

Could This Overlooked Vitamin Be the Key to Healthier Bones?

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August 31, 2026

STORY AT-A-GLANCE

- › Vitamin K does far more than support blood clotting; research in mice found it helps regulate the constant cycle of removing old bone and building new bone — a process that influences long-term bone strength
- › Researchers identified a vitamin K-dependent protein called GAS6 that acts as a messenger between bone-building cells and bone-removing cells, helping coordinate the remodeling process that keeps your skeleton healthy
- › Bone-building cells use vitamin K at remarkably high levels; researchers found that the enzymes responsible for vitamin K activity were 10 to 40 times more abundant in bone-building cells than in bone-removing cells, a sign that bone-building cells are among the body's heaviest users of vitamin K, on par with the liver
- › Foods rich in vitamin K2, including egg yolks, liver, Gouda, Brie, and fermented foods such as natto, help direct calcium into your bones and teeth instead of allowing it to accumulate in soft tissues
- › Protecting your bones involves more than getting enough calcium; adequate protein, healthy vitamin D levels, regular weight-bearing exercise, avoiding soft drinks, and reducing seed oils all support the cellular energy and nutrient balance required for healthy bone remodeling

Your skeleton is never finished. Every day it tears down old bone and lays down new bone in its place, a constant remodeling process that quietly determines whether your frame stays strong or slowly weakens with age. When people set out to protect that process, they reach almost reflexively for calcium and vitamin D, and stop there.

Yet, another nutrient has been linked to bone health for decades while rarely earning the same attention: vitamin K, found in leafy green vegetables, egg yolks, certain animal foods, and fermented foods. That oversight matters, because bone loss rarely announces itself.

Osteoporosis, a disease marked by weak, fragile bones that break more easily, often develops silently for years before the first warning signs appear, whether a loss of height, a stooped posture, or a fracture from a minor fall. Left unaddressed, it raises the risk of disability, chronic pain, and lost independence. For years, the link between vitamin K and bone strength was just that, a link researchers could see but not explain.

Recent research has finally moved beyond that association, tracing how this overlooked vitamin reaches into bone tissue and helps regulate the cells that break old bone down, part of the constant renewal that keeps a skeleton sound. What that work uncovered reframes vitamin K as far more than a clotting nutrient — and points to a hidden communication system that may help determine how strong your bones remain over time.

Vitamin K Helps Direct the Cells That Shape Your Skeleton

For a study published in *Bone Research*, researchers sought to determine exactly how **vitamin K** influences **bone health** at the cellular level.¹ For years, scientists observed that people with lower vitamin K intake often had lower bone mineral density and higher fracture risk, but the biological explanation remained unclear.

A second clue comes from people with atrial fibrillation. A meta-analysis of observational studies found that those taking warfarin, a drug that blocks vitamin K, had higher rates of hip and spine fractures than those on anticoagulants that leave vitamin K

alone. Together these clues made the missing piece clear: No one had shown what vitamin K actually does inside bone.

Instead of looking only at bone density measurements, the researchers examined the communication network between the cells that build bone and the cells that remove old bone. Their goal was to identify the specific vitamin K-dependent proteins involved in this process and determine how they affect skeletal strength.

- **Vitamin K plays an active role in bone renewal** — By disrupting a vitamin K-dependent pathway in mice, researchers uncovered one of the ways vitamin K helps regulate bone remodeling. The experiment showed that vitamin K influences the activity of osteoclasts, the cells responsible for removing old bone so it can be replaced with new tissue.*

On its own, this finding complicates the simple picture — when researchers shut down this vitamin K pathway in the bone-building cells, the mice ended up with more bone, not less, because they produced fewer bone-removing cells.

- **A newly identified protein turned out to be the missing link** — One of the study's most important discoveries was a protein called growth arrest specific 6, or GAS6. Bone-building cells released this vitamin K-dependent protein, which acted like a messenger between the cells that build bone and the cells that break old bone down. When more GAS6 was present, bone-removing cells grew larger and became more active. When GAS6 levels dropped, fewer of these cells developed.

At first glance, a nutrient that ramps up bone removal sounds like bad news for your skeleton. But removal isn't damage; it's how bone clears microscopic wear and keeps fresh tissue cycling in. What matters isn't whether bone is removed, but whether removal stays matched to replacement. This is where vitamin K-dependent signaling appears to earn its keep: helping keep that balance in tune rather than letting either side run unchecked.

- **Vitamin K helped bone-removing cells fuse into larger cells** — Bone-removing cells don't start out fully formed. Several smaller immature cells need to combine to create a larger cell capable of breaking down old bone tissue. The researchers found that GAS6 helped drive this joining process. In laboratory experiments, adding GAS6 increased both the number and size of bone-removing cells, while blocking GAS6 reduced their formation.

