitamin D, PTH, Calcium and Phosphorus levels of the patients with normal RFT & LFT were documented.

### Statistical analysis

The results obtained were put in excel sheet (Microsoft Office Excel 2007) & statistically analyzed.

### Results

**Table 1:** Distribution of study population according to age

Age Group (in years)	No. of cases	Distribution (%)
31-40	9	3.42
41-50	68	25.85
51-60	109	41.44
61-70	77	29.28
Total	263	100
Mean±SD	55.37±8.04 years	

In our study maximum number of patients (109, 41.44%) fell in the age group 51-60 years with age ranging from 37-70 years. Mean age is 55.37±8.04 years.

**Table 2:** Distribution of age according to gender

Age Group (in years)	Male	Female
31-40	0	9
41-50	27	41
51-60	50	59
61-70	41	36
Total	118	145

Number of female patients was more (N=145) compared to males (N=118). Majority of them belonged to the age group 51-60 years. Mean age of males is 56.84±7.94 years with age ranging from 41-70 years. Mean age of females is 54.18±7.93 years with age ranging from 37-69 years. Male female ratio was 0.81:1.

**Table 3:** Vitamin D status of the study population

Vitamin D Level	No. of cases	Distribution (%)
Sufficient (30-100 ng/100ml)	19	7.23
Insufficient (20-30 ng/100ml)	96	36.5
Deficient (<20 ng/100ml)	148	56.27
Total	263	100

Mean serum Vitamin D level is 18.27±8.34 ng/ml with range from 4.2-44.34 ng/ml. Maximum no. of patients were in the Vitamin D deficient group (148, 56.27%), 96 (36.5%) patients were Vitamin D insufficient while only 19 (7.23%) patients had Vitamin D levels

above normal range.

**Table 4:** Vitamin D status according to gender

Vitamin D Level	No. of cases (Males)	No. of cases (Females)
Sufficient (30-100 ng/100ml)	14	5
Insufficient (20-30 ng/100ml)	43	53
Deficient (<20 ng/100ml)	61	87
Total	118	145

The no. of Vitamin D sufficient, insufficient & deficient males is 14 (11.86%), 43 (36.44%), 61 (51.70%) & that of females is 5 (3.45%), 53 (36.55%), 87 (60%) respectively.

**Table 5:** Distribution of study population according to Kellgren- Lawrence grading

Grade	Number of cases	Distribution (%)
0	7	2.66
1	22	8.36
2	82	31.18
3	90	34.22
4	62	23.58
Total	263	100

Maximum number of cases were of grade 3 (90, 34.22%). followed by grade 2 (82, 31.18%). Minimum no. of cases are of grade 0 (7, 2.66%) followed by grade 1 (22, 8.36%). The mean Kellgren- Lawrence grading for the cases is  $2.68 \pm 1.01$ .

**Table 6:** Distribution of to Kellgren- Lawrence grading according to gender

Grade	Male	Female
0	0	7
1	10	12
2	37	45
3	38	52
4	33	29
Total	118	145

While comparing sex wise distribution of grades it was observed that in both males & female's maximum no. of cases belonged to grade 3. The mean Kellgren- Lawrence grading for males is  $2.80 \pm 0.95$  and for females is  $2.58 \pm 1.05$ .

## Discussion

Osteoarthritis is a degenerative disorder, it is impossible to revert the pathological process once it starts & when knee OA reaches the debilitating stage, joint replacement surgery remains the only modality of treatment. Therefore, it becomes very important to identify factors which are associated with severity of the disease so that the role these factors might play in the prevention of Osteoarthritis can be defined. One such factor is serum Vitamin D level.

Our study shows that the maximum no. of cases 109 (41.44%) were in the age group 51-60

years, followed by 77 (29.28%) in 61-70 years age group. The mean age for case was  $55.37 \pm 8.04$  years with an age range from 37-70 years. In the present study the results are consistent with previous researches like Ahmed Lotfi A *et al.* they found that mean age was  $52.42 \pm 9.80$  years with an age range from 40-77 years<sup>[21]</sup>. Al-Jarallah *et al.* in their study on primary knee osteoarthritis patients found the mean age as  $56.5 \pm 9.1$  years with an age range 36-80 years<sup>[3]</sup>.

