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ESSENTIAL FATTY ACIDS
A sustainable future
The rise of algal DHA

CARDIOVASCULAR HEALTH
The science behind soy
Sodium reduction

NATURAL COLOURS

Getting the good health glow

HERBALS AND BOTANICALS
Anti-inflammatory support
Spiking and adulteration

GUT HEALTH
Where man meets microbes

OMEGA-3s: FISH VERSUS THE WORLD

• ingredients • functional foods • nutraceuticals • supplements • raw materials •

KNOW THE DIFFERENCES VITAMIN K1 AND K2

Almost 90% of vitamin K in the human diet occurs in the form of K1. Although modern technology has enabled its quantification in food for several decades, it was only 11 years ago that the equivalent information could first be gained for K2. This data was subsequently published by Schurgers et al., and the resulting table continues to be used worldwide to estimate human vitamin K2 intake in study cohorts.[1]

The first study cohort in which vitamin K intake was differentiated into K1 and K2 was the Rotterdam Study, which analysed the dietary habits of 4500 elderly men and women (above the age of 55) using food frequency questionnaires and monitored their health throughout a follow up period of 10 years. The results were astounding; whereas dietary vitamin K1 intake had no effect on cardiovascular health, there was a strong inverse association between K2 intake and the extent of aortic calcification, the occurrence of myocardial infarction and cardiovascular mortality (50% lower in those consuming 45 µg/day or more of K2). In addition, a 25% reduction of overall mortality was registered in this group.[2] At this time, the underlying mechanism of these outcomes was not understood, prompting disbelief in the scientific community. As a result, the study was repeated by a different research group in an independent and much larger cohort known as the Prospect Study. The total number of subjects was more than 16,000 and, again, the observation period was 10 years or more. Once more, no effect on cardiovascular health of K1 was observed, in contrast to the major effect that K2 displayed. With far more certainty and confidence than those involved in the Rotterdam study, the researchers went so far as to calculate that each extra intake of 10 µg/day of K2 resulted in a 9% decreased risk for cardiovascular mortality and that the so-called long-chain menaquinones were the most active forms in this respect.[3]

Protective Effect Against Cancer

The differences between K1 and K2 are not restricted to the prevention of cardiovascular disease; 2008 and 2009 saw the publication of two important papers demonstrating that a high dietary intake of K2 has a strong protective effect against prostate cancer and all other major forms of cancer, excepting breast cancer.[4,5] Again, K1 had no effect and — as with cardiovascular disease — the effective dose of K2 was reported to be around 45 µg/day. It is of course intriguing that K2, which constitutes only 10% of our total dietary vitamin K intake, can have such dramatic effects. To understand this, we must first realize that K1 has its origins in plants, where it is tightly bound to the chloroplasts; this means that dietary sources of K1 are green, leafy vegetables. Chloroplasts are poorly digested, however, which results in only 5–10% of the ingested K1 entering the circulation and becoming available for the body. In comparison, K2 is produced by bacteria and occurs in the fat fraction of foods such as cheese, curd, eel and flat fish (where it originates from the decaying organic matter consumed by them), and is taken up from the digestive tract rapidly and completely.[6] Thus, it may be calculated that there is a comparable influx of K1 and K2 in our system.

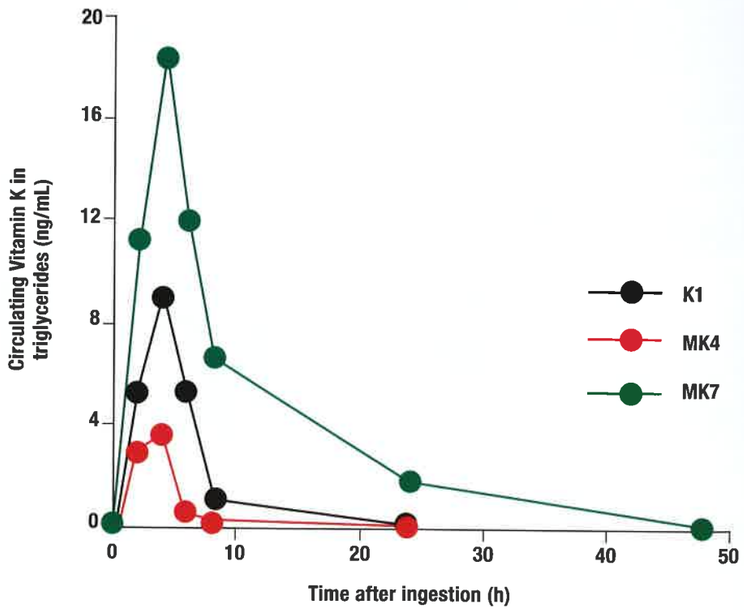


Figure 1: Postprandial vitamin k uptake in circulating triglyceride fraction.

