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Without Magnesium, Vitamin D Supplementation May Backfire

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STORY AT-A-GLANCE

- When taking high-dose vitamin D3, it's important to also take extra vitamin K2 and magnesium to avoid complications associated with excessive calcification
- Magnesium, the fourth most abundant mineral in your body, is a component necessary for the activation of vitamin D, and without sufficient amounts of it, your body cannot properly utilize the vitamin D you're taking
- As many as 50% of Americans taking vitamin D supplements may not get significant benefit, as the vitamin D simply gets stored in its inactive form due to magnesium deficiency
- The only way to determine how much sun exposure is enough and/or how much vitamin D3 you need to take is to measure your vitamin D level, ideally twice a year
- To assess your magnesium level, check your RBC magnesium level and track signs and symptoms of magnesium insufficiency to determine how much magnesium you need. Low potassium and calcium are also common laboratory signs indicating magnesium deficiency

This article was previously published March 12, 2018, and has been updated with new information.

I've previously written about the importance of taking vitamin K2 when you're taking

high-dose supplemental vitamin D to avoid complications associated with excessive calcification in your arteries. Now, research highlights the vital importance of also taking magnesium in combination with vitamin D.

Magnesium, the fourth most abundant mineral in your body, is a component necessary for the activation of vitamin D, and without sufficient amounts of it, your body cannot properly utilize the vitamin D you're taking.[1,2,3,4]

This may actually help explain why many need rather high doses of vitamin D to optimize their levels — it could be that they simply have insufficient amounts of magnesium in their system to activate the vitamin D. As noted by coauthor Mohammed Razzaque, professor of pathology at Lake Erie College of Osteopathic Medicine in Pennsylvania:[5]

> *"People are taking vitamin D supplements but don't realize how it gets metabolized. Without magnesium, vitamin D is not really useful. By consuming an optimal amount of magnesium, one may be able to lower the risks of vitamin D deficiency, and reduce the dependency on vitamin D supplements."*

Without Magnesium, Vitamin D Supplements May Be Ineffective

According to this scientific review,[6] as many as 50% of Americans taking vitamin D supplements may not get significant benefit, as the vitamin D simply gets stored in its inactive form. As reported in the press release by the American Osteopathic Association:[7]

> *"… [C]onsumption of vitamin D supplements can increase a person's calcium and phosphate levels even if they remain vitamin D deficient. The problem is people may suffer from vascular calcification if their magnesium levels aren't high enough to prevent the complication. Patients with optimum magnesium*

levels require less vitamin D supplementation to achieve sufficient vitamin D levels …

Deficiency in either of these nutrients is reported to be associated with various disorders, including skeletal deformities, cardiovascular diseases, and metabolic syndrome. While the recommended daily allowance for magnesium is 420 mg for males and 320 mg for females, the standard diet in the United States contains only about 50 percent of that amount.

As much as half of the total population is estimated to be consuming a magnesium-deficient diet."

Higher Magnesium Intake Lowers Risk of Vitamin D Deficiency

Indeed, previous research has indicated that higher magnesium intake helps reduce your risk of vitamin D deficiency — likely by activating more of it. As noted in one 2013 study:[8]

"Magnesium plays an essential role in the synthesis and metabolism of vitamin D and magnesium supplementation substantially reversed the resistance to vitamin D treatment in patients with magnesium-dependent vitamin-D-resistant rickets … High intake of total, dietary or supplemental magnesium was independently associated with significantly reduced risks of vitamin D deficiency and insufficiency respectively.

Intake of magnesium significantly interacted with intake of vitamin D in relation to risk of both vitamin D deficiency and insufficiency. Additionally, the inverse association between total magnesium intake and vitamin D insufficiency primarily appeared among populations at high risk of vitamin D insufficiency.

Furthermore, the associations of serum 25(OH)D with mortality, particularly due to cardiovascular disease and colorectal cancer, were modified by

magnesium intake, and the inverse associations were primarily present among those with magnesium intake above the median. Our preliminary findings indicate it is possible that magnesium intake alone or its interaction with vitamin D intake may contribute to vitamin D status."

Vitamin D Lowers Mortality Risk of Heart Disease

Vitamin D, a steroid hormone, is vital for the prevention of many diseases, including but not limited to Type 2 diabetes, age-related macular degeneration (the leading cause of blindness), Alzheimer's disease, heart disease and well over a dozen different types of cancer (including skin cancer). Vitamin D also exhibits its infection-fighting abilities in the treatment of tuberculosis, pneumonia, colds and flu.

