

## Liquid D3 & MK-7

### TECHNICAL SUMMARY

Vitamins D<sub>3</sub> and K<sub>2</sub> have been extensively studied regarding their roles in calcium metabolism.\* Research indicates that a synergistic relationship exists between vitamin K<sub>2</sub> and vitamin D<sub>3</sub>, especially in terms of bone strength and cardiovascular health.\* While vitamin D<sub>3</sub> is recognized for its role in calcium absorption and metabolism, it is vitamin K<sub>2</sub> that directs calcium to bones rather than joint spaces and arteries.\* This product is formulated with a clinically relevant dose of MK-7, a unique, soy-free form of vitamin K<sub>2</sub> that has been shown to promote healthy vascular structures.\*

#### Structure Formula:

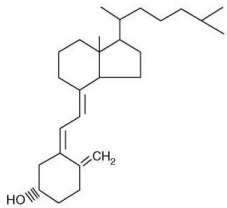


Figure 1: Vitamin D<sub>3</sub>

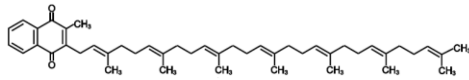


Figure 2: Vitamin K<sub>2</sub>. 7 isoprenyl units attached to a 2-methyl-1,4-naphthoquinone structure

#### Chemical Name:

Vitamin D<sub>3</sub>: Cholecalciferol (activated 7-dehydrocholesterol; (3β,5Z,7E)-9,10-secocholesta-5,7,10(19)-trien-3-ol)

Vitamin K<sub>2</sub>: 2-methyl-3-farnesylgeranylgeranyl-1,4-naphthoquinone (menaquinone-7; MK-7)

**Allergen and Additive Disclosure:** Not manufactured with wheat, gluten, soy, milk, egg, fish or shellfish ingredients. Cholecalciferol is from lanolin (sheep origin). MK-7 is produced using a soy-free substrate derived from chickpeas. Produced in a GMP facility that processes other ingredients containing these allergens.

**Delivery Form:** Liquid.

### ROLE AS NUTRIENT/FUNCTION

Vitamin K<sub>2</sub> is a generic term for a group of molecules of different sizes. This product has menaquinone-7 (Figure 2), a purified form of vitamin K<sub>2</sub> with unique biological properties. Vitamin K is essential for the proper function (gamma-carboxylation of glutamyl amino acid residues) of GLA-proteins in the body, including proteins involved in extracellular matrix mineralization such as osteocalcin in bones, and other matrix GLA-proteins (MGP) found in cartilage and artery walls.\* Clinical data suggest, for example, that MK-7 supplementation is able to induce prolonged carboxylation of osteocalcin and MGP in the blood.\*

Vitamin D<sub>3</sub>'s main function in the body is well established, allowing for the tight regulation of calcium levels in the blood, as well as phosphate homeostasis.\* In addition, more recent discoveries have shown that vitamin D is also involved in many other bodily functions such as regulation of cell proliferation, cell differentiation, immunomodulation, and cardiovascular health.\*

## Supplement Facts

Serving Size 5 Drops (approx. 0.184 mL)  
Servings Per Container about 163

	Amount Per Serving	% Daily Value
Vitamin D	62.5 mcg (2,500 IU)	313%
(as D <sub>3</sub> Cholecalciferol) (from Lanolin)		
Vitamin K <sub>2</sub>	100 mcg	†
(as Menaquinone-7) (MK-7) (MenaQ7®) (from chickpea)		

† Daily Value not established.

Other ingredients: Medium-Chain Triglycerides (MCT) Oil, Sunflower Oil, Safflower Oil, Soy-Free Vitamin E, Peppermint Oil and Rosemary Extract.

### • Bone and Cardiovascular Support\*

**SUGGESTED USAGE:** Shake well. Take 5 drops daily, or as directed by your healthcare practitioner. Take directly or add to a beverage. Best when taken with a fat-containing meal.

Preliminary data suggest that synergy exists between vitamin D<sub>3</sub> and vitamin K<sub>2</sub>.\* It appears that this synergy is the result of several combined biological functions, for example they are both involved in osteocalcin regulation in the body: vitamin D<sub>3</sub> regulates its production and vitamin K<sub>2</sub> is necessary for its activation.\*

### NATUROKINETICS®

**Liberation:** Liquid D3 & MK-7 is already in a convenient easily absorbable liquid form.

**Absorption:** Both vitamin D<sub>3</sub> and K<sub>2</sub> are fat-soluble vitamins. Following oral ingestion, MK-7 is rapidly and well absorbed in the intestine and enters

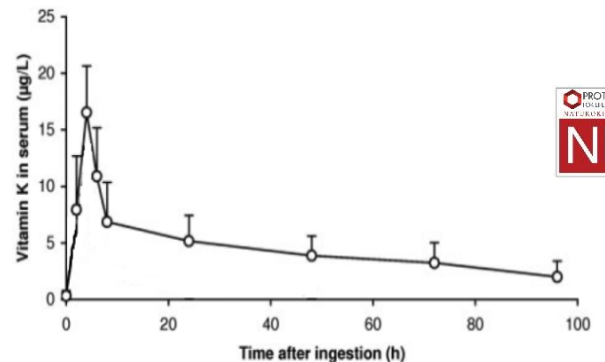


Figure 3: Circulating vitamin K concentrations following a single oral dose of 1 mg MK-7. Baseline level <0.05 mcg/L was subtracted from all values.

blood circulation via the lymphatic system as part of the chylomicron fraction of plasma (Figure 3).

