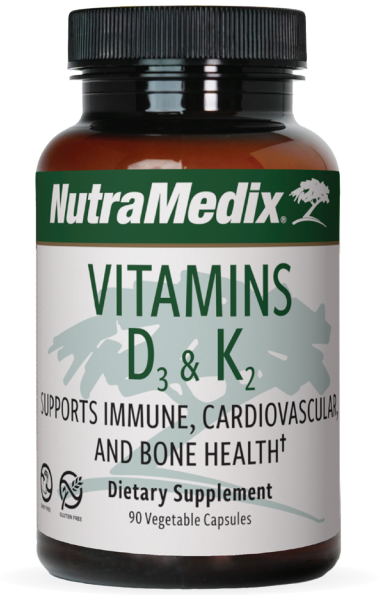
VITAMINS D_3 & K_2

NutraMedix

APPLICATIONS

- Immune System Support
- Cardiovascular Support
- Bone Health Support
- Neurological Support
- Vitamin Support



INTRODUCTION

Vitamin D is a fat-soluble vitamin that may be synthesized in the body through a multi-step process. UVB rays convert 7-dehydro-cholesterol in the skin to pre-vitamin D3, which is converted to D3 (cholecalciferol). Cholecalciferol is hydroxylated to calcidiol (25(OH)D) in the liver, and then to calcitriol (1,25(OH)2D) in the kidneys, at which time it is biologically active.[1] The amount of vitamin D produced depends on several factors including latitude, season, skin exposure, skin color, and liver and kidney health.[2]

While outright vitamin D deficiency is rare, low vitamin D status may affect up to 75% of U.S. adults.[3] In supplement form, vitamin D is available as cholecalciferol (D3) or ergocalciferol (D2). D3 is more effective than D2 at maintaining vitamin D levels already within the normal range.*[4] The DRI for Vitamin D is 15 mcg/day (600 IU) for ages 1-70 and 20 mcg/day (800 IU) for ages 70 and older,[2] as the ability to synthesize vitamin D declines with age.[2] Significant dietary sources of vitamin D include rainbow trout, sockeye salmon, eggs, and beef liver. Foods such as cow's milk and alternative plant milks are often fortified with vitamin D. Mushrooms, when treated with UV light, are a vegetarian source of vitamin D.[5]

Vitamin K is a fat-soluble vitamin that can be synthesized by colonic bacteria in the form of menaquinones (K2). Vitamin K encompasses a group of compounds with the chemical structure 2-methyl-1,4-naphthoquinone.[6] Deficiency is rare in adults, and when present, is usually from malabsorption, as occurs in celiac disease, in ulcerative colitis, or from bariatric surgery.[7,8] The adult DRI for Vitamin K is 90 mcg/day in women and 120 mcg/day in men.[9]

Food sources of vitamin K1 include leafy green vegetables and soybeans, while food sources of vitamin K2 include dairy, fermented foods and animal foods.[5,8] As a dietary supplement, Vitamin K is available as K1 or K2, the latter of which is preferred due to better absorption and bioavailability.*[9,10] Of the K2 menaquinones, MK-4 and MK-7 are the most commonly available. While both are well-absorbed, the MK-7 form is preferred due to a longer half-life.*[7,12]

Together, D3 and K2 have synergistic roles in both bone and cardiovascular health.* Vitamin D supports the production of vitamin-K-dependent proteins such as osteocalcin and matrix Gla protein, while vitamin K allows for their carboxylation and function.[13,14] Studies suggest that their concurrent use may be more effective than either alone.*[13]

IMMUNE SYSTEM SUPPORT

Vitamin D receptors and 1-alpha hydroxylase, the enzyme that converts calcidiol to active calcitriol, are found on a variety of immune cells.[15,16] In innate immunity, vitamin D helps support healthy monocyte function; in adaptive immunity, vitamin D may help to support immune tolerance and homeostasis.*[16,17,18] Vitamin D may help maintain cytokines already within the normal range, and may additionally help to maintain dendritic cell function and T cell function already within the normal range.*[19] Vitamin D 5000 IU may help with immune support, particularly during the winter season.*[20] Other amounts have also been protective.*[21]

CARDIOVASCULAR SUPPORT

Vitamin D levels are associated with cardiovascular health.*[22] Vitamin D may help to support heart health by maintaining insulin sensitivity, blood glucose, and blood lipids already within the normal range.*[23] It may also help with homeostatic support of the renin-angiotensin-aldosterone system (RAAS).*[24] Vitamin K is needed for the gamma-carboxylation of matrix Gla protein, which is important for vascular health.*[25]

