

# The Crucial Connection Between Vitamin K2, Calcium Metabolism and Disease Prevention

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## STORY AT-A-GLANCE

- › Vitamin K2 directs calcium into your bones instead of arteries, which helps keep them strong and reduces calcification that leads to heart disease
- › A recent Nutrients review revealed that higher K2 intake improved bone mineral density (BMD) and slashed fracture risk, particularly among older adults and postmenopausal women
- › Your apolipoprotein E (ApoE) genotype influences how your body processes vitamin K2. ApoE 2/2 individuals clear it slowly, risking buildup, while ApoE 3/4 or 4/4 clear it fast, requiring higher doses
- › MK-4, found in animal foods, has a short half-life; MK-7, from natto or supplements, lasts longer. Matching the correct form to your genetic profile helps ensure optimal calcium transport
- › To direct calcium where it belongs, balance vitamin K2 with D3, avoid vegetable oils, and get enough magnesium. This will help prevent arterial calcification while maintaining strong bones and reducing your fracture risk

For decades, the conventional advice for optimal bone health has been to take calcium supplements – but the fact is that without the right co-factors, like vitamin K2, this nutrient doesn't end up strengthening bones, and could cause damage instead.

Vitamin K2 ensures that calcium binds to bone where it belongs. Without sufficient amounts of K2, calcium builds up in places where it shouldn't – like your arteries – while leaving your bones weak and brittle. This is why people with low vitamin K2 levels often develop both osteoporosis and hardened arteries, a paradox that drastically increases their risk of fractures and heart disease.

## **Vitamin K2 Strengthens Bones and Protects Against Fractures**

A recent review published in *Nutrients* examined the role of vitamin K2 in bone health, specifically its impact on bone mineral density (BMD) and fracture risk in adults. The researchers focused on how K2 influences calcium utilization in the body, ensuring that this essential mineral strengthens bones rather than accumulating in arteries.<sup>1</sup>

- **Vitamin K2 strengthens skeletal function** – The study analyzed a population of older adults, who are particularly vulnerable to bone loss and fractures. They found that participants who regularly consumed vitamin K2, whether through diet or supplementation, exhibited stronger bones and a lower risk of fractures compared to those with lower intake levels.

The researchers noted that K2 supplementation was especially beneficial for postmenopausal women, who are at the highest risk for osteoporosis-related fractures.

- **Bone mineral density is higher** – One of the most striking findings was the measurable increase in BMD among those supplementing with K2. Bone density improved significantly within months, reducing the likelihood of fractures over time. Individuals with low K2 intake had signs of weakened bone structure, making them more susceptible to breaks from minor falls or injuries.
- **Risk of fractures is reduced** – The study also looked at fracture rates over time. Participants with higher K2 intake had fewer fractures, particularly in the hip and spine, two of the most vulnerable areas in aging individuals.

The difference was significant – those with insufficient K2 intake experienced nearly twice as many fractures as those who maintained adequate levels. This suggests that K2 not only improves bone density but also enhances bone strength and resilience.

- **Vitamin K2 directs calcium** – The biological mechanism behind these findings is straightforward but powerful. Vitamin K2 activates key proteins – osteocalcin and matrix Gla protein (MGP) – which direct calcium where it is needed and prevent it from accumulating where it shouldn't.

Osteocalcin ensures calcium binds to the bone matrix, while MGP prevents calcium deposits from forming in arteries. Without sufficient K2, these proteins remain inactive, leading to both weakened bones and arterial calcification.

- **Vitamin D interplays with vitamin K2** – To summarize, the researchers said, "[W]e find that an adequate supply of vitamin K, on top of an optimal vitamin D status, seems to add to the benefit of maintaining bone health. More research related to synergism and the possible mechanisms of vitamins D3 and K interaction in bone health is needed."<sup>2</sup>

## Concerns and Challenges Regarding Vitamin K2 Absorption

However, there are significant challenges when it comes to optimizing vitamin K2. For example, testing isn't widely available, as most doctors do not consider it part of routine health screenings. There are also individual factors that affect your ability to utilize K2, one of which is your genetics.

- **The journey to testing vitamin K2** – In the video above, Nadir Shah, a licensed structural engineer and educational consultant who runs the YouTube channel "Knowledge for Quality of Life," shares his personal health journey and how he discovered that your genetic makeup influences the amount of vitamin K2 you absorb.

His research began back in 2021, when he and his wife (who has osteopenia, or bone density loss) became curious if they are meeting the optimal levels of nutrients – particularly for vitamin K2.<sup>3</sup>

- **Vitamin K2 testing is challenging** – According to Shah, "There is no such test that which can test all the micronutrients and all the vitamins, all the minerals, because I've been hunting those tests, basically in the insurance literature, health insurance, which I'm covered with, and there's none basically.

