

By Dr. Mercola

Vitamin K is a fat-soluble vitamin most well known for the important role it plays in blood clotting. However, many do not realize that there are different kinds of vitamin K, and they are completely different.

The health benefits of vitamin K2 go far beyond blood clotting, which is done by vitamin K1, and vitamin K2 also works synergistically with a number of other nutrients, including calcium and vitamin D.

Dr. Kate Rheaume-Bleue, a naturopathic physician with a keen interest in nutrition, has authored what I believe is one of the most comprehensive books on this important topic, titled: *Vitamin K2 and the Calcium Paradox: How a Little Known Vitamin Could Save Your Life*

"I tuned in to the emerging research about K2 early in 2007," she says. "Not long before, I had read Nutrition and Physical Degeneration by Weston A. Price. When I learned about vitamin K2, I thought:

"Hey, you know what? I'm sure Price talked all about this in his book." I went to the book, looked through it, and didn't find any reference to vitamin K2. I was really stumped.

A little bit later in 2007, I read a brilliant article by Chris Masterjohn that links vitamin K2 to Price's work on Activator X.

Once I realized that link, the light bulb went on about how important this nutrient is, and how overlooked it's been for so long. It really provides the missing piece to the puzzle of so many health conditions, and yet it was being completely overlooked, despite the overwhelming amounts of modern-day research."

What's So Special About Vitamin K2?

Vitamin K is actually a group of fat-soluble vitamins. Of the two main ones, K1 and K2, the one receiving the most attention is K1, which is found in green leafy vegetables and is very easy to get through your diet. This lack of distinction has created a lot of confusion, and it's one of the reasons why vitamin K2 has been overlooked for so long.

The three types of vitamin K are:

1. **Vitamin K1**, or phyloquinone, is found naturally in plants, especially green vegetables; K1 goes directly to your liver and helps you maintain healthy blood clotting
2. **Vitamin K2**, also called menaquinone, is made by the bacteria that line your gastrointestinal tract; K2 goes straight to your blood vessel walls, bones, and tissues other than your liver
3. **Vitamin K3**, or menadione, is a synthetic form I do not recommend; it's important to note that toxicity has occurred in infants injected with this synthetic vitamin K3

Vitamin K1 exclusively participates in blood clotting — that's sole purpose. K2 on the other hand comes from a whole different set of food sources, and its biological role is to help move calcium into the proper areas in your body, such as your bones and teeth.

It also plays a role in removing calcium from areas where it shouldn't be, such as in your arteries and soft tissues.

"K2 is really critical for keeping your bones strong and your arteries clear," Rheaume-Bleue says.

Now, vitamin K2 can be broken into two additional categories, called:

1. MK-4 (menaquinone-4), a short-chain form of vitamin K2 found in butter, egg yolks, and animal-based foods
2. MK-7 (menaquinone-7), longer-chain forms found in fermented foods. There's a variety of these long-chain forms but the most common one is MK-7. This is the one you'll want to look for in supplements, because in a supplement form, the MK-4 products are actually *synthetic*. They are not derived from natural food products containing MK-4. The MK-7 – these long-chain, natural bacterial-derived vitamin K2 – is from a fermentation process, which offers a number of health advantages:
 - a. It stays in your body longer, and

- b. It has a longer half-life, which means you can just take it once a day in very convenient dosing

How Much Vitamin K2 Do You Need?

The optimal amounts of vitamin K2 are still under investigation, but it seems likely that 180 to 200 micrograms of vitamin K2 should be enough to activate your body's K2-dependent proteins to shuttle the calcium where it needs to be, and remove it from the places where it shouldn't.

"The most recent clinical trials used around those amounts of K2," Rheaume-Bleue says. "The average person is getting a lot less than that. That's for sure. In the North American diet, you can see as little as maybe 10 percent of that or less. Certainly, not near enough to be able to optimize bone density and improve heart health."

She estimates that about 80 percent of Americans do not get enough vitamin K2 in their diet to activate their K2 proteins, which is similar to the deficiency rate of vitamin D. Vitamin K2 deficiency leaves you vulnerable for a number of chronic diseases, including:

Osteoporosis	Heart disease	Heart attack and stroke
Inappropriate calcification, from heel spurs to kidney stones	Brain disease	Cancer

"I talked about vitamin K2 moving calcium around the body. Its other main role is to activate proteins that control cell growth. That means K2 has a very important role to play in cancer protection," Rheaume-Bleue says.

