



K2VITAL
VITAMIN K2 MK-7

BONE HEALTH

Vitamin K2 Fact Sheet

K2VITAL® – Your Key to Optimal Bone Health

Calcium, vitamin D3 and vitamin K2 are the “tri-essentials” for optimal bone health.

Vitamin K2 :

- is needed to secure activation of osteocalcin, which facilitates binding of calcium to bones
- has been demonstrated to improve bone strength in women in a placebo controlled trial
- is involved in the calcium balance in the body and makes sure calcium gets into bones and out of vessel walls

The active compound in K2VITAL® is vitamin K2 in its natural form, the most efficient form of vitamin K; MK-7. Vitamin K2 is tested in numerous clinical trials and K2VITAL® is documented as safe.

Bones are a living substance, constantly renewed

The skeleton is built up by bone (hydroxyapatite) supplemented by ligaments, tendons, muscles and cartilage. Calcium is an important building block in the bone matrix. There are constantly bone building processes ongoing and the entire skeleton is replaced every seven years. Build-up cells (osteoblasts) and break-down cells (osteoclasts) regulate the strength of bones. When break-down cell activity dominates, the skeleton becomes fragile and this may result in development of osteoporosis.

After 30 years of age, bone mass is decreasing in both men and women (Figure1). Calcium supplement is especially important in the childhood/puberty and from the age of 30-35 and onwards. Post-menopausal women are particularly at risk for development of brittle bones, leading to fractures. Worldwide, lifetime risk of osteoporotic fractures in women and men is 30-50% and 15-30%, respectively (International Osteoporosis Foundation).

The importance of combining vitamin K2, vitamin D3 and calcium – “the tri-essentials”

The most widely used supplements to support bone health are calcium and vitamin D3. Vitamin D3 increases the intestinal uptake of calcium; the most important bone-building-mineral. Vitamin D3 also induces the synthesis of osteocalcin, which is responsible for incorporation of calcium into the bone matrix. Osteocalcin, however, is dependent on activation by vitamin K before it can react with calcium and build bone. Individuals with low vitamin K2 intake have a large fraction of non-activated osteocalcin, resulting in reduced capacity for

calcium binding. To secure an optimal bone building process, vitamin K2, vitamin D3 and calcium must work in concert: the “tri-essentials” for bone health.

Vitamin K2 needed for bone health at all ages

Clinical studies focusing on parameters important for bone health are long-term studies involving computerized scanning analysis of bone mineral density (BMD), bone mineral content (BMC) and bone strength as well as scores for bone fractures (hip, arm, vertebra).

Several studies have demonstrated favourable bone health effect of vitamin K2, especially with respect to bone strength and reduced incidences of bone fractures. Most studies have been carried out with high doses (drug doses) of the vitamin K2 as MK-4. Similar studies on effects of vitamin K2 as MK-7 are mainly based on intake of Natto (the traditional Japanese dish with exceptionally high content of MK-7). A statistically significant inverse correlation has been found between the relative incidence of hip fracture and intake of natto in Japanese women. (Yaegashi et al. 2008, Kaneki et al. 2001)

A recent study proves that MK-7 in dietary supplement doses is sufficient to improve bone strength. In a placebo controlled study in postmenopausal women, it was demonstrated that intake of 180 µg/day MK-7 as a dietary supplement for 3 years resulted in significant improvement of bone parameters such as bone mineral density (BMD), bone mineral content (BMC) as well as bone strength (Knäpen et al 2013)(Figure2).

Osteocalcin – a biomarker for vitamin K status

Osteocalcin (OC) is a bone-specific protein synthesized by osteoblasts (bone building cells). Vitamin K is a co-factor for activation of OC. It is well documented that vitamin K deficiency is correlated with high level of inactive OC (ucOC). Many investigations have revealed that the western populations in general is vitamin K2 deficient, indicating that their osteocalcin is not maximally activated; (i.e. high ucOC). Nutritional doses of MK-7 are effective in activation of OC and reducing

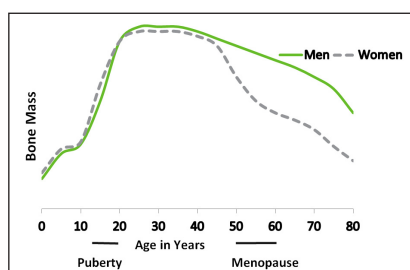


Figure 1: Bone mass as a function of age. During puberty a large increase in bone mass. From 50 years onwards a strong decrease in bone mass, particularly in females.