We've been taking vitamin K2 along with vitamin D, which I have mentioned in my previous vlogs. We've been taking 100 micrograms, myself and my wife, both. We've been taking the same dosage. But there is no test for vitamin K2," Shah explained.<sup>4</sup>

After an extensive search, Shah was able to find two labs that offered testing for K2 – Genova Diagnostic and Vibrant Labs of America. However, there is no separate K2 test; it's actually part of a micronutrient panel test that costs nearly \$400. What's more, the test needs to be prescribed by a physician.<sup>5</sup>

- **Finding a solution** – According to Shah, he found an integrative medicine doctor in Phoenix, Arizona who recommend Vibrant Labs of America for micronutrient panel testing. After this encounter, his family got their results after four to six weeks.
- **The importance of getting tested** – Shah noted that, "[T]he eye-opening thing for me in that test ... was the vitamin K2 level. I came OK in vitamin K2, but my wife was a bit short. She was OK at the serum level, when I say serum level means it's the blood level, but at the blood cells at the cellular level, she falls short. And that was an alarming point for me ..."

As Shah and his wife were taking the same dose, he then sought answers as to why there was such a significant difference in their levels. Her cellular levels of this nutrient were not reaching the optimal amount, which means it's not activating the vitamin K-dependent proteins, matrix GLA protein and osteocalcin. It took him months, but he eventually found the answer in a research paper.<sup>6</sup>

# The Role of ApoE Genotype in Vitamin K2 Absorption

Your apolipoprotein E (ApoE) genotype is one of the key genetic markers involved in processing vitamin K2. This gene influences how your body processes fats and vitamins, including vitamin K2. There are different variations of the ApoE gene, and depending on which one you inherit, your body may either clear vitamin K2 quickly or retain it for a longer time. In Shah's case, he and his wife have different ApoE genotypes.<sup>7</sup>

- **The differences in genotypes** — According to Shah, "There are genotypes which we have inherited from mom and dad. There are basically three copies: 2, 3 and 4. Then there is a combo 2/3, 3/3, 3/4 and 4/4. So, there's a combination of six altogether. These are called ApoE genotype alleles."
- **Genotypes determine vitamin K2 clearing** — Shah continues, "I found out in that paper that people who are ApoE 2/2, they clear vitamin K2 very slow; particularly, their clearance rate is very slow. Now, 3/3 are typically neither slow nor fast, but 3/4 and 4/4 people — people who carry ApoE one copy of 4 or double copy of 4 — they clear their vitamin K2 from the body pretty fast."

It means that the dosage which I've been taking, 100 micrograms ... was okay because I'm 3/3. We got both tested after that and that was like a light bulb went on," Shah says.<sup>8</sup>

Many people do not know their ApoE genotype because it is not a standard diagnostic test. However, getting tested provides valuable insights into how your body processes vitamin K2 and other nutrients. After learning this information, Shah increased his wife's K2 dose, and since then they have seen noticeable results.

- **The impact of increasing vitamin K2 intake** — Shah recalls their story, "Since 2021, we did another DEXA scan. Her osteopenia stopped progressing at two locations. That's a good sign. Very good sign. Because if ... the T-score doesn't go in the negative further, it means that it has stopped. It means that she is getting enough K2 ..."

- **Boosting your vitamin K2 intake has no side effects** — According to Shah, his wife is "eating natto as well. She is in the range of probably 800, 900 micrograms — eight- or ninefold than what she was taking before. And I am the same way. I increased even though I was okay, but I increased because there is no, we don't feel any side effect, nothing whatsoever."<sup>9</sup>

He adds that understanding your ApoE genotype is also useful for other aspects of your health. Certain variations are linked to a higher risk of Alzheimer's disease, cardiovascular issues, and how your body handles cholesterol. Knowing this information will help you make better choices about your diet, supplements, and overall lifestyle.

## The Type of Vitamin K2 You Take Matters

Shah also mentions that the form of vitamin K2 affects how efficiently you absorb it. The most common forms are menaquinone-4 (MK-4) and menaquinone-7 (MK-7).

- **The difference between MK-4 and MK-7** — Shah explains, "MK-4's half-life is only four hours and MK-7's half-life is 72 hours. It stays in the system in the body longer ... So, it means that MK-7 is not good for people who are ApoE genotype 2/2, because I've been seeing a lot of people when they take K2 MK-7, they feel palpitation.

What happens is that, based on the literature, if they take [it] on daily basis, the body is not clearing because it's clearing slow, it's going to back up and then it's going to give you a side effect."

- **Your genotype dictates which form of vitamin K is better** — From Shah's findings, he noted that "People who are ApoE genotype 2/2, based on the literature, they are better off with MK-4 because it clears fast. Now, if you are 2/2 — the only way we are going to know what type of ApoE genotype we carry is we need to get tested, and it's a once in a lifetime test."<sup>10</sup>
- **Top sources of MK-4** — MK-4 is a short-chain form of vitamin K2 found in animal products such as meat, eggs, liver and dairy.<sup>11,12</sup> However, it has a short biological

half-life, which makes it a poor candidate as a dietary supplement. However, MK-4 from food is important for good health as it plays a role in gene expression. For example, research has found it helps lower your risk of liver cancer.<sup>13</sup>

- **Top sources of MK-7** – Meanwhile, MK-7 is a longer-chained vitamin K2 found in fermented foods such as sauerkraut, certain cheeses and natto. It's produced by specific bacteria during the fermentation process. However, not all strains of bacteria make it, so not all fermented foods will provide it.<sup>14</sup>

## How to Make Sure Calcium Goes to the Right Places

If you want strong bones and flexible arteries, getting enough vitamin K2 is non-negotiable. Without it, calcium ends up in all the wrong places – clogging your arteries instead of strengthening your bones. The good news is, you have control over this. By making a few simple adjustments, the calcium you ingest will work for you, not against you.

