KRESSER INSTITUTE
FOR FUNCTIONAL AND EVOLUTIONARY MEDICINE

Maintenance Supplementation: Vitamin K2

Hey, everyone. In this presentation, we're going to talk about supplementing with vitamin K2. K2 is the most important vitamin most people haven't even heard of. Even a lot of doctors and dietitians aren't really aware of the beneficial roles of K2.

K2 is needed to activate proteins such as osteocalcin that regulate calcium metabolism via a process called carboxylation. Carboxylated osteocalcin deposits calcium in the bones and teeth where it's required. It keeps it out of the soft tissues where you don't want it, so this can help to prevent osteoporosis, osteopenia, and other disorders that involve calcium deficiency in the hard tissues.

It also prevents calcification of soft tissues such as arterial lining, and this can reduce the risk of atherosclerosis and heart attack. In one study, people with the highest intake of vitamin K2 had a 52 percent lower risk of aortic calcification, 41 percent lower risk of coronary heart disease, 51 percent lower risk of death from heart disease, and 26 percent lower risk of death from all causes.

K2 has more benefits than just preventing heart disease and improving bone health, though. It reduces the risk of prostate cancer by 35 percent. It may be protective against cancer in general. It can reduce the risk of fractures by 81 percent. It prevents calcification of elastin in skin. It's required for the proper function of vitamin D- and A-dependent proteins and prevents deficiency symptoms for each of those vitamins. So, we've talked about this before how all of the fat-soluble vitamins work in a synergistic relationship, and K2 protects against the toxicity of D and A just like D protects against the toxicity of A and vice versa. K2 supports enzymes in the brain that protect against Alzheimer's. It may prevent kidney stones, and it can promote healthy facial bone structure in developing babies.

The research is currently unclear on just how much K2 is optimal for health. There is no upper limit or toxicity level at this point, so like B12, K2 is remarkably safe even in high doses, and very high doses of 30 to 45 mg (K2 is typically dosed in micrograms, as you'll see), 30 to 45 mg has been used in Japanese osteoporosis studies with no adverse effects. So there is a much greater risk of deficiency of K2 than overdosing. As I said on the last slide, K2 can reduce the likelihood of vitamin D or vitamin A toxicity, so if patients are increasingly supplementing with vitamin D, and to a lesser extent vitamin A, with things such as cod liver oil, this can become another important function of K2.

One of the issues with K2 is that it's not very easy to obtain in the diet. K2 is not the same as K1. K1 is found in leafy greens such as kale and collards, and in the body, it's primarily used in blood clotting rather than calcium regulation, which is the primary impact of K2. K2 is found primarily in the fat from animal products and some fermented foods. The conversion of K1 to K2 happens in the body. So, for example, let's say a cow is eating rapidly growing green grass, and it consumes

that K1 and converts it into K2. Then we would eat it in the fat of that cow, whether it's the dairy fat or the fat from the meat itself.

The human body, on the other hand, is relatively inefficient at converting K1 to K2, so when we eat leafy greens and things that contain K1, we don't make that conversion to K2 as well as some of the ruminant animals do. In terms of bacterial fermentation, it's been pointed out that some of the bacteria in our gut do produce K2, and that's true, but very little is absorbed from that bacterial production in our gut. So the major forms of K2 that we consume in the diet would be MK4, which is found in animal fats, so dairy fats, organ meats, or fat tissue of ruminant animals that we consume, and then MK7, which is primarily found in fermented foods.

A little more detail on the highest sources of MK4. That would be grass-fed, full-fat dairy products, and the reason that grass-fed dairy products are so much higher in K2 is because the grass is what contains the K1 that the animals convert into K2, so eating conventionally raised animals that have never seen grass in their life and are fed grains, they are not going to have high levels of K2. This has been shown in studies comparing the dairy of European animals, which are typically raised on pasture more often than in the U.S., that the levels of K2 in the butter, cheese, and cream from these European dairy animals are higher than those found in conventionally raised animals in the U.S. in the factory farm, the CAFO type of animals.

There are particular cheeses that are high in K2. Cheese, of all the dairy products, is the highest in K2. Gouda and Brie are the two highest of all the cheeses. Then we have poultry liver, particularly goose liver, that is very high in K2. Pastured egg yolks, again not conventional egg yolks as much, but pastured egg yolks I think are two or three times higher in K2 than conventional. Organ meats from pastured animals such as pancreas and kidneys are expected to be high in K2 because of how it is metabolized, but they have not been measured at this point scientifically.

Major sources of K2: Natto, which is a fermented soy product from Japan, is the highest source of K2 gram for gram of any food. It has a very strong taste, and people either like it or absolutely hate it, so it may not be a viable way of your patients getting K2 into them. Other fermented foods such as sauerkraut, and, of course, we talked about cheese, a fermented dairy product on the last slide, can be good sources of MK4 and MK7, the MK7 if it's a fermented plant food such as sauerkraut, and MK4 if it's a fermented animal food such as cheese.

So, of course, we can supplement with K2 as well, and this may be necessary for people who aren't eating organ meats, who aren't eating grass-fed dairy products. The recommended dose for supplementation is 100 to 1,000 mcg a day. As I mentioned before, doses as high as 45 mg per day have been used in some studies for osteoporosis, and K2 seems to be safe and well tolerated even at that amount. Currently, there is no known toxicity level for K2.

One theory is that once all proteins are carboxylated, vitamin K2 no longer has any effect on the body and, thus, no toxicity. That is still being investigated, but it may be that once it's done its job, it really has no effect on the body at all. Time will tell, hopefully.

K2 is best combined with optimal levels of vitamin A and D, but excess of K2, according to the current science, will not cause any deficiency symptoms of vitamin A or D. Higher doses in the milligram quantity can be used therapeutically for decreased bone density and also prevention of cardiovascular disease. MK7, usually in the supplement form, is an extract of natto, the fermented soy product that we just talked about, and it has a longer half-life in the blood, so you can take it at lower doses such as 100 mcg per day. MK4 supplements are synthetic, but they're believed to be chemically identical to the form that is found in animal fats, and these have a shorter half-life, so larger doses are probably more appropriate in this case, such as 1,000 mcg per day.

Some research suggests that MK4 is more effective than MK7 in preventing heart disease and osteoporosis, but that is inconclusive, and I think both forms are likely to be beneficial in supplement form. High-vitamin butter oil from Green Pasture, for example, or pasture-raised ghee will both naturally contain MK4 in decent amounts. There is no guarantee of dosage when you're using butter oil or ghee for K2 because it's not quantified, and it's not consistent. It depends on the amount of grass that the cows were eating, etc., but it can be a good natural food source.

Keep in mind that supplementation of K2 is maybe contraindicated with patients who are on blood thinners such as Coumadin (warfarin), and it would be better to stick to foods that are high in K2 in those cases.

Okay, that's it for K2. See you next time.