Notably, GAS6 did this by driving the fusion step specifically — the physical merging of smaller cells — rather than switching on the genes that make a bone-removing cell in the first place. Vitamin K's influence here is about coordinating how these cells come together, not acting on a single cell in isolation.

- **The study also revealed where vitamin K exerts much of its influence inside bone tissue** — Researchers found that the enzymes responsible for vitamin K's activity were expressed at levels roughly 10 to 40 times higher in osteoblasts than in bone-resorbing cells. Their abundance in osteoblasts was comparable to levels found in the liver, where vitamin K plays a central role in activating clotting factors.

This tells you that bone-building cells are major users of vitamin K. Rather than acting as a passive nutrient that simply supports mineralization, vitamin K functions inside highly active cellular pathways that help coordinate skeletal maintenance throughout life.

- **Bone remodeling occurs every day, whether you notice it or not** — The cells involved constantly remove older bone and replace it with new tissue. According to the researchers, vitamin K-dependent signaling helps regulate this process by controlling the maturation of osteoclasts through GAS6.

When researchers increased this signaling in mice, bone removal rose and density fell; when they blocked it, fewer bone-removing cells formed. The direction of the effect tracks the strength of the signal.

This reinforces the importance of obtaining vitamin K from nutrient-dense foods such as leafy green vegetables for **vitamin K1** and certain animal foods and fermented foods for vitamin K2. Strong bones are not built by calcium alone. They depend on an entire communication system inside bone tissue, and this study identified one of the key messengers that keeps that system running efficiently.

Two caveats keep this in perspective. The bone measurements were done in male mice, and human bone cells weren't tested — so the study maps a mechanism rather than proving an effect in people. And human trials of vitamin K supplements for bone density have produced mixed results, which is part of why pinning down how the vitamin works has mattered so much.

**These findings are from laboratory or animal research and may not directly apply to human health.*

Support the Nutrients That Keep Bone Remodeling Balanced

Strong bones depend on much more than **calcium**. The featured study suggests that vitamin K helps regulate the cellular communication system involved in how much bone gets removed and replaced over time. If you focus only on minerals while ignoring the nutrients that direct bone remodeling, you miss an important part of the equation. Focus first on supplying the raw materials your skeleton uses every day to maintain its strength.

- 1. Prioritize vitamin K2-rich foods every day** — What this study makes clear is how deeply vitamin K is woven into bone biology; these signaling proteins can't function without it at all. That's a reason to make sure your diet reliably supplies vitamin K, chiefly K2 from animal and fermented foods, rather than to treat any single pathway as a lever to push harder.

Focus on grass fed and pasture-raised animal foods such as egg yolks, liver, and tallow, along with fermented foods that naturally contain vitamin K2. Unlike vitamin K1, which is abundant in leafy greens, vitamin K2 plays a key role in directing

calcium into your bones and teeth instead of allowing it to accumulate in soft tissues.

Certain cheeses are also excellent sources of vitamin K2. Gouda and Brie are among the richest dietary sources, particularly when made with traditional animal rennet. If you already enjoy cheese, choosing these varieties (preferably grass fed) offers a simple way to increase your vitamin K2 intake while supporting bone health. [Fermented foods](#) deserve special attention as well.

Natto, a traditional fermented soybean food, contains the highest known concentration of MK-7, a highly bioavailable form of vitamin K2 that remains active in your body longer than many other forms. Even small amounts provide a substantial boost in K2 intake.

Because vitamin K2 is fat-soluble, absorption improves when you consume it with healthy fats such as grass fed butter or ghee. I also recommend viewing vitamin K2 as part of a larger nutrient team that includes vitamin D and magnesium.

These nutrients work together to support proper calcium placement, bone remodeling, and cellular energy production. If your diet consistently falls short of vitamin K2-rich foods, an MK-7 supplement is another option worth discussing with your health care provider.

The exception is if you take a vitamin K antagonist such as warfarin. These drugs work specifically by blocking vitamin K, so adding an MK-7 supplement can interfere with how the medication controls clotting. If you are on one of these drugs, do not add vitamin K2 without talking to the prescriber who manages it.

- 2. Build your diet around nutrient-dense protein** — Bone is not just a mineral structure. A large portion of your skeleton consists of protein. I recommend consuming about 0.6 to 0.8 grams of protein per pound (1.32 to 1.76 grams per kilogram) of your ideal body weight, with one-third coming from [collagen-rich sources](#) like slow-cooked meats or bone broth.

If you're an older adult concerned about age-related bone loss, this step becomes even more important because both muscle and bone depend on adequate protein for maintenance and repair.

