

# Vitamin K: More than Just the "Klotting" Vitamin!

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Vitamin K is a fat-soluble "vitamin," now known for over 70 years to be imperative for proper coagulation, which, in the native Danish tongue of its discoverer, Henrik Kam, is spelled with a "K." But did you know that vitamin K is technically not a vitamin, and that it has several other important physiological functions? If not, then further familiarity with this usually neglected nutrient is worth review.

Vitamin K is actually a fat-soluble phytonutrient (technically a subclassification of terpenes, a mixed isoprenoid chromanol subgroup known as the quinones). There are three kinds of vitamin K: K<sub>1</sub> (phylloquinone); K<sub>2</sub> (menaquinone); and K<sub>3</sub> (menadione, synthetic vitamin K). Chlorophyll-rich greens, broccoli and soybeans are major sources of vitamin K<sub>1</sub>. Fermented soy, beef liver, chicken, egg yolks, butter, and some cheeses are vitamin K<sub>2</sub> sources (and therefore technically not a phytonutrient, but rather, a "zoonutrient"). Fermentation via healthy, eubiotic intestinal microorganisms occurs as well, providing more vitamin K<sub>2</sub>. However, vitamin K<sub>2</sub> is very poorly absorbed.<sup>a</sup> We humans enjoy only limited hepatic storage of vitamin K.

Coagulation difficulties related to deficiencies of vitamin K are rarely seen in reasonably healthy humans with reasonably balanced diets. Nonetheless, vitamin K deficiency may be seen in the following situations:

- very restricted chronic "fad" weight-loss diets, "detox" and severe cleansing diets/fasts, and, of course, severe bulimia and anorexia;
- severe dysbiosis, dumping syndromes, diarrhea, malabsorption, and associated diseases such as ulcerative colitis and Crohn's disease;
- hepatic disorder, disease and degeneration; and
- pharmacological iatrogenic causes, including overly strict vitamin K avoidance with anticoagulant therapy, cholesterol-lowering medications, and even chronic mineral oil and NSAID ingestion.

Even so, acute hypovitaminosis K is rare. However, subtle suboptimal vitamin K levels may increase the risk of osteoporosis, arteriosclerosis, perhaps some cancers, and maybe even Alzheimer's disease and diabetes!

## Boning Up on Vitamin K

Poor vitamin K blood levels and dietary intake are directly correlated with female osteopenia (low bone mineral density) and frank osteoporosis with hip fracture.<sup>6,7,11,12,13</sup> It is well-established that supplemental vitamin K promotes osteotrophic (bone-building) processes and slows osteoclastic (bone-depleting) processes by enhancing the bonding of calcium to the protein matrix tissue of bone, thereby increasing bone density. Furthermore, vitamin K assists in the manufacture of the protein bony matrix itself (known as matrix G1a protein)!<sup>5,8,9,10</sup>

Osteocalcin is the latticework matrix into which minerals, especially calcium, are incorporated (via gamma-carboxylation). To do so, osteocalcin must be activated to perform its bone-building duties. Said activation is dependant on vitamin K.<sup>1,2</sup> Diagnostically, large amounts of inactive osteocalcin suggests suboptimal vitamin K levels. If so, supplemental vitamin K will lower osteocalcin blood levels.<sup>3-5</sup> Similarly, supplemental vitamin K can also reduce urinary calcium loss related to such osteoclastic processes.<sup>5,8</sup>

In 1998, researchers analyzed data from the prestigious Nurses Health Study and found that consuming about 110 micrograms of vitamin K per day reduced the risk of breaking a hip by approximately 30 percent.<sup>13</sup> In fact, vitamin K has been an approved treatment for osteoporosis in Japan since 1995.

It should be noted that Kaneki et al., found that Japanese women with identical K<sub>1</sub> levels, but twice the K<sub>2</sub> levels (specifically MK7, as found in natto, a fermented soy product), had significantly less osteoporotic bone fracture.

### Anti-Artery "Klogging"

Vitamin K is not only vital to enmeshing calcium into bone; it also appears to simultaneously inhibit calcium's incorporation into the lining of our arteries.<sup>9,16</sup> Such undesirable incorporation yields stiffening of the otherwise flexible arteries (atherosclerosis), a well-known risk factor for heart disease and stroke. Therefore, vitamin K may help prevent arteriosclerosis, although more studies are required.<sup>10</sup> Still, it appears that in activating the aforementioned matrix G1a protein (and perhaps other vitamin K-dependent proteins), vitamin K strongly inhibits arterial calcification while supporting bone calcification.<sup>14,15</sup>

Kan K Kombat Kancer? Phylloquinone supports cell replication, transformation, survival and inhibition.<sup>17,18</sup> Menaquinone and its analogues promote normal cell self-destruction (apoptosis) in pancreatic, ovarian, and leukemia cancer cells.<sup>19,20</sup> Therefore, it may be that optimal vitamin K status inhibits cancer cell formation and growth to some extent.

The Alzheimer's Konnection: Studies hint that vitamin K blood levels may be lower in those with apolipoprotein E4, the genotype that has been linked to Alzheimer's, and that vitamin K may help modulate CNS biochemistry.<sup>21</sup>

Blood Sugar Kontrol: Vitamin K is relatively abundant in the pancreas, the endocrine function of which is to manufacture and secrete insulin to prevent hyperglycemia. In a study with laboratory animals, Japanese researchers found that vitamin K deficiency interferes with insulin release and glucose regulation in ways that mimic diabetes.<sup>23</sup>

Skin Kare: In news that is of at least passing interest, University of Miami researchers reported that in a small study, applying topical vitamin K to the face after laser treatment significantly reduced the severity of bruising.<sup>22</sup>

ReKommended Dosages: In spite of the results from the Nurses Health Study, the Food and Nutrition Board of the National Institute of Medicine advises 90 micrograms (mcg) and 120 mcg of vitamin K daily for women and men, respectively. American adults consume an average of between

59-82 mcg of vitamin K per day.<sup>25</sup> This is another reason leafy greens need to be added to the diet, especially in those avoiding the cholesterol and calorie-rich, but vitamin K<sub>2</sub>-abundant foods mentioned above. Even direct vitamin K supplementation is extremely safe, as large doses do not "cause" clotting.<sup>26</sup>

One should, however, check with a physician if one is taking medications such as blood thinners, the effectiveness of which may be affected by dietary and supplemental changes in the intake of vitamin K. A good resource for those on anticoagulants is the Web site [www.vitk.org](http://www.vitk.org). It should be noted that when anticoagulants are given, the advice to "avoid vitamin K" should perhaps be more exactly understood as the advice to *inform your physician of any marked dietary or supplementation changes that may significantly increase vitamin K, such that the prescribing physician can evaluate the need to recalibrate the dosage needed to maintain effective anticoagulation activity while promoting optimal vitamin K status.*

## Konclusion

Vitamin K's vital importance to proficient blood clotting has been appreciated for over seven decades, but coagulation is certainly not its lone function. More recent investigations promote vitamin K as yet another nutrient involved in maintaining strong bones and clear arteries - two very important functions, considering the prevalence and morbidity of osteoporosis and cardiovascular disease. Future research may more clearly define vitamin K's possible importance in preventing certain cancers, Alzheimer's disease and diabetes, and even topical postlaser recuperation. In the meantime, the above information is, at the very least, yet another of the many reasons for you and your patients to enjoy a diet abundant in chlorophyll-rich greens and fermented soy.

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