



## Estimation of the levels of Vitamin K<sub>2</sub> and Vitamin D<sub>3</sub> in women patients with osteoporosis and heart diseases

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### Abstract

A Cross-Sectional study that includes an assessment of the relation of the physiological and immunological factors among postmenopausal women with osteoporosis and heart diseases who attended Samarra General Hospital in Salah AL-Din Governorate. The study started from January 2022 to November 2022 on a study population whose ages ranged from 45-70 years, their total number is 100 women, 25 of whom are healthy women who are considered as a control group, and 75 of them are represented by groups of patients that were distributed into three main groups: 25 women with Heart disease only include myocardial infarction and 25 women with osteoporosis only and 25 women with Heart disease and osteoporosis blood samples were collected from patients and healthy subjects and then serum separated for testing. The present study was designed to obtain more clarification of some Antioxidant changes in women patients with osteoporosis and heart diseases and Body mass index. and find out the role of some Biochemical parameters like Vitamin K<sub>2</sub> and vitamin D<sub>3</sub> in the serum of women patients with osteoporosis and heart diseases the result of biochemical parameters including Vitamin K<sub>2</sub> and vitamin D<sub>3</sub> showed significant decreases ( $P < 0.05$ ) in patient groups comparison with the control group.

**Keywords:** Osteoporosis, heart disease, serum analysis, Vitamin K<sub>2</sub> and D<sub>3</sub> levels.

### Introduction

Osteoporosis (OP) is a prevalent condition globally, especially as individuals age. It is characterized by a reduction in bone mineral density, which significantly increases the susceptibility to fragility fractures. Traditionally, osteoporosis has been primarily perceived as a metabolic bone disease (Azeez, 2022). However, it is crucial to recognize that osteoporosis is a chronic condition, and age-related bone loss, often coupled with estrogen deficiency, plays a pivotal role in its development.

The connection between osteoporosis and cardiovascular health is a topic of growing interest. Declining estrogen levels, which commonly occur during menopause and as women age, have been associated with an increased risk of cardiovascular disease. This hormonal change can have implications for bone health and the cardiovascular system.

Numerous clinical studies have delved into the intricate relationship between atherosclerosis and osteoporosis. (Stojanovic et al., 2011; Mo et al., 2022). Atherosclerosis is a condition where arterial walls accumulate fatty deposits, leading to narrowed and hardened arteries. These two seemingly distinct diseases share some common pathophysiological mechanisms.

For instance, chronic inflammation and altered lipid metabolism can contribute to both atherosclerosis and bone loss (Wang, et al., 2022). When we consider these shared mechanisms, it raises the intriguing possibility that interventions aimed at preventing bone loss may also have a beneficial impact on slowing down the progression of atherosclerosis. This connection suggests that addressing one condition could have a positive influence on the other, ultimately improving the overall health and well-being of

individuals at risk for both osteoporosis and atherosclerosis (Wu et al., 2020).

Osteoporosis, although traditionally viewed as a bone-related disorder, is increasingly recognized as a complex, multifaceted condition with links to cardiovascular health. Understanding the shared mechanisms and risk factors between osteoporosis and atherosclerosis is essential for developing more comprehensive strategies for prevention and treatment, particularly in aging women.

**Material and Methods**

A cross-sectional study was done in Samarra General Hospital on patients from Samarra, in Salah-Alddin governorate. The study started from January to November 2022 on the study population age ranged from (45 to 70) years old. The total subjects were 100 female individuals 25 individuals as a control group and 75 individuals' patient groups, who volunteered to take part in the research were recruited and separated into four main groups as follows:

**Group 1:** Twenty-five subjects, apparently normal and healthy as control.

**Group 2:** Twenty-five Patients with Heart disease and osteoporosis

**Group 3:** Twenty-five patients with heart disease (MI) only

**Group 4:** Twenty-five patients with osteoporosis only  
Serum samples treatment

Approximately 5 ml of fasting human blood was collected from each subject (patients and control) transferred into sterilized test tubes and allowed for 30 minutes to clot at room temperature, the sample was centrifuged for 15 minutes at 3000 rotations per minute and the serum was immediately separated and stored at (-20°C) till used for Vitamin K<sub>2</sub> (Vit K<sub>2</sub>), Vitamin D<sub>3</sub> (VitD<sub>3</sub>)

**Determination Vitamin K<sub>2</sub> (Vit K<sub>2</sub>) in serum**

Vitamin K<sub>2</sub> concentration in the serum of osteoporosis with heart disease patients was estimated depending on the kit procedure is an Enzyme-Linked Immunosorbent Assay (ELISA) from Bioassay Technology, China.

**Determination of Vitamin D<sub>3</sub> (Vit D<sub>3</sub>) in serum**

Vitamin D<sub>3</sub> concentration in the serum of osteoporosis with heart disease patients was estimated depending on the kit procedure is an Enzyme-Linked Immunosorbent Assay (ELISA) from Bioassay, Technology, China.

**Statistical analysis**

All data were presented as a mean ± standard deviation by ANOVA test and to compare the mean of different variables used Duncan multiple range test. The significant level is P value ≤ 0.05.

**Results and Discussion**

**Vitamin D<sub>3</sub> (Vit D<sub>3</sub>)**

The results in Table (1) showed a significant decrease (p<0.05) in groups of osteoporosis, Heart disease, and osteoporosis with heart disease in comparison with the control group.