"When we're lacking K2, we're at much greater risk for osteoporosis, heart disease, and cancer. And these are three concerns that used to be relatively rare. Over the last 100 years, as we've changed the way we produced our food and the way we eat, they have become very common."

Researchers are also looking into other health benefits. For example, one recent study published in the journal *Modern Rheumatology*¹ found that vitamin K2 has the potential to improve disease activity besides osteoporosis in those with rheumatoid arthritis (RA). Another, published in the journal *Science*², found that vitamin K2 serves as a mitochondrial electron carrier, thereby helping maintain normal ATP production in mitochondrial dysfunction, such as that found in Parkinson's Disease.

According to the authors:

"We identified Drosophila UBIAD1/Heix as a modifier of pink1, a gene mutated in Parkinson's disease that affects mitochondrial function. We found that vitamin K(2) was necessary and sufficient to transfer electrons in Drosophila mitochondria. Heix mutants showed severe mitochondrial defects that were rescued by vitamin K(2), and, similar to ubiquinone, vitamin K(2) transferred electrons in Drosophila mitochondria, resulting in more efficient adenosine triphosphate (ATP) production. Thus, mitochondrial dysfunction was rescued by vitamin K(2) that serves as a mitochondrial electron carrier, helping to maintain normal ATP production."

The Interplay Between Vitamin K2, Vitamin D, and Calcium

As I've discussed on numerous occasions, vitamin D is a critical nutrient for optimal health and is best obtained from sun exposure or a safe tanning bed. However, many are taking oral vitamin D, which may become problematic unless you're also getting sufficient amounts of vitamin K2. Dr. Rheume-Bleue explains:

"When you take vitamin D, your body creates more of these vitamin K2-dependent proteins, the proteins that will move the calcium around. They have a lot of potential health benefits. But until the K2 comes in to activate those proteins, those benefits aren't realized. So, really, if you're taking vitamin D, you're creating an increased demand for K2. And vitamin D and K2 work together to strengthen your bones and improve your heart health."

... For so long, we've been told to take calcium for osteoporosis... and vitamin D, which we know is helpful. But then, more studies are coming out showing that increased calcium intake is causing more heart attacks

*and strokes. That created a lot of confusion around whether calcium is safe or not. But that's the wrong question to be asking, because we'll never properly understand the health benefits of calcium or vitamin D, unless we take into consideration K2. That's what **keeps the calcium in its right place.**"*

IMPORTANT: If You Take Vitamin D, You Need K2

This is a really crucial point: **If you opt for oral vitamin D, you need to also consume in your food or take supplemental vitamin K2.**

"There are so many people on the vitamin-D-mega-dose bandwagon, taking more and more of vitamin D. And it could absolutely be causing harm if you are lacking the K2 to complete the job to get the calcium where it's supposed to be," Rheume-Bleue warns.

"We don't see symptoms of vitamin D toxicity very often. But when we do, those symptoms are inappropriate calcification. That's the symptom of vitamin D toxicity. And it is actually a lack of vitamin K2 that can cause that..."

While the ideal or optimal ratios between vitamin D and vitamin K2 have yet to be elucidated, Rheume-Bleue suggests about 150-200 micrograms of K2 will meet the need for the "average" healthy person.

The latest vitamin D dosing recommendations, which call for about 8,000 IU's of vitamin D3 per day if you're an adult, means you'd need in the neighborhood of 800 to 1,000 micrograms (0.8 to 1 milligram/mg) of vitamin K2, but the jury is still out.

"My earlier recommendation was not taking into account people who were doing high dose of vitamin D supplementation," Rheume-Bleue says. "That's where it gets a little bit more technical. It seems that for the average person, around 200 to 280 micrograms will activate your K2 proteins and do a lot of good for your bones and your heart. If you're taking high levels of vitamin D... then I would recommend taking more K2."

The good news is that vitamin K2 has no toxicity. No toxic effects have

ever been demonstrated in the medical literature.

"The reason why K2 doesn't have potential toxic effect is that all vitamin K2 does is activate K2 proteins. It will activate all the K2 proteins it finds. And if they're all activated and you take extra K2, it simply won't do that. That's why we don't see a potential for toxicity the way we do with vitamin A or D," she says.

If You Need Calcium, Aim for Calcium-Rich Foods First

For those who are calcium deficient, Rheaume-Bleue recommends looking to food sources high in calcium, before opting for a supplement. This is because many high calcium foods also contain naturally high amounts of, you guessed it, vitamin K2! Nature cleverly gives us these two nutrients in combination, so they work optimally. Good sources of calcium include dairy, especially cheeses, and vegetables, although veggies aren't high in K2.