1. **Get enough vitamin K2 from the right sources** – Your body needs K2 to activate the proteins that direct calcium into your bones and keep it out of your arteries. The best natural sources are natto, hard cheeses like Gouda and Brie, egg yolks and organ meats.

If you don't regularly eat these foods, consider a high-quality vitamin K2 supplement. If you opt for an oral K2 supplement, it's best taken with your evening meal, along with any vitamin D and/or calcium and magnesium you're taking.

2. **Balance your vitamins D3 and K2 intake** – If you are supplementing with calcium and vitamin D3 but not vitamin K2, you're making a huge mistake. Vitamin D3 increases calcium absorption, but, as discussed, you need K2 to prevent that extra calcium from going where it doesn't belong.

Always make sure that for every 1,000 IU of vitamin D3 you take, you're also getting around 100 to 200 mcg of vitamin K2. This keeps calcium metabolism in balance and prevents calcification where you don't want it.

**3. Eliminate vegetable oils and processed foods** – Too much **linoleic acid (LA)**, found in vegetable oils like soybean, canola and corn oil, damages your arteries, making them more vulnerable to calcium buildup.

Processed foods are packed with these inflammatory oils, so eliminating them from your diet is one of the best strategies to support your heart and overall health. Instead, cook with saturated fats like grass fed butter, ghee or tallow, and avoid anything that lists vegetable oil as an ingredient.

**4. Get more magnesium to keep calcium in check** – Along with vitamin K2, magnesium is another key to proper calcium regulation. It helps prevent calcium from accumulating in soft tissues. If you're not getting enough magnesium, your body struggles to properly use both vitamins K2 and D3.

The easiest way to find your ideal magnesium dose is by using magnesium citrate – slowly increasing the amount until you notice loose stools, then backing off slightly. Once you know your threshold, you can switch to other forms of magnesium, such as magnesium threonate (which doesn't cause loose stools), for better brain and bone benefits.

If you're eating a balanced diet with dairy, leafy greens and bone broth, you probably don't need extra calcium. Instead, focus on getting the right co-factors mentioned above, and let your body handle the rest naturally.

## **Frequently Asked Questions on Vitamin K2 and Bone Health**

**Q: Why is vitamin K2 important for bone health?**

**A:** Vitamin K2 plays a crucial role in directing calcium to the bones, where it strengthens bone mineral density (BMD) and reduces fracture risk. Without sufficient K2, calcium accumulates in arteries instead, increasing the risk of both osteoporosis and cardiovascular disease.



**Q: How does vitamin K2 impact bone density and fracture risk?**

**A:** Studies show that vitamin K2 supplementation improves BMD and significantly reduces fractures, especially in older adults and postmenopausal women. It activates osteocalcin and matrix Gla protein (MGP), which ensure calcium binds to bones rather than accumulating in arteries.

**Q: What factors affect vitamin K2 absorption in the body?**

**A:** Genetics, specifically the ApoE genotype, influence how quickly your body clears vitamin K2. Individuals with ApoE 3/4 or 4/4 genotypes clear K2 faster and will need higher doses, while those with ApoE 2/2 clear it slowly and are better suited to the MK-4 form of vitamin K2.

**Q: What are the best sources of vitamin K2?**

**A:** Natural sources of vitamin K2 include fermented foods like natto, cheese made from grass fed dairy, egg yolks and organ meats. For supplementation, MK-4 has a shorter half-life and is better suited for fast K2 metabolizers, while MK-7 remains in the body longer and is preferable for slower metabolizers.

**Q: How can I ensure calcium is used properly in my body?**

**A:** To direct calcium to bones and prevent arterial calcification, maintain a balance of vitamins K2, D3 and magnesium. Aim for 100 to 200 micrograms of K2 for every 1,000 IU of D3. Also, avoid processed foods and vegetable oils, which contribute to arterial damage and improper calcium distribution.

## Sources and References

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- <sup>1, 2</sup> [Nutrients 2024, 16\(15\), 2420](#)
- <sup>3, 4, 5, 7, 8, 9, 10</sup> [YouTube, Nadir Shah, "Knowledge for Quality of Life", September 22, 2024](#)
- <sup>6</sup> [Longevity Medicine Review, July 20, 2018](#)
- <sup>11</sup> [Journal of Agricultural and Food Chemistry 2006; 54: 483-468 \(PDF\)](#)
- <sup>12</sup> [Haemostasis, 2000; 30: 298](#)
- <sup>13</sup> [Journal of Hepatology, 2007; 47\(1\): 83](#)
- <sup>14</sup> [J Food Sci Technol. 2014 Oct 19;52\(8\):5212–5219](#)