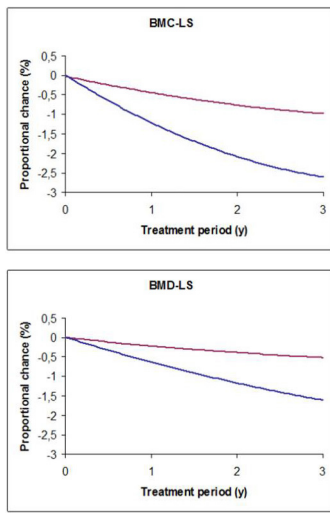


Figure 2: Three year placebo controlled study in post-menopausal woman, 180 µg/day MK-7. Effects on bone mineral content (BMC) and bone mineral density (BMD) at lumbar spine (Modified from Knapen et al 2013).

ucOC; a prerequisite for improved bone health.

Vitamin K and calcium

Can intake of too much calcium be harmful? What happens when OC is not activated, and calcium is not absorbed into the bone? Calcium will be deposited in the wrong place,

being in the blood stream, eventually depositing in the arterial walls and heart valves, increasing the risk of cardiovascular disease. Thus, calcium supplement intake without vitamin K2 can increase calcium deposition in the cardiovascular system, causing arterial stiffening and blockages that can lead to cardiovascular events.

Vitamin K – regulatory status and health claims

European Commission, the Panel on Dietetic Products, Nutrition and Allergies, Article 13, health claims in relation to vitamin K: Vitamin K is important for maintenance of normal bone.

High intake of MK-7 versus low intake of MK-7*	Reference
Strong correlation between high intake of natto (MK-7), MK-7 and bone health: Higher Bone Mineral Density Improved Bone strength Low serum level of ucOC Lower frequency of fractures	Fujita et al. 2011 Ikeda et al. 2006 Kaneki et al. Nutr. 2001
Vitamin K2 deficiency: Strong correlation between low serum vitamin K2 (and vitamin D) level and high serum ucOC level and fracture incidences.	Hodges et al. 1993 Arunakul et al. 2009 Nakano et al. 2001 Yaegashi et al. 2008

* Markers of healthy bones: High Bone Mineral Density (BMD), low serum concentration of under-carboxylated osteocalcin (ucOC), low frequency of fractures

K2VITAL® - The Vitamin of Tomorrow

K2VITAL® is currently the only product based on pure MK-7 to facilitate the optimal bioavailability and effect in non-activated GLA proteins such as osteocalcin and MGP.

Application Field	K2VITAL® MCC Microcrystalline cellulose powder	K2VITAL® MCT OIL Medium chain triglyceride oil	K2VITAL® DELTA Microencapsulated powder
Food based (low fat basis)			✓
Food based (adequate fat basis)		✓	
Beverages (no fat base)*			✓
Beverages (with fat base, eg Dairy)		✓	
Powdered Beverage Formulation			✓
Compressed Tablets (without minerals)	✓		
Compressed Tablets (with minerals)			✓
Soft Gel Capsules		✓	
Hard Gel Capsules	✓		✓
Dietary Powder Formulation			✓

*Stability tests are ongoing

Country of origin: USA & Europe

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ABOUT KAPPA BIOSCIENCE

Kappa Bioscience AS, a Norwegian entity, is the innovative leader and first mover with its patent protected high purity, all-trans vitamin K2 as menaquinone-7 (MK-7). Driven by our core vision to make Vitamin K2 MK-7 available for everyone, we own and manage the whole value chain - from production to sales. Kappa Bioscience has substantial resources and knowledge about vitamins and vitamin K2 in particular. We deliver our vitamin K2, branded as K2VITAL® on various commercially suitable carriers, such as MCC, MCT & microencapsulated powder.



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References: For Appendix information, please go to: www.kappabio.com/references