- 3. Support healthy vitamin D levels through sensible sun exposure** — Vitamin D remains one of the most important nutrients for skeletal health because it helps regulate calcium metabolism and supports bone remodeling. Regular sunlight exposure also promotes cellular energy production and supports overall metabolic health.

Aim for a vitamin D blood level between 60 and 80 ng/mL (150 to 200 nmol/L). If you consume seed oils and other major sources of **linoleic acid** (LA), avoid intense midday sun for at least six months, since LA is a polyunsaturated fat that oxidizes easily, builds up in your skin, and increases your risk of skin damage.

Note: *Talk to your health care provider about whether this testing is appropriate for you.*

- 4. Remove foods and drinks that work against bone health** — Ultraprocessed foods do more than crowd out nutritious foods. Many contain seed oils that are loaded with LA, a polyunsaturated fat that accumulates in your tissues and interferes with mitochondrial function over time. Your mitochondria are the tiny energy-producing structures inside your cells, including the cells responsible for building and maintaining bone.

When mitochondrial energy production declines, bone-forming cells become less efficient, inflammation rises, and the balance between bone formation and bone breakdown shifts in the wrong direction. I recommend eliminating seed oils, packaged snack foods, fried foods, margarine, and other highly processed products that contribute little nutritional value.

Replace them with whole foods such as fruit, root vegetables, pasture-raised animal foods, grass fed butter, ghee, and properly prepared vegetables. Every meal becomes an opportunity to strengthen the nutritional foundation that supports

healthy bone remodeling.

One major but often overlooked problem is soft drinks. Many sodas contain **phosphoric acid**, which disrupts the balance between calcium and phosphorus in your body. When that balance shifts in the wrong direction, your body may draw on its calcium reserves, including those in your bones, to compensate. Over time, this places additional strain on your skeletal reserves. Every soda you skip helps protect the minerals your bones depend on.

Iron balance matters as well. While it is an important mineral, excessive levels contribute to inflammation and may impair the cells responsible for building new bone. If you're an adult who regularly consumes iron-fortified foods or large amounts of red meat, keeping an eye on your iron status is another important step toward supporting long-term bone strength.

5. Make strength-building movement part of your weekly routine — Bones respond to physical demand. Walking, resistance training, carrying groceries, climbing stairs, and other weight-bearing activities send a signal that stronger bones are required.

If traditional weight training feels intimidating, start with bodyweight exercises and gradually increase the challenge. Blood flow restriction training, also known as BFR or **KAATSU training**, is another option that stimulates muscle and bone adaptations with lighter loads. Treat it like a long-term challenge. Every workout gives your skeleton another reason to stay strong.

FAQs About Vitamin K for Healthy Bones

Q: What does vitamin K do for my bones?

A: Vitamin K helps regulate the process of bone remodeling, the continuous cycle in which old bone is removed and new bone is built. In the featured Bone Research study, vitamin K-dependent proteins helped coordinate communication between

bone-building cells and bone-removing cells — a process researchers believe supports healthy bone structure over time, though this has not yet been confirmed in people.²

Q: Is vitamin K1 the same as vitamin K2?

A: Both forms belong to the vitamin K family, but they're found in different foods and play somewhat different roles. Vitamin K1 is abundant in leafy green vegetables, while vitamin K2 is found in foods such as egg yolks, liver, certain cheeses, and fermented foods. Vitamin K2 is especially important for directing calcium into your bones and teeth rather than allowing it to accumulate in soft tissues.

Q: What foods contain the most vitamin K2?

A: Some of the richest sources include natto, Gouda cheese, Brie cheese, egg yolks, liver, and other grass fed or pasture-raised animal foods. Natto contains exceptionally high amounts of MK-7, a form of vitamin K2 that remains active in the body for an extended period.

Q: Why are soft drinks and processed foods harmful to bone health?

A: Many soft drinks contain phosphoric acid, which can disrupt the balance between calcium and phosphorus and may increase the amount of calcium drawn from your bones. Ultraprocessed foods often contain seed oils rich in LA, which interferes with mitochondrial energy production. Because bone-building cells require large amounts of energy, impaired mitochondrial function makes it harder for your body to maintain strong bones.

Q: What else supports strong bones besides vitamin K?

A: Bone health depends on multiple factors working together. Adequate protein intake, collagen-rich foods, healthy vitamin D levels, regular weight-bearing exercise, and avoiding seed oils and other ultraprocessed foods all help support the cells responsible for maintaining bone strength. Strong bones result from a coordinated system, not a single nutrient acting alone.

This article is for informational purposes only and does not constitute medical advice. Consult a qualified health care provider before making changes to your health regimen.

Sources and References

- ^{1, 2} [Bone Research April 28, 2026](#)