In ageing individuals, it is estimated that 80% of all adults at or above the age of 65 years exhibit radiographic evidence of knee Osteoarthritis & a statistically significant correlation also exists between age & grade of knee OA.

In our study there were total 145 (55.13%) females and 118 (44.87%) males. This shows that there is no significant difference in the prevalence of osteoarthritis based on gender in our population. While in other studies there was a clear preponderance of females over males like in the study of Al-Jarallah *et al.* out of 99 patients 90 (90.9%) were females & only 9 (9.1%) were males<sup>[3]</sup>.

Similarly, in the study of Ahmed Lotfi A *et al.* out of 140 patients 110 (78.6%) were females & only 30 (21.4%) were males<sup>[21]</sup>. The clear preponderance of females in these studies can be attributed to sunlight exposure and hence Vitamin D levels as both these studies were conducted in a population with excess of Muslim community (Kuwait & Egypt respectively) where there is reduced exposure to sunlight in female population leading to reduced dermal synthesis of Vitamin D and hence increased prevalence of Osteoarthritis in females.

In our study, the results show that the mean value of Vitamin D is  $18.27 \pm 8.34$  ng/ml with the range of Vitamin D from 4.2-44.34 ng/ml. In the study conducted by Al-Jarallah *et al.* the mean value of Vitamin D was  $11.4 \pm 6.07$  ng/ml, while in the study conducted by Ahmed Lotfi A *et al.* the mean value of Vitamin D was  $35.77 \pm 14.6$  ng/ml and the range of Vitamin D was from 10.62–71.82 ng/ml. This shows that the overall Vitamin D levels in our population was less than that of the population in the study of Ahmed Lotfi A *et al.* and more than that of the population in the study of Al-Jarallah *et al.*<sup>[21,3]</sup>.

The mean serum Vitamin D level for males was  $19.19 \pm 8.71$  ng/ml with range from 4.2-44.34 ng/ml and the mean serum Vitamin D level for females was  $17.53 \pm 8.00$  ng/ml with range from 4.2-38.62 ng/ml. This shows that there is no significant difference in the levels of Vitamin D between males & females.

In our study 148 patients out of a total 263 were Vitamin D deficient (56.27%) and 96 patients (36.5%) were having insufficient Vitamin D levels leaving only 19 patients (7.23%) as having Vitamin D levels above normal range. This is similar to the study of Al-Jarallah *et al.* in which 92 out of 99 patients (92.9%) were Vitamin D deficient and only 7 (7.1%) were having above normal Vitamin D levels.<sup>3</sup> While, in the study of Ahmed Lotfi A *et al.* hypovitaminosis was seen in 90 (64.3%) out of 140 patients. However, in their study Ahmed Lotfi A *et al.* set the cut-off of Vitamin D deficiency at values  $<40$  ng/ml<sup>[3]</sup>.

In our study we found the mean Kellgren- Lawrence grading for osteoarthritis patients as  $2.68 \pm 1.01$ . This is similar to the results obtained in the study of Al-Jarallah *et al.* In their study the mean Kellgren- Lawrence grading was  $2.43 \pm 0.85$ <sup>[3]</sup>.

We also looked for the no. of patients in our study which showed significant joint space narrowing (patients which come under Kellgren- Lawrence grade 2-4). In our study no. of such patients was 234 (88.97%). Very similar results were seen in the study of Al-Jarallah *et al.* in which 87 (87.9%) out of 99 patients with significant joint space narrowing were reported<sup>[3]</sup>.

## Conclusion

There is high prevalence of Vitamin D deficiency in Osteoarthritis patients. But this prevalence needs to be compared with the prevalence in general population by including age

& sex-matched healthy controls. The present study could be further taken in this direction. Also, based on our study we postulate that Vitamin D supplementation might have a role in slowing the progression or prevention of radiological arthritis. This preventive role of Vitamin D supplementation in osteoarthritis can be further taken up for investigation in prospective studies.

