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Original Research Article

Association Between Vitamin D Levels and Severity of Osteoarthritis

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Abstract

Background: Osteoarthritis (OA) is a progressive degenerative joint disorder characterized by cartilage destruction, pain, and functional disability. Vitamin D plays an important role in bone metabolism, cartilage homeostasis, and muscle function. Several studies have suggested an association between vitamin D deficiency and increased severity of osteoarthritis.

Objective: To evaluate the association between serum vitamin D levels and severity of osteoarthritis among adult patients.

Materials and Methods: A hospital-based cross-sectional study was conducted among 150 patients diagnosed with primary knee osteoarthritis. Serum 25-hydroxyvitamin D [25(OH)D] levels were estimated using chemiluminescent immunoassay. Osteoarthritis severity was graded radiologically using the Kellgren–Lawrence (K-L) classification. Patients were categorized into vitamin D deficient (<20 ng/mL), insufficient (20–29 ng/mL), and sufficient (≥30 ng/mL) groups. Statistical analysis was performed using Chi-square test, ANOVA, and Pearson correlation. A p-value <0.05 was considered statistically significant.

Results: The mean age of participants was 58.4 ± 8.7 years. Vitamin D deficiency was observed in 54.7% of patients. Severe OA (K-L Grade III–IV) was significantly more common among vitamin D-deficient individuals (75.6%) compared to sufficient individuals (28.6%) ($p<0.001$). Serum vitamin D levels demonstrated a significant negative correlation with OA severity score ($r = -0.48$, $p<0.001$).

Conclusion: Lower serum vitamin D levels were significantly associated with greater radiological severity of osteoarthritis. Screening and correction of vitamin D deficiency may be beneficial in patients with osteoarthritis.

Keywords: Osteoarthritis, Vitamin D, Kellgren-Lawrence Grade, Knee Osteoarthritis, Cartilage Degeneration

Introduction

Osteoarthritis (OA) is the most prevalent form of arthritis and represents a major cause of disability among older adults worldwide. It is characterized by progressive degeneration of articular cartilage, subchondral bone remodeling, synovial inflammation, and joint dysfunction. Knee osteoarthritis is particularly common and contributes substantially to reduced quality of life. [1]

Vitamin D is a steroid hormone essential for calcium homeostasis, skeletal health, muscle strength, and immune regulation. Emerging evidence suggests that vitamin D receptors are expressed in chondrocytes and osteoblasts, indicating a potential role in cartilage metabolism and joint health. [2] Several observational studies have reported that low serum vitamin D concentrations are associated with increased pain, reduced physical function, and greater radiographic progression of knee osteoarthritis. However, results remain inconsistent. [3,4,5] Therefore, the present study was undertaken to investigate the association between serum vitamin D levels and osteoarthritis severity. Aim was to determine the association between serum vitamin D levels and severity of osteoarthritis.

Materials and Methods

This cross-sectional observational study was conducted in the Department of Orthopedics of a tertiary care teaching hospital between January 2024 and December 2024. A total of 150 patients diagnosed clinically and radiologically with primary knee osteoarthritis were included after obtaining informed consent. Patients with inflammatory arthritis, chronic kidney disease, metabolic bone disorders, malignancy, or those receiving vitamin D supplementation during the preceding six months were excluded.

Demographic details including age, sex, body mass index, duration of symptoms, and comorbidities

were recorded. Fasting venous blood samples were collected for estimation of serum 25-hydroxyvitamin D [25(OH)D] levels using chemiluminescent immunoassay. Vitamin D status was categorized as deficient (<20 ng/mL), insufficient (20–29 ng/mL), and sufficient (≥30 ng/mL).

Radiographic severity of osteoarthritis was assessed using standing anteroposterior knee radiographs and graded according to the Kellgren–Lawrence classification (Grades I–IV). Statistical analysis was performed using SPSS version 25. Continuous variables were expressed as mean ± standard deviation and categorical variables as percentages. Chi-square test and Pearson correlation analysis were used. A p-value <0.05 was considered statistically significant.

Results

A total of 150 patients diagnosed clinically and radiologically with primary knee osteoarthritis were included in this study, More than half of the study population exhibited vitamin D deficiency, indicating a high prevalence among patients with osteoarthritis.

Table 1. Distribution of Participants According to Vitamin D Status

Vitamin D Status	Number (%)
Deficient (<20 ng/mL)	82 (54.7%)
Insufficient (20–29 ng/mL)	40 (26.7%)
Sufficient (≥30 ng/mL)	28 (18.6%)
Total	150

Table 2. Association Between Vitamin D Status and OA Severity

Deficient	20 (24.4%)	62 (75.6%)
Insufficient	18 (45.0%)	22 (55.0%)
Sufficient	20 (71.4%)	8 (28.6%)

Chi-square = 24.7

$p < 0.001$

Table no 2 shows that Patients with vitamin D deficiency demonstrated significantly higher rates of severe osteoarthritis compared with those having sufficient vitamin D levels. This finding suggests a strong association between hypovitaminosis D and disease severity.

Table 3. Correlation Between Vitamin D Levels and OA Severity Score

Variable	Correlation Coefficient (r)	p-value
Vitamin D vs OA Severity	-0.48	<0.001

Table no 3 shows that A moderate negative correlation was observed between serum vitamin D concentration and osteoarthritis severity, suggesting that lower vitamin D levels were associated with more advanced radiographic disease.

Discussion

The present study demonstrated a significant inverse association between serum vitamin D levels and osteoarthritis severity. Patients with vitamin D deficiency exhibited a substantially higher prevalence of severe radiographic osteoarthritis. These findings are consistent with the review by Mabey and Honsawek, who reported that vitamin D deficiency may contribute to cartilage degeneration, muscle weakness, and progression of osteoarthritis. [2]

Park et al. observed that lower vitamin D concentrations were associated with worsening symptoms and radiographic progression in knee osteoarthritis. [8,9] Furthermore, several meta-analyses have reported that vitamin D supplementation may improve pain and functional outcomes in patients with knee osteoarthritis, although evidence regarding structural disease modification remains inconclusive. [10] The observed negative correlation in the present study supports the hypothesis that vitamin D may influence cartilage metabolism and disease progression. Nevertheless, longitudinal studies are needed to establish causality.

Conclusion

Vitamin D deficiency was highly prevalent among patients with osteoarthritis. Lower serum vitamin D levels were significantly associated with greater radiographic severity of osteoarthritis. Routine assessment of vitamin D status may aid in identifying patients at increased risk of severe disease. Correction of vitamin D deficiency may represent an adjunctive strategy in osteoarthritis management.

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