

**PHENOTYPE-SPECIFIC DIFFERENCES IN SERUM VITAMIN D AND
CALCIUM LEVELS IN PATIENTS WITH OSTEOARTHRITIS**

**Kurbonova Zumrad Chutbayevna¹, Saidrasulova Gulizebo Baxtiyorovna²,
Nuriddinova Shahlo Fazliddinovna³**

¹ **Kurbonova Zumrad Chutbayevna**- Associate Professor (Dotsent), DSc, Tashkent State Medical University (TDTU), Tashkent, Uzbekistan

² **Saidrasulova Gulizebo Baxtiyorovna**- Senior Lecturer of the 1st Department of Propaedeutics of Internal Diseases, PhD, Tashkent State Medical University (TDTU), Tashkent, Uzbekistan

³ **Nuriddinova Shahlo Fazliddinovna**- Master's Degree Holder, Department of Hematology, Transfusiology and Laboratory Work, Tashkent State Medical University (TDTU), Tashkent, Uzbekistan

Abstract

This thesis investigates phenotype-specific differences in serum vitamin D and calcium levels among patients with osteoarthritis (OA). A total of 139 patients with OA were classified into three clinical-pathogenetic phenotypes: metabolic (n=64), inflammatory (n=49), and post-traumatic (n=26). Serum calcium and vitamin D concentrations were measured using standard biochemical methods. Statistical analysis showed no significant differences in calcium levels across the groups: 1.99 ± 0.07 mmol/L (metabolic), 2.00 ± 0.08 mmol/L (inflammatory), and 1.97 ± 0.05 mmol/L (post-traumatic). In contrast, vitamin D levels differed significantly, with the highest values observed in the inflammatory phenotype (8.99 ± 1.77), followed by the metabolic phenotype (8.37 ± 1.79), and the lowest in the post-traumatic phenotype (7.69 ± 1.29). These findings suggest that vitamin D deficiency is more pronounced in post-traumatic OA and may be linked to altered joint remodeling processes after injury. The results highlight the importance of assessing vitamin D status for a better understanding of OA heterogeneity and for developing phenotype-oriented diagnostic and therapeutic approaches.

Keywords: Osteoarthritis; Vitamin D; Calcium; Osteoarthritis phenotypes; Metabolic phenotype; Inflammatory phenotype; Post-traumatic phenotype; Bone metabolism.

Background

Osteoarthritis (OA) is one of the most prevalent chronic musculoskeletal diseases and a major cause of disability worldwide. Although OA has long been considered a degenerative joint disorder, recent studies suggest that inflammatory and metabolic mechanisms also play an important role in its pathogenesis. Vitamin D is a key regulator of calcium metabolism and bone remodeling and is involved in immune modulation and cartilage homeostasis. Insufficient vitamin D levels may contribute to structural joint changes, increased inflammatory activity, and progression of osteoarthritis. Investigating vitamin D status in different OA phenotypes may help better understand disease heterogeneity.

Objective

To evaluate serum levels of vitamin D and calcium in patients with different clinical phenotypes of osteoarthritis and to determine possible differences between these groups.

Materials and Methods

The study included 139 patients diagnosed with osteoarthritis. Based on clinical and pathogenetic characteristics, the patients were categorized into three phenotype groups: metabolic phenotype (n=64), inflammatory phenotype (n=49), and post-traumatic phenotype (n=26). Blood samples were collected from all participants, and serum concentrations of vitamin D and calcium were determined using standard biochemical laboratory methods. The results were expressed as mean \pm standard deviation (M \pm SD). Statistical analysis was performed to assess differences between the groups.

Results

The analysis demonstrated no statistically significant differences in serum calcium levels among the studied phenotypes. Calcium concentrations were 1.99 ± 0.07 mmol/L in the metabolic phenotype group, 2.00 ± 0.08 mmol/L in the inflammatory phenotype group, and 1.97 ± 0.05 mmol/L in the post-traumatic phenotype group. In contrast, serum vitamin D levels showed significant variation between the groups. The inflammatory phenotype exhibited the highest vitamin D concentration (8.99 ± 1.77), followed by the metabolic phenotype (8.37 ± 1.79), while the lowest level was observed in the post-traumatic phenotype (7.69 ± 1.29). These findings indicate that vitamin D deficiency may be more pronounced in patients with post-traumatic osteoarthritis.

Conclusion

The study revealed phenotype-specific differences in serum vitamin D levels among patients with osteoarthritis, whereas calcium levels remained relatively stable across groups. The lowest vitamin D concentration observed in the post-traumatic phenotype suggests a possible relationship between vitamin D status and post-injury joint remodeling processes. Assessment of vitamin D levels may therefore be useful in



understanding the biological mechanisms of osteoarthritis and in developing phenotype-oriented therapeutic strategies.

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