**Table 1: Vitamin D<sub>3</sub> (ng/ml) in control and Patient groups**

Groups	No. of Individuals	Vitamin D <sub>3</sub> (ng l/ml)
Control	25	9.20±1.30a
Osteoporosis	25	6.50±0.90b
Heart disease	25	5.30±0.70c
Osteoporosis with Heart disease	25	4.10±0.30 d

In the present study, Serum levels of Vitamin D<sub>3</sub> (Vit.D<sub>3</sub>) were significantly decreased (p<0.05) in postmenopausal osteoporosis and heart disease women when compared with the control group. This finding agrees with previous results that women after menopause suffering from vitamin D deficiency, (Kharroubi et al., 2017)

Several factors impact vitamin D<sub>3</sub> levels including nutrition, sun exposure, age, eating habits, lifestyle, metabolic, genetic, as well as other biological influences (Neville et al, 2021). In the Middle East, ample sunlight is accessible throughout the year; but owing to cultural and socioeconomic issues, women's exposure to sunlight is limited. Furthermore, the lack of screening programs, a lack of knowledge of the condition, and insufficient guidance on the need for regular consumption of dairy products and vitamin D-rich foods all contribute to postmenopausal women's significant vitamin D deficit. Furthermore, bad socioeconomic situations, such as low income and a big family number, exacerbate the problem. (Abd-Alhameed, 2010)

Menopause causes a decrease of skeletal mass due to an imbalance between bone reabsorption and bone production induced by ovarian function decline. As a result, it is thought that the loss of ovarian functions is the most critical component in the development of postmenopausal osteoporosis (Wang et al., 2023).

Calcium metabolism, osteoblastic activity, matrix ossification, bone mineral density, and bone remodeling have all been demonstrated to be harmed by vitamin D deficiency. Decreased levels of vit D<sub>3</sub> in the blood are linked to secondary hyperparathyroidism, faster bone turnover, lower BMD, and an elevated chance of osteoporotic fractures. (Cashman et al., 2016).

### Vitamin K<sub>2</sub> (Vit K<sub>2</sub>)

The results in Table (2) showed a significant decrease (p<0.05) in groups of osteoporosis, heart disease, and osteoporosis with heart disease in comparison with the control group.

**Table 2: Vitamin K<sub>2</sub> (ng/ml) in control and Patient groups**

Groups	No. of Individuals	Vitamin K <sub>2</sub> (ng/ml)
Control	25	17.40±2.40a
Osteoporosis	25	9.30±1.70b
Heart disease	25	7.90±1.20c
Osteoporosis with Heart disease	25	4.80±0.90 d

In the present study, Serum levels of Vitamin K<sub>2</sub> (Vit.K<sub>2</sub>) were significantly decreased (P ≤ 0.05) in postmenopausal osteoporosis and heart disease women when compared with normal healthy control. This finding agrees with the results, (Wen, et al, 2018).

Vitamin K, well known for its role in blood coagulation, has intrigued the scientific community because of its potentially beneficial effect on bone and fractures (Rodríguez and Curiel, 2019).

Vitamin K<sub>2</sub> serves an important role in cardiovascular health through the regulation of calcium homeostasis. Its effects on the cardiovascular system are mediated through activation of the anti-calcific protein known as matrix Gla protein. In its inactive form, this protein is associated with various markers of cardiovascular diseases (Hariri et al., 2021)

Another anabolic pathway has been shown for vitamin K. It has been found that vitamin K can regulate the transcription of bone-specific genes required for the expression of osteoblastic markers (Stock and Schett et al., 2021).

In addition to the anabolic effects, vitamin K may exert some anti-resorptive effects explained through other pathways. Vitamin K may be able to affect bone turnover and suppress osteoclast genesis through three alternative mechanisms: 1) inhibition of the nuclear factor kappa B; 2) regulation of the expression of interleukin-6 (Popa et al., 2021) inhibition of prostaglandin E2 (Rodríguez-Olleros and Diaz . 2019).

Vitamin K<sub>2</sub> is a potential treatment for the primary prevention of osteoporotic fractures. In a meta-analysis of seven clinical trials in elderly Japanese populations, vitamin K<sub>2</sub> at a dose of 45 mg/day significantly reduced vertebral (Ma et al., 2022).

### Conclusion

The study revealed several significant findings. First, there were notable reductions in antioxidant levels in the groups of women with heart disease, osteoporosis, and both conditions, compared to the control group. This suggests that these patients may have altered antioxidant status, which could have implications for their overall health.

Secondly, the study showed that vitamin K<sub>2</sub> levels were significantly lower in the patient groups compared to the control group, indicating a potential role for vitamin K<sub>2</sub> in the development and progression of both heart disease and osteoporosis in postmenopausal women.

Finally, vitamin D<sub>3</sub> levels were also found to be significantly decreased in the patient groups, highlighting the potential importance of vitamin D<sub>3</sub> in the context of these health conditions.

In conclusion, this study establishes a significant relationship between physiological and immunological factors in postmenopausal women with osteoporosis and heart diseases. The observed reductions in antioxidants, vitamin K<sub>2</sub>, and vitamin D<sub>3</sub> levels in these patient groups compared to healthy individuals suggest these factors may be pivotal in the pathophysiology of these conditions. Further research is necessary to better understand these relationships and develop potential interventions to improve the health of postmenopausal women affected by these conditions. This study offers crucial insights to guide future research and medical strategies for this specific patient population.

### Conflict of Interest

The author hereby declares no conflict of interest.

### Consent for publication

The author declares that the work has consent for publication.

### Ethical Considerations

The study was approved by the institutional ethical committee.

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