BONE HEALTH SUPPORT

Vitamin D helps with bone support by facilitating the absorption of dietary calcium and regulating calcium and phosphorus.*[26] Vitamin D also helps to maintain PTH already within the normal range, maintaining the calcium in bones and supporting normal bone density.*[27] Vitamin K is needed for the gamma-carboxylation of osteocalcin, which is important for normal bone mineralization.*[28,29,30] Vitamin D3 at 5,000 IU per day may help to maintain normal z scores ($p<0.001$) and may help with postmenopausal bone support.*[31]

Vitamin K2, both alone and with D3, helps to support bone health in early postmenopausal women ($p<0.005$), as evidenced by the maintenance of serum undercarboxylated osteocalcin (ucOC) already within the normal range.*[32] Vitamins K2 and D3 together may help to maintain intact osteocalcin (OC) and bone alkaline phosphatase (BAP), serum markers of bone formation, already within the normal range ($p<0.05$), though K2 alone did not show these benefits.*[32]

OTHER USES

Neurological Support

Vitamin D receptors have been found in neurons and glial cells, and vitamin D may help with neurological support.*[33,34] Vitamin D has many roles in the nervous system, including the regulation of neurotransmitter synthesis.*[33] It may help microglia to maintain levels of cytokines, IL-6, IL-12, and TNF-alpha already within the normal range.*[35] Vitamin D may support healthy cognition and help to maintain A-beta-related biomarkers already within the normal range.*[36] Vitamin K may help to support healthy proliferation, differentiation, and lifespan of brain cells through its role in sphingolipid metabolism, which may help to support healthy cognition.*[37]

Vitamin Support

This product includes 125 mcg (5000 IU) of vitamin D3 as cholecalciferol, which is 625% of the Dietary Reference Intake (DRI). This product also includes 150 mcg of vitamin K2 as Menaquinone-7, which is 125% of the DRI.[2,9]

SAFETY AND CAUTIONS

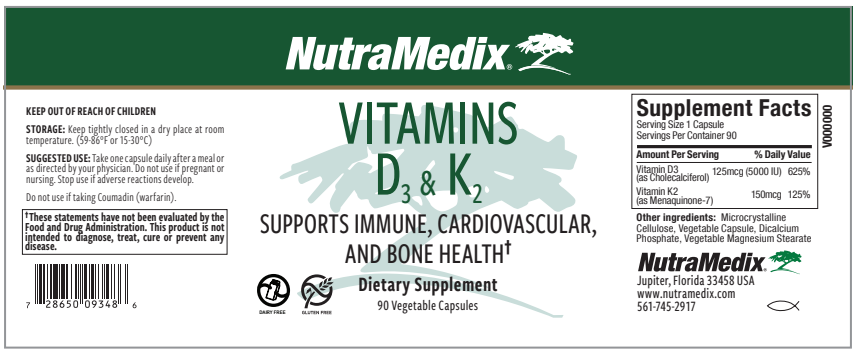
Vitamin D is generally well tolerated. Numerous studies have used a dose of 5,000 IU/day safely and without adverse effects.[38,39] Long-term, high-dose vitamin D may result in hypercalcemia, azotemia, or anemia.[40] Possible side effects of vitamin D toxicity include hypertension,[40] pancreatitis,[40] elevated INR,[41] osteoporosis,[40] or

kidney stones.[42] Vitamin D may increase the absorption and toxicity of aluminum in patients with kidney failure.[43] Vitamin D may induce CYP3A4 enzymes, which may decrease absorption of CYP3A4 substrates such as atorvastatin.[40] Taken concurrently with thiazide diuretics, Vitamin D may increase the risk for hypercalcemia,[44] which may decrease the effectiveness of anti-arrhythmics.[45]

Vitamin K is generally well tolerated. Side effects may include nausea, stomach upset, and diarrhea.[46] This supplement should not be taken with warfarin, as Vitamin K antagonizes the anticoagulant effects.[47]

Safety not documented in breastfeeding or pregnant women, or in children under 3 years of age due to insufficient safety research.

*** This statement has not been evaluated by the Food and Drug Administration. This product is not intended to treat, cure, or prevent any diseases.**



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