Additionally, magnesium is far more important than calcium if you are going to consider supplementing. Magnesium will also help keep calcium in the cell to do its job far better. In many ways it serves as nutritional version of the highly effective class of drugs called calcium channel blockers. If you do chose to supplement with calcium, for whatever reason, it's important to maintain the proper balance between your intake of calcium and other nutrients such as:

- Vitamin K2
- Vitamin D
- Magnesium

The Importance of Magnesium

As mentioned previously, magnesium is another important player to allow for proper function of calcium. As with vitamin D and K2, magnesium deficiency is also common, and when you are lacking in magnesium and take calcium, you may exacerbate the situation. Vitamin K2 and magnesium complement each other, as magnesium helps lower blood

pressure, which is an important component of heart disease.

Dietary sources of magnesium include sea vegetables, such as kelp, dulse, and nori. Few people eat these on a regular basis however, if at all. Vegetables can also be a good source, along with whole grains. However, grains **MUST** be prepared properly to remove phytates and anti-nutrients that can otherwise *block* your absorption of magnesium. As for supplements, Rheaume-Bleue recommends using magnesium citrate. Another emerging one is magnesium threonate, which appears promising primarily due to its superior ability to penetrate the mitochondrial membrane.

How Can You Tell if You're Lacking in Vitamin K2?

There's no way to test for vitamin K2 deficiency. But by assessing your diet and lifestyle, you can get an idea of whether or not you may be lacking in this critical nutrient. If you have any of the following health conditions, you're likely deficient in vitamin K2 as they are all connected to K2:

- Do you have osteoporosis?
- Do you have heart disease?
- Do you have diabetes?

If you do not have any of those health conditions, but do **NOT** regularly eat high amounts of the following foods, then your likelihood of being vitamin K2 deficient is still very high:

- Grass-fed organic animal products (i.e. eggs, butter, dairy)
- Certain fermented foods such as natto, or vegetables fermented using a starter culture of vitamin K2-producing bacteria. Please note that most fermented vegetables are not really high in vitamin K2 and come in at about 50 mcg per serving. However, if specific starter cultures are used they can have ten times as much, or 500 mcg per serving.

- Goose liver pâté
- Certain cheeses such as Brie and Gouda (these two are particularly high in K2, containing about 75 mcg per ounce)
- *"An important thing to mention when it comes to cheese (because this becomes an area of confusion), [is that] because cheese is a bacterial derived form of vitamin K2, it actually doesn't matter if the cheese came from grass-fed milk. That would be nice, but it's not the milk that went into the cheese that makes the K2. It's the bacteria making the cheese, which means it doesn't matter if you're importing your brie from France or getting it domestically. Brie cheese, the bacteria that makes brie cheese, will make vitamin K2," she says.*

Fermented vegetables, which are one of my new passions, primarily for supplying beneficial bacteria back into our gut, can be a great source of vitamin K if you ferment your own using the proper starter culture. We recently had samples of high-quality fermented organic vegetables made with our specific starter culture tested, and were shocked to discover that not only does a typical serving of about two to three ounces contain about *10 trillion* beneficial bacteria, but it also contained 500 mcg of vitamin K2.

Note that not every strain of bacteria makes K2. For example, most yoghurts have almost no vitamin K2. Certain types of cheeses are very high in K2, and others are not. It really depends on the specific bacteria. You can't assume that any fermented food will be high in K2, but some fermented foods are very high in K2, such as natto. Others, such as miso and tempeh, are not high in K2.

Pregnant? Make Sure You're Getting Enough Vitamin K2

Last but not least, while vitamin K2 is critical for the prevention of a number of chronic diseases listed above, it's also vital for women who are trying to conceive, who are pregnant, and for growing healthy children. "K2 plays a very important role throughout pregnancy (for the development of teeth for both primary and adult teeth, the development of proper facial form, healthy facial form, as well as strong bones), then again throughout childhood to prevent cavities, and through adolescence as the skeleton is growing," Rheaume-Bleue says.

Vitamin K2 is needed throughout pregnancy, and later while breastfeeding. It may be particularly important during the third trimester, as most women's levels tend to drop at that time, indicating there's an additional drain on the system toward the end of the pregnancy. Since vitamin K2 has no toxicity issues, it may be prudent to double or even triple — which is what Rheaume-Bleue did during her own recent pregnancy — your intake while pregnant.