Like vitamin K<sub>2</sub>, vitamin D<sub>3</sub> is absorbed with other dietary fats in the small intestine, enters the blood circulation via the lymphatic system and is transported in the chylomicron fraction of plasma.

Both vitamins K<sub>2</sub> and D<sub>3</sub> are most efficiently absorbed when consumed with foods containing fat.

**Distribution:** MK-7's distribution in tissues has not been yet fully elucidated; however, it is known to be present in the liver, pancreas, heart and bone lipids.

Once vitamin D enters the circulation, it is cleared by the liver or stored in fat tissues within a few hours. However, vitamin D deposited in fat is not readily available to exert its bodily functions.

**Metabolism:** In the bloodstream, chylomicrons carrying vitamin K are metabolized into chylomicron remnants, which are cleared by the liver. MK-7 metabolism in the liver is only partially known; it is most likely degraded through omega- and beta-oxidation and the obtained metabolites are then conjugated with glucuronic acid.

Vitamin D (cholecalciferol) is an inactive prohormone and must first be metabolized to its hormonal form before it can function. This metabolism is complex with a first phase occurring in the liver and a second phase in the kidney. It is tightly regulated by the parathyroid gland, which is sensitive to changes in blood calcium and phosphate levels.

**Elimination:** MK-7 has a long half-life. After oral ingestion it can be detected in the plasma for more than 48 hours and up to 92 hours. The products of MK-7 metabolism are excreted in the bile and urine.

The products of vitamin D metabolism are excreted through the bile into the feces, and very little is eliminated through the urine.

### CLINICAL VALIDATION

- In a 12-month, multi-group supplementation clinical study, 173 healthy post-menopausal women received dairy products enriched with Calcium (800 mg/d) & vitamin D (10 mcg/d) as well as either 100 mcg vitamin K<sub>1</sub> or 100 mcg MK-7. After 12 months of supplementation, authors observed a significant improvement of bone mass density in the lumbar spine and total body in the group receiving MK-7 compared to the control group (no supplementation) and baseline. (Figure 4)\*

### SAFETY INFORMATION

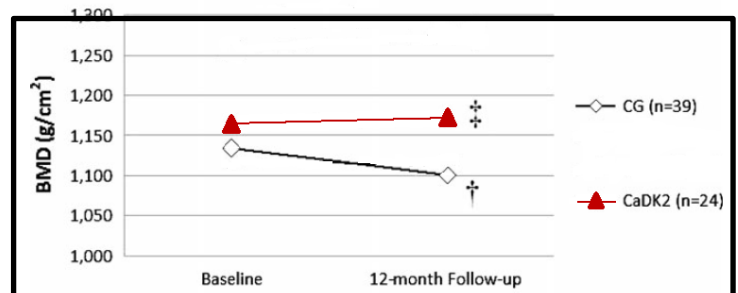
**Tolerability:** While vitamin D<sub>3</sub> is typically well tolerated, minor GI manifestations (nausea, abdominal discomfort) have been described with vitamin K<sub>2</sub> supplementation.

**Contraindications:** Individuals receiving vitamin K antagonists (VKA). Individuals with hypercalcemia.

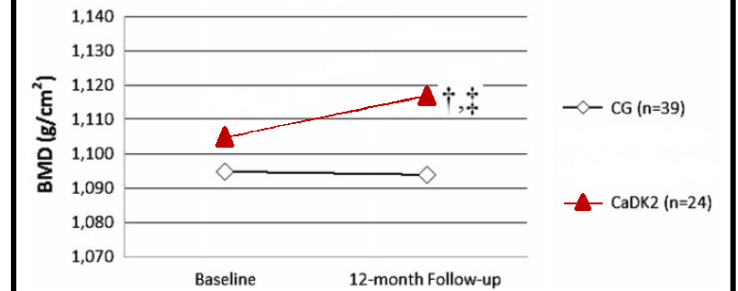
### INTERACTIONS

**Drug Interactions:** Possible interactions with cardiac glycosides, atorvastatin, thiazide diuretics, and anti-coagulant medication.

### Lumbar Spine (L2-L4)



### Total Body



**Supplement Interactions:** Vitamin D increases calcium and magnesium

Figure 4: Changes in lumbar spine and total-body bone mass density for women in the control group (CG) and the group receiving MK-7 (CaDK2). †p<0.05 compared to baseline value within group, ‡p<0.05 compared to control group. (Adapted from original publication presenting results for control group and MK-7 group only)

absorption and may therefore interact with calcium and magnesium supplementation.

Coenzyme Q10 is chemically similar to vitamin K<sub>2</sub> and can theoretically have vitamin K-like effects, including antagonism of warfarin. Concomitant use of coenzyme Q10 and vitamin K might cause additive effects and increase the risk of clotting in people taking anticoagulants.

**Interaction with Lab Tests:** Theoretically, blood calcium and urinary calcium may be modified by a combined supplementation with vitamin K<sub>2</sub> and vitamin D<sub>3</sub>. However this has not been clinically evaluated.

Osteocalcin blood levels can be increased by vitamin K<sub>2</sub> supplementation.

### STORAGE

Store in a cool, dry environment in sealed container. Store in ambient conditions (<80°F). Protect from excessive heat, moisture, air and light.