Uptake and Biological Half-Life

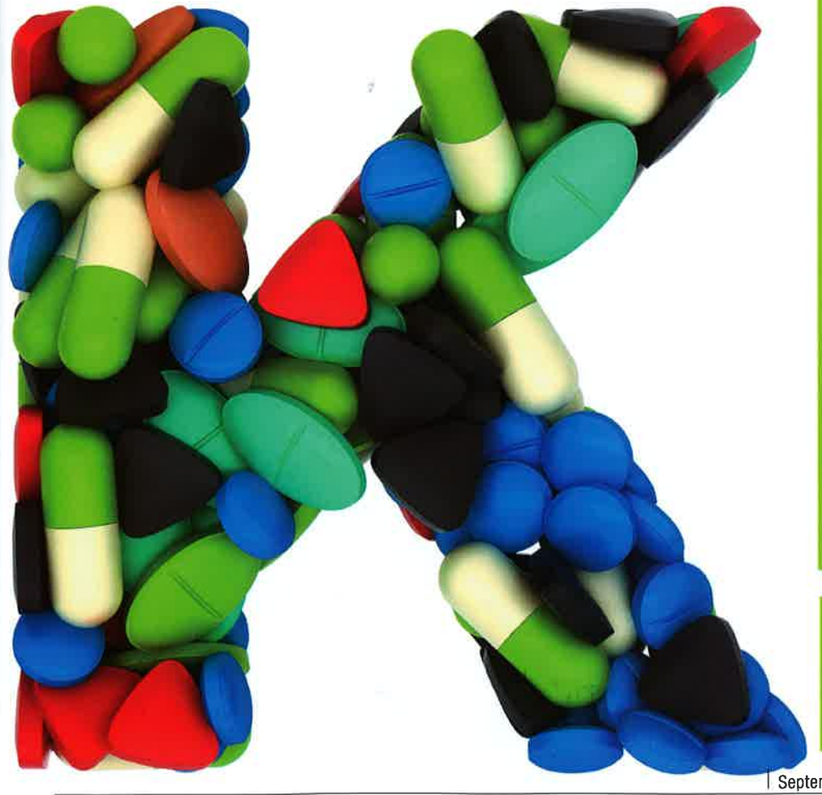
When the transport of the vitamins following intestinal absorption is compared, a second difference becomes clear. Both vitamins are fat soluble and require transportation to the liver, which is accomplished by triacylglycerol-rich lipoproteins (triglyerides). In a second step, the long-chain forms of K2, the most lipophylic of the K vitamins, are incorporated into low density lipoproteins (LDL) that transport them to other tissues, including bone, vessel walls, prostate and lungs. K1, however, is hardly found in LDL (Figure 1); this difference in transport mechanisms is the reason behind the prominent health effects of K2 in extrahepatic tissue in comparison with it.[7] A third major distinction may be drawn in relation to the half-life times in circulation; K1 has a half-life of about 1.5 hours, which is brief when compared with that of the predominant dietary forms of K2 — 3 days or longer.[8] The increased half-life time, probably related to that of its carrier LDL, results in K2 being available for uptake by the extrahepatic tissues for a much greater period of time than K1.

Japanese Food Natto

Although large population-based studies have demonstrated the significant health effects associated with K2 at intakes of 45 µg/day and higher, 75% of the healthy adult population falls short of this level. In addition, it is important to note that, in the Western diet, K2 is almost inevitably found in saturated fats, which are regarded as unhealthy. A healthy alternative can be found in the Japanese foodstuff, natto, which is low fat and extremely rich in K2. However as, natto is often difficult to procure and, owing to its pungent taste and aroma, frequently rejected, fortified foods containing extracts from natto or its K2 producing bacteria, *Bacillus subtilis* natto, are a useful and healthy alternative.

Clinical Trials

Norwegian company NattoPharma has supported major human studies at VitaK BV and Maastricht University, which reveal that in the majority of the healthy adult population, bone and arteries are insufficient in vitamin K — a risk factor for osteoporotic hip fractures and cardiovascular mortality.[3,9] Furthermore, it has been demonstrated that long-chain menaquinones (vitamin K2) are the preferred form of vitamin K for combating age-related diseases, owing to their preferential distribution to the extrahepatic tissues.[7,10] nbt



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