

# VITAMINS

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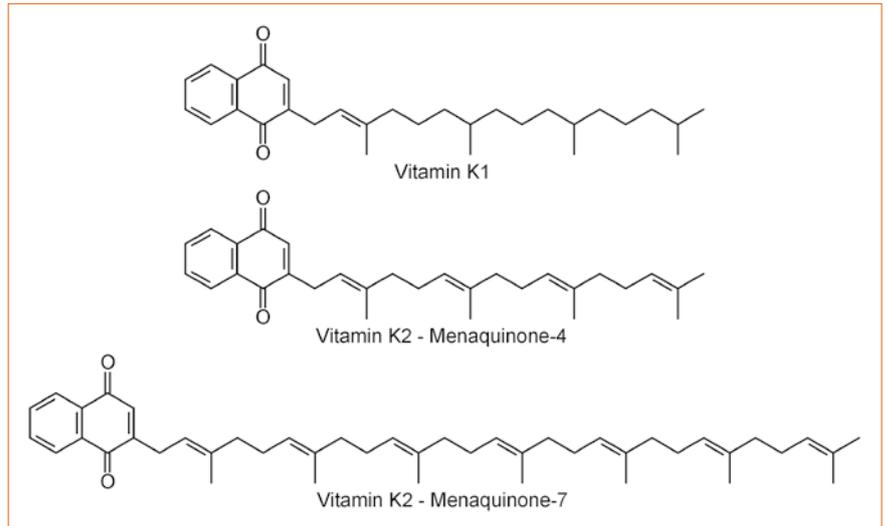


# Vitamin K2 – One of the natto's benefits

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*We saw during these last years the appearance of a poorly known vitamin: vitamin K2. The idea of an unique vitamin K, acting only on blood clotting is outdated. One must now consider the existence of a vitamin K2, and its specific activities on calcium metabolism, bone health and cardiovascular protection.*



## SOME CHEMICAL FORMULAS (JUST A FEW)

The concept of vitamin K covers several distinct molecules. They have in common a cyclic moiety and differ by the composition of their side chain.

Vitamin K1 or phylloquinone has a mono-unsaturated side chain. Vitamin K2 or menaquinone includes a series of isoforms which have unsaturated side chain differing by their length. The most well-known are menaquinone-4, MK4, and menaquinone-7, MK7 (Figure 1).



## SOURCES AND FOOD SUPPLY

The recommended food supply in Europe is 75 mg vitamin K/day, irrespective of the nature of the vitamin K. Vitamin K1 is present in green vegetables. Vitamin K2 is found in animal products as MK4 (fermented cheeses), and as MK7 in fermented vegetal products like fermented cabbage (sauerkraut) or in a Japanese speciality called natto.

It has been estimated that 90% of the food supply of vitamin K in Europe is composed of vitamin K1 while vitamin K2 represents the remaining 10%.



## THE BENEFITS OF NATTO

The observations done in Japan on the bone and cardiovascular health of some populations were at the origin of the description of the specific properties of vitamin K2. Analyses have shown that the plasmatic K2 concentration is higher in people who consume more natto, a typical Japanese food product made of fermented soya beans.

Moreover, an inverse correlation exists between the fracture frequency in an aging population and the average amount of natto consumed (1).

*Bacillus subtilis natto* is the bacterial strain which transforms the natto and produces the menaquinone-7 isomer it contains. With more than 1 mg menaquinone-7 per 100 g, natto is the richest food according to the vitamin K2 content.



### THE MISSING LINK FOR CALCIUM METABOLISM

The importance of calcium in the edification of the bone structure is well-known. The European DRI of calcium is 800 mg. The role of the vitamin D3 (DRI=5 mg) in the assimilation of calcium has also been described. Some food products like dairy products and food supplements followed this evolution of the knowledge in calcium metabolism and products fortified in calcium and/or vitamin D3 are proposed.

It is now recognized that vitamin K2 is needed for the incorporation of calcium in the bone structure after its assimilation and during its blood transport. Menaquinone-7 is the most efficient among all the isomers of vitamin K2.

The vitamin K2 activates osteocalcin, a plasmatic protein synthesized by the bone cells osteoblasts, which enhances the calcium binding in the bone structure. The ratio between carboxylated (active) and non carboxylated (inactive) forms of osteocalcin is considered to be a reliable tracer of the blood vitamin K2 status (2).

The capacity of vitamin K2 to activate plasmatic proteins can also explain its properties to protect the cardiovascular health also observed in natto consuming populations. A series of proteins called GLA proteins is able to inhibit the calcification of the blood vessel walls after being activated by vitamin K2 (3).

At the level authorized in Europe, it is now accepted that a supply of vitamin K2 doesn't interfere with blood clotting. This has been officially confirmed in an opinion of EFSA published in October 2008 (4). The incorporation of vitamin K allows to use a claim dedicated to bone health "contributes to the maintenance of normal bones". A property that we can now attribute to a specific supply in vitamin K2.

### HOW TO SUPPLY VITAMIN K2?



The most direct way may be to eat natto. But it appears to be a hard challenge for non Japanese native people. The other way is to use supplements based on the different extracts available on the market. They are produced either by chemical synthesis or by a natural enzymatic process coming from a selected microorganism. In this last case, the production is done with specific nutrients in a closed fermentor with carefully controlled conditions, and soya beans are not used.

Vitamins K are lipophilic molecules that must be extracted before to be purified and concentrated. Different methods can be used to produce a vitamin K2 concentrated ingredient, which may explain the differences in composition, quality and residual solvent traces observed in these extracts.

\* The other products of the Gnosis range are SAME, glutathione, Quatrefolic, *S. boulardii* and Biokyn.



### VITAMK7: THE VITAMINE K2 OF OUR PARTNER GNOSIS

Gnosis produces its vitamin K2 in its own GMP Pharma certified facility in the south of Italy\*. VitaMK7 is produced from a fermentation process with *Bacillus subtilis natto*, the same bacterial strain that produces vitamin K2 in the Japanese food natto where its properties were described. The selected culture media leads to a final product devoid of any allergen. VitaMK7 is composed of the menaquinone-7 isomer active on bone health. The supercritical CO<sub>2</sub> extraction step is specific to VitaMK7. It preserves the all-*trans* conformation which is the natural and active form of the molecule and excludes the use of any organic solvent in its production process. It makes VitaMK7 an unique product on the market.



### NOVASTELL'S FORMULATIONS AND SEMI FINISHED PRODUCTS INCORPORATING VITAMK7

- Bone Synergy is dedicated to bone health. It contains vitamins K2 and D3, phosphatidylserine – which enhances the incorporation of calcium in the bone matrix – and DHA which inhibits bone resorption.
- Femini'Calm is formulated with the same ingredients – phosphatidylserine, omega-3 fatty acids, vitamins K2 and D3 – in a mix intended to improve the troubles linked to menopause: hot flashes and mood swings. Bone Synergy and Femini'Calm are available both in oily bulk presentations and as softgel capsules.

### REFERENCES

- 1) Kaneki M. et al. *Nutrition* **2001**, 17, 315-21.
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- 3) Schurgers L.J. et al. *Thromb. Haemost.* **2008**, 100, 593-603.
- 4) EFSA opinion adopted on 02 october 2008; [http://www.efsa.europa.eu/fr/scdocs/doc/nda\\_op\\_ej822\\_vit\\_k2\\_summary\\_en.pdf](http://www.efsa.europa.eu/fr/scdocs/doc/nda_op_ej822_vit_k2_summary_en.pdf).

