THE D

Clinical Applications

- Supports Bone Health by Promoting Carboxylation of Bone Proteins*
- Supports Cardiovascular Health by Affecting Arterial Calcium Deposits*
- Supports Healthy Blood Clotting*

The D provide vitamin K2 as menaquinone-7 (MK-7), a highly bioavailable and bioactive form of K2. K2-D3 also features vitamin D3 (cholecalciferol), the identical form in which vitamin D is derived in the body from cholesterol and synthesized by sunlight on the skin. Historical use and numerous studies have demonstrated the efficacy of vitamin K supplements for bone and cardiovascular health.*

All MSW Nutrition Formulas Meet or Exceed cGMP Quality Standards

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Discussion

Naturally occurring vitamin K is found as either K1 (phylloquinone), which isderived from food sources such green leafy vegetables, or K2 (menaquinones).Menaquinones are designated as MK-n, where n denotes the length of themolecule's aliphatic side chain. Menaquinones are synthesized by bacteria andcan be obtained from animal-based and fermented foods. Structural differencesbetween K1 and K2 impact their bioavailability and bioactivity. Furthermore,among menaquinones, menaquinone-7 (MK-7), with its longer side chain, is veryhydrophobic. Compared to K1, MK-7's physiochemical properties make it highlytransportable by plasma lipoproteins, increase its extrahepatic (bones, arteries,etc.) availability, and produce its long half-life.[1-3]

Absorption of K1 from food can be limited due to its membrane-bound natureand the individual consumer's digestive and absorptive variability. Moreover,adequate consumption of foods high in K2 can be challenging. Therefore, dietarysupplementation is an important option. In addition, research suggests that higherlevels of menaquinones are needed than were previously thought. Supplementaryvitamin K can be found in three forms: synthetic K1; MK-4, which is structurallysimilar to K1; and natural, long-chain MK-7. XYMOGEN provides MK-7 asVitamk7™, a naturally derived and solvent-free vitamin K2 that has been obtainedthrough a patent-granted biofermentation process of Bacillus subtilis nattocultures.*

MK-7 Bioavailability Increases Extrahepatic Tissue Utilization

Schurgers et al conducted human studies to compare the in vivo properties oforally administered K1 and MK-7. The results supported better bioavailability andutilization of MK-7. Expressed as AUC_{96}, MK-7 demonstrated a six-fold betterhalf-life, a seven- to eight-fold higher dose-response level, and a three timeshigher carboxylated to uncarboxylated osteocalcin ratio (cOC:ucOC†). Furthermore,on a molar basis, MK-7 is a three-to-four times more potent antidote for oralanticoagulation than is K1. Researchers note that, aside from sensitive individuals,"MK-7 supplements containing more than 50 mcg/d may interfere with oralanticoagulant treatment, whereas doses of at least 50 mcg are not likely to affectthe INR value in a relevant way."[2] Nonetheless, practitioners should closelymonitor patients taking anticoagulants.*

While studies on the absorption and bioavailability of MK-4 at nutritional levels(i.e., doses of 500 mcg/d or lower) suggest less efficacy compared to longer-chainmenaquinones at similar doses,[4] this remains subject to debate. It is possible thatrapid uptake of MK-4 could account for its observed lack of detection in serumafter oral administration,[5] but more studies are needed for clarification.*

Bone Benefits

Among the dietary factors critical to bone health, vitamin K has emerged as a key player. Vitamin K is believed to be necessary for bone mineralization. ThroughBone BenefitsAmong the dietary factors critical to bone health, vitamin K has emerged as a keyplayer. Vitamin K is believed to be necessary for bone mineralization. Through carboxylation, vitamin K activates osteocalcin, the protein needed to bind calciumto the mineral matrix in bone.[6] Several studies have demonstrated the efficacyof MK-7 (e.g., doses of 45-90 mcg/d) to increase osteocalcin carboxylation andto increase the cOC:ucOC ratio. A high cOC:ucOC ratio is associated with bonehealth.[1,2,4] A recent in vitro study also showed an osteogenic effect of MK-7administration on human mesenchymal cell differentiation.[6] In addition, thevitamin may protect bone integrity by reducing the synthesis of prostaglandin E2or interleukin-6 by osteoclasts.[7]

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Animal and human studies have demonstrateda significant beneficial effect of MK-7 supplementation on bone health.[8-10]Vitamin K and vitamin D share some similar characteristics and are believed to actsynergistically.*[11]

Cardiovascular and Other Health Benefits

Vitamin K benefits cardiovascular health by participating in the carboxylation ofmatrix GLA protein (MGP), a protein regarded to be the most potent inhibitor ofarterial calcification. Researchers have demonstrated that supplementation withvitamin K reduces arterial calcium deposits[1,3,12] and that long-term intake oflong-chain menaquinones is inversely correlated with calcium accumulation inarteries.*[5]

Vitamin K has specific receptor binding sites that allow it to regulate geneactivity.[13] Besides its gene-mediating effects upon critical proteins, the vitamincan also bind with the steroid and xenobiotic receptors and influence theirexpression.[14] In addition, vitamin K also demonstrates antioxidant activity[15];reduces levels of certain markers, such as acute phase reactants (e.g., C-reactiveprotein)[16]; and participates in the induction of apoptosis.*[17]

Vitamin D (as D3)

Although vitamin D3 (cholecalciferol) is made in the skin when7-dehydrocholesterol reacts with sunlight, many things affect the degree towhich this biosynthesis occurs, including time of day, seasons, location, smog/pollution, clothing, shade of skin (darker skin requires more sun), and sunscreenuse. Low-cholesterol diets and certain cholesterol therapies can also affect vitaminD formation. By some estimates, one billion people worldwide have vitamin Ddeficiency or insufficiency.[18] The body needs vitamin D to absorb calcium, and theimportance of vitamin D in skeletal health and bone density is well-established.Without adequate absorption, the body must take calcium from its stores in theskeleton, which weakens existing bone and prevents the formation of strong,new bone. Researchers suggest that vitamin D supplementation may decreasebone turnover and increase bone mineral density.[19] A pooled analysis evaluating11 randomized, double-blind, placebo-controlled trials supported this analysis.It concluded that vitamin D supplementation (> 800 IU daily) was favorablein maintaining hip and nonvertebral bone integrity in individuals aged 65 andolder.*[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.

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Supplement Facts

Serving Size: 1 Capsule
Servings Per Container: 120

	Amount Per Serving	%Daily Value
Vitamin D3 (cholecalciferol)	125 mcg (5000 IU)	625%
Vitamin K2 (as menaquinone-7)	90 mcg	**

** Daily Value not established.

Other Ingredients: Capsule (hypromellose and water), microcrystalline cellulose, ascorbyl palmitate, and silica.

VEGETARIAN CAPS

Directions:

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

Consult your healthcare professional before use. Individuals taking blood thinners or other medication should discuss potential interactions with their healthcare professional. Do not use if tamper seal is damaged.

Storage:

Keep closed in a cool, dry place out of reach of children.

References

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Formulated To Exclude

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

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