## References

1. Mc Alindon TE. Nutraceuticals, do they work and when should we use them? *Best Pract Res. Clin Rheumatol.* 2006;20:99-115.
2. Andriacchi TP, Koo S, Scanlan SF. "Gait mechanics influence healthy cartilage morphology and osteoarthritis of the knee". *J Bone Joint Surg Am.* 2009;91:95-101.
3. Al-Jarallah KF, Shehab D, Al-Awadhi A, Nahar I, Haider MZ, and Moussa MA. "Are 25(OH) D levels related to the severity of knee osteoarthritis and function?" *Med Princ Pract.* 2012;21:74-78.
4. Grushko G, Schneiderman R, Maroudas A. "Some biochemical and biophysical parameters for the study of the pathogenesis of osteoarthritis: a comparison between the processes of ageing and degeneration in human hip cartilage". *Connect. Tissue Res.* 1989;19(2-4):149-76.
5. Miller RR, Hicks GE, Shardell MD, *et al.* "Association of serum vitamin D levels with inflammatory response following hip fracture: the Baltimore Hip Studies". *J Gerontol A Biol Sci Med Sci.* 2007;62:1402-6.
6. Hogervorst T, Bouma HW, de Vos J. "Evolution of the hip and pelvis". *Acta orthopaedica. Supplementum.* 2009 Aug;80(336):1-39.
7. Holick MF. "Sunlight and Vitamin D for bone health and prevention of autoimmune diseases, cancers, and cardiovascular disease". *Am J Clin Nutr.* 2004;80(6):1678-88S.
8. Brandt KD, Dieppe P, Radin E. "Etiopathogenesis of osteoarthritis". *Med. Clin. North Am., XV.* 2009 Jan;93(1):1-24.
9. Guccione AA, Felson DT, Anderson JJ, Anthony JM, Zhang Y, Wilson PW, *et al.* "The effects of specific medical conditions on the functional limitations of elders in the Framingham Study". *Am J Public Health.* 1994;84:351-8.
10. Lacraz S, Dayer JM, Nicod L, Welgus HG. 1, 25-Dihydroxy vitamin D3 dissociates production of interstitial collagenase and 92-kDa gelatinase in human mononuclear phagocytes. *J Biol Chem.* 1994;269:6485-6490.
11. Linn S, Murtaugh B, Casey E. Role of sex hormones in the development of osteoarthritis. *PMR.* 2012;4(5):S169-73.
12. Felson DT. Do occupation related physical factors contribute to arthritis? *Balliere's Clin Rheumatol.* 1994;8:63-77.
13. Laing CJ, Cooke NE. Section 8. Vitamin D Binding Protein. In Feldman D, Glorieux FH, Pike JW. *Vitamin.* Academic Press. 2004;1(2):117-134.
14. Felson DT, Niu J, Clancy M, Alibadi P, Sack B, Geurmazi A, *et al.* "Low levels of Vitamin D and worsening of knee osteoarthritis: results of two longitudinal studies". *Arthritis Rheum.* 2007;56:129-36.
15. Buckwalter JA, Martin JA. Osteoarthritis. *Adv Drug deliv Rev.,* 2006;58:150-167.
16. Mankin HJ, Thrasher AZ. Water content and binding in normal and osteoarthritic human cartilage. *J Bone Joint Surg Am.* 1975;57(1):76-80.
17. Holick MF. "Vitamin D deficiency". *N Engl J Med.* 2007;357:266-81.
18. Bollet AJ, Nance JL. "Biochemical Findings in Normal and Osteoarthritic Articular Cartilage. II. Chondroitin Sulfate Concentration and Chain Length, Water, and Ash Content". *J. Clin. Invest.* 1966;45(7):1170-7.
19. Brand C, Hunter D, Hinman R *et al.* "Improving care for people with osteoarthritis of the

- hip and knee: how has national policy for osteoarthritis been translated into service models in Australia?" *Int J Rheum Dis.* 2011;14:181-90.
20. Buckwalter JA, Saltzman C, Brown T. "The impact of osteoarthritis: implications for research." *Clin Orthop Relat Res.* 2004; 427:S6-S15.
  21. Lotfi AA, Abdel-Magied RA, El-Shereef RR, Saedii AA, Abdel Gawad EA. Relationship between serum 25-hydroxy vitamin D levels, knee pain, radiological osteoarthritis, and the Western Ontario and McMaster Universities Osteoarthritis Index in patients with primary osteoarthritis. *Egypt Rheumatol Rehabil.* 2014;41(2):66-70.