

## EFFECTIVENESS OF MUTUAL APPLICATION OF VITAMINS D AND K

Harrush Hamza

Scientific supervisor: Seniuk I.V.

National University of Pharmacy, Kharkiv, Ukraine

citochrom@gmail.com

**Introduction.** Vitamins D and K are both fat-soluble vitamins and play a central role in calcium metabolism. Vit. D promotes the production of vit. K-dependent proteins, which require vit. K for carboxylation in order to function properly. The role of vit. K in cardiovascular health has mainly been studied in isolation; however, a growing body of evidence suggests a synergistic effect of vit. K combined with vit. D.

**Aim.** The purpose of this narrative review is to summarize available evidence in the field of the synergistic interplay between vitamins D and K on bone and cardiovascular health.

**Materials and methods.** A literature search was conducted in PubMed, Scopus and Web of Science databases using keywords.

**Research results.** Human osteoblast cell cultures indicate that glycoxidation interferes with the maturation of osteoblasts; however, this process may be counterbalanced by adding vitamins D and K, which reverses the detrimental glycoxidation on several bone markers. Therefore, the addition of vitamins D and K may induce important biochemical changes in bone, which may exert therapeutic effects on bone metabolic diseases such as osteoporosis.

Besides bone health, also, the interaction between vitamins D and K with regard to cardiovascular health receives growing research interest. Matrix Gla protein (MGP) – the vascular marker of vit. K status – needs  $\gamma$ -glutamate carboxylation to inhibit vascular calcification. In an experimental rat model, warfarin was administered to induce vit. K deficiency and caused arterial calcification, which was accelerated when given toxic doses of vit. D and resulted in premature death.

A few studies show some potential for the combined effect of vitamins D + K versus D alone on subclinical CVD risk markers. It should be noted that very few clinical studies have been conducted in this field and that vit. D + K supplements have been often combined with different micronutrients making it difficult to solely pinpoint the effect of vit. D + K. These limited studies indicate that joint supplementation might benefit cardiovascular health.

Another pathway that might affect CVD risk is via disturbances in glucose metabolism. Among Iranian vit. D-deficient women with polycystic ovary syndrome – a dysmetabolic disorder – cosupplementation of calcium and vitamins D and K for 8 weeks improved markers of insulin metabolism and lipid concentrations compared to placebo. The joint supplementation of vitamins D and K might improve insulin metabolism through an effect on upregulation of the insulin receptor genes, the regulation of insulin secretion from the pancreatic  $\beta$ -cell, the enhancement of  $\beta$ -cell proliferation, and suppression of parathyroid hormone. The joint supplementation of calcium with vitamins D and K had beneficial effects on endocrine and oxidative stress markers, however no effect on inflammatory markers.

A large group of people uses both vit. D and calcium for the prevention of falls and fractures. Given the fact that 25(OH)D is converted to 1,25(OH)D, vit. D supplementation stimulates the production of 1,25(OH)D. This means that long-term vit. D supplementation could promote the production of large amounts of vit. K-dependent proteins, which remain inactive because there is not enough vit. K to carboxylate (Fig. 1). A new hypothesis that if vit. D concentrations are constantly high, there might not be enough vit. K for activation of vit. K-dependent proteins. Consequently, excess vit. D diminishes the ability of vit. K-dependent proteins to function properly, to stimulate bone mineralization, and to inhibit soft tissue calcification.

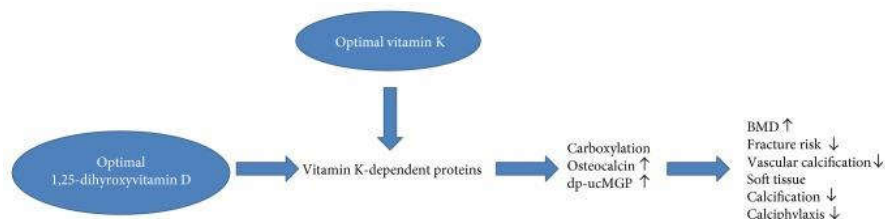


Figure 1. Simplified overview of potential synergy between vitamins D and K and bone and cardiovascular health. dp-ucMGP: dephosphorylated-uncarboxylated matrix Gla protein: Osteopenia is a loss of bone mineral density (BMD): bone mineral density

Genetic, molecular, cellular, and human evidence support those optimal concentrations of both vit. D and vit. K are beneficial for bone and cardiovascular health. Vit. K is needed for the carboxylation of vit. K-dependent proteins such as osteocalcin and matrix Gla protein, while vit. D promotes the production of vit. K-dependent protein concentrations. These vit. K-dependent proteins are needed for extrahepatic organs such as the bone and the vascular system. This will result in bone mineralization and will inhibit soft tissue calcification, which will ultimately lead to lower risks of fractures and coronary heart disease.

**Conclusions.** Taken together, animal and human studies suggest that optimal concentrations of both vit. D and vit. K are beneficial for bone and cardiovascular health as supported by genetic, molecular, cellular, and some human studies. However, vit. D and calcium supplementation along with vit. K deficiency might also induce long-term soft tissue calcification and CVD, particularly in vit. K antagonist users and other high-risk populations. At this moment, we should be careful about supplementing high-dose vit. D, unless indicated differently. More clinical data about the potential interplay between vit. D and vit. K metabolism is urgently needed before broader treatment recommendations can be given. The consumption of a well-balanced diet is key for population-based primary prevention of chronic diseases. As more is discovered about the powerful combination of vitamins D and K, it gives a renewed reason to eat a healthy diet including a variety of foods such as vegetables and fermented dairy for bone and cardiovascular health.

## HEREDITARY HUMAN DISEASES

Hasnae Maajaoui

Scientific supervisor: Galuzinska L.V.

National University of Pharmacy, Kharkiv, Ukraine

ljubvgaluzinskaja@ukr.net

**Introduction.** Did you know that we can pass on genetic disorders to our children, even if we do not suffer from them ourselves? In fact, we only need to be carriers to pass them down our offspring. In other words, even if we have not developed symptoms, if we are carriers, our children are at risk of inheriting the disorder. We can also develop hereditary diseases if an error occurs during foetal formation; these are the cases where the parents are not carriers.

**Aim.** The purpose of the study is to analyse scientific research on hereditary disorders and how they can be passed down from generation to generation.

**Materials and methods.** Analytical review of scientific literature on hereditary diseases

**Research results.** A genetic disorder occurs when one or more genes are altered. If this genetic alteration is passed on to offspring, then it is a hereditary genetic disorder. Therefore, we should clarify