

D3 & K2 OPTIMAL

**NORTH
CENTURY
PHARMACY**

Clinical Applications

- Supports Bone Health*
- Promotes Carboxylation of Bone Proteins*
- Supports Cardiovascular Health and Arterial Elasticity*

*D3 & K2 Optimal is formulated for those who need a more substantial presence of vitamin K2, delivering 180 mcg per serving. The combination of highly bioavailable and bioactive menaquinone-7 (MK-7) with vitamin D3 provides complementary benefits for bone and cardiovascular health.**

All North Century Pharmacy Formulas Meet or Exceed cGMP Quality Standards

Discussion

Vitamin K (as MK-7)

The body has limited vitamin K storage capacity compared with other lipophilic vitamins. Vitamin K rapidly depletes without regular dietary intake, yet a small reserve is recycled through a complex oxidation–reduction cycle. The primary function of vitamin K is as a cofactor in producing blood coagulation factors in the liver. Vitamin K also has rather complicated physiological roles in the carboxylation of the proteins involved in promoting bone mineralization and inhibiting arterial calcification.^{1,2} These physiological roles directly affect bone health and arterial elasticity, respectively.^{*2,3}

Supplemental vitamin K can be found in the 3 following forms: synthetic K1; menaquinone-4 (MK-4), which is structurally similar to K1; and natural, long-chain menaquinone-7 (MK-7), which provides the highest vitamin K activity.⁴ Structural variations between K1 and K2 impact their bioavailability and bioactivity. Menaquinone-7, with its longer side chain, is very hydrophobic. Compared with K1, the physiochemical properties of MK-7 make it highly transportable by plasma lipoproteins, increase its extrahepatic (bones, arteries, etc) availability, and result in its long half-life.^{2,5,6} Findings from a series of studies comparing the in vivo properties of orally administered K1 and MK-7 demonstrated better bioavailability and utilization of MK-7.^{*2}

Bone Health

Through carboxylation, vitamin K activates osteocalcin, the protein needed to bind calcium to the mineral matrix in bone. A 2020 review concluded that MK-7 has the highest bioavailability and the most significant effect on human osteocalcin carboxylation.⁷ Several studies have demonstrated the efficacy of MK-7 in increasing the carboxylated-to-uncarboxylated osteocalcin (cOC:ucOC) ratio. A high cOC:ucOC ratio is associated with bone health.^{2,5,6,8} Results from phase 1 of a dose-finding, randomized, double-blind, placebo-controlled trial (N = 60) support that 100 mcg of MK-7 is an effective minimum dose for improving osteocalcin carboxylation. When phase 2 (N = 120) used the placebo or 100-mcg MK-7 dose for 12 weeks with a controlled diet, the test group showed a significant increase in the cOC:ucOC ratio compared with the placebo, confirming the improvement of bone health indices.⁵ In a randomized, double-blind, placebo-controlled trial in healthy postmenopausal women (N = 244), the test group subjects received 180 mcg of MK-7 daily for 3 years. Supplementation of MK-7 significantly improved vitamin K status, and a decrease was seen in measurements of age-related bone loss.^{*8}

Arterial/Cardiovascular Support

Vitamin K participates in the carboxylation of matrix GLA protein (MGP), a protein regarded as the most potent inhibitor of arterial calcification, and the intake of long-chain MK is inversely correlated with calcium accumulation in arteries.^{4,6,9} Conversely, during vitamin K insufficiency, MGP is produced in its inactive form, which is associated with increased cardiovascular risk.¹⁰ Arterial calcification makes arteries stiff and less able to expand and contract. In a double-blind, placebo-controlled trial, 244 healthy postmenopausal women were given 180 mcg/d of MK-7 and followed for 3 years using pulse wave velocity and ultrasound techniques to determine changes in local carotid and regional aortic stiffness. At the conclusion of the study, the Stiffness Index β in the MK-7 group had decreased significantly compared with a slight increase in the placebo group. Results confirmed that MK-7 inhibited age-related stiffening of the artery walls and significantly improved vascular elasticity.¹¹ Reviews of the research results evaluating the relationship between vitamin K2 and cardiovascular health suggest a reduction in the mortality rate related to arterial calcification with vitamin K2 intake.^{*4,12}

Vitamin D (as D3)

Vitamin D3 deficiency is common and widespread.¹³ Many factors can affect D3 biosynthesis, including time of day, seasons, location, smog/pollution, clothing, skin tone (darker skin requires more sun exposure), sunscreen use, low-cholesterol diets, and certain cholesterol therapies. The body needs vitamin D to absorb calcium, and the importance of vitamin D in skeletal health and bone density is well-established. Without adequate absorption, the body must take calcium from its skeletal stores, which weakens existing bone and prevents the formation of strong, new bone. Research results indicate that vitamin D deficiency coexists with low bone mineral density, and vitamin D insufficiency is a common risk factor for osteoporosis associated with increased bone remodeling and low bone mass.¹⁴ A pooled analysis evaluating 11 randomized, double-blind, placebo-controlled trials concluded that vitamin D supplementation (>800 IU daily) was favorable in maintaining hip and nonvertebral bone integrity in individuals aged 65 and older.^{*15}

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in skeletal health and bone density is well-established. Without adequate absorption, the body must take calcium from its stores in the skeleton, which weakens existing bone and prevents the formation of strong, new bone. Researchers suggest that vitamin D supplementation may decrease bone turnover and increase bone mineral density.^[19] A pooled analysis evaluating 11 randomized, double-blind, placebo-controlled trials supported this analysis. It concluded that vitamin D supplementation (> 800 IU daily) was favorable in maintaining hip and nonvertebral bone integrity in individuals aged 65 and older.^{*[20]}

Although D2 and D3 are similar biochemically, one study demonstrated D3 to be approximately 87% more potent in raising and maintaining serum calcidiol (the body's storage form) concentrations and in producing two- to threefold greater storage of vitamin D than did equimolar D2.^{*[21]}

[†]The cOC:ucOC ratio can be used as a determinant of vitamin K status.

K2 Vitamin D3 5000



Directions

Take one capsule daily, preferably at mealtime, or as directed by your healthcare professional.

Consult your healthcare professional prior to use. Individuals taking medication should discuss potential interactions with their healthcare professional. Consider total vitamin K intake (food + supplements) if you are taking blood-thinning medication. Do not use if tamper seal is damaged.

Formulated To Exclude

Wheat, gluten, yeast, soy protein, dairy products, fish, shellfish, peanuts, tree nuts, egg, ingredients derived from genetically modified organisms (GMOs), artificial colors, artificial sweeteners, and artificial preservatives.

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