Studies have also linked higher vitamin D levels with lowered mortality from all causes.[9,10,11] Most recently, a Norwegian study[12] published in the Journal of Clinical Endocrinology and Metabolism found "a normal intake of vitamin D" significantly reduces your risk of death if you have cardiovascular disease.[13]

About 4,000 patients diagnosed with stable angina pectoris (chest pain caused by coronary heart disease) were followed for 12 years. The average age at the outset of the study was 62. Overall, those with vitamin D blood levels between 16.8 and 40 ng/mL (42 to 100 nmol/L) had the lowest mortality risk.

Vitamin D Deficiency Could Increase Your COVID-19 Risk by 12x

Mounting evidence demonstrates that vitamin D has important roles in regulating the immune system that should reduce COVID-19 risks; primarily by reducing survival and replication of the SARS-CoV-2 virus and by reducing the risks of "cytokine storms" by reducing proinflammatory cytokine production and increasing anti-inflammatory cytokine production.

In the comprehensive vitamin D report below — which has been reviewed by many vitamin D scientists for accuracy — I detail how vitamin D works to fight COVID. I consider this the most important paper I've ever written and **you can access this paper, free, here**.[14]

Evidence Suggests Higher Vitamin D Levels Are Better

Interestingly, these findings are actually at odds with mounting research showing 40 ng/mL is at the low end of optimal. The new target is 60 to 80 ng/mL, but even a level upward of 100 ng/mL appears safe and beneficial for certain conditions, especially cancer. For example:

- Having a serum vitamin D level of 40 ng/mL has been shown to reduce your risk for cancer by 67%, compared to having a level of 20 ng/ml or less; most cancers were found to occur in people with a vitamin D blood level between 10 and 40 ng/mL[15,16]
- Research published in 2005 showed women with vitamin D levels above 60 ng/mL had an 83% lower risk of breast cancer than those with levels below 20 ng/mL[17]
- A 2007 study found women over 55 who raised their average serum level to 38 ng/mL lowered their risk of all invasive cancers, including breast cancer, by 77%[18]

Other recent research[19] has also highlighted the importance of vitamin D for the prevention and treatment of heart disease, showing it plays a vital role in protecting and repairing damage to your endothelium. The findings also suggest vitamin D3:

- Helps trigger production of nitric oxide — a molecule known to play an important signaling role in controlling blood flow and preventing blood clot formation in your blood vessels
- Significantly reduces oxidative stress in your vascular system, which is important to help prevent the development and/or progression of cardiovascular disease

According to vitamin D researcher Dr. Michael Holick, author of "The Vitamin D Solution: A Three-Step Strategy to Cure Our Most Common Health Problem," vitamin D deficiency — defined as a level below 20 ng/mL — can raise your risk of heart attack by 50%. What's worse, if you have a heart attack while vitamin D deficient, your risk of dying is nearly guaranteed.

Vitamin D Levels Below 20 ng/mL Are Inadequate

Vitamin D levels below 20 ng/mL have repeatedly been shown to raise your risk for a number of other problems as well, including depression[20] and Type 2 diabetes. Research suggests 20 ng/mL is not even adequate for the prevention of osteomalacia (softening of your bones).

In the case of depression, studies have shown that vitamin D deficiency is linked to even mild depression,[21] and evidence suggests vitamin D deficiency may be a significant driver of the rise we see in both mood and mental disorders such as psychotic[22] and obsessive-compulsive[23] disorders.

As for diabetes, an analysis[24] by GrassrootsHealth reveals people with a median vitamin D level of 41 ng/mL have a diabetes rate of 3.7 per 1,000, whereas those with a median serum level of just 22 ng/mL have a diabetes rate of 9.3 per 1,000. In other words, raising your level above 40 ng/mL can lower your risk of Type 2 diabetes by nearly 60%.

All in all, there's very little reason to believe that a level as low as 16 ng/mL would be protective against death if you have heart disease. Research also shows higher vitamin D levels can help prevent and/or treat:

Dry eye syndromes[25,26] **and macular degeneration**[27,28]
Autoimmune diseases, including psoriasis

Gastrointestinal diseases[29]

Infectious diseases, including influenza and HIV[30,31]

Inflammatory rheumatic diseases[32] such as rheumatoid arthritis

Osteoporosis and hip fractures

Neurological diseases such as Alzheimer's disease[33,34] and epilepsy. In one study,[35] epileptics given a one-time megadose of vitamin D3, ranging from 40,000 IUs all the way up to 200,000 IUs, followed by a daily dose of 2,000 to 2,600 IUs a day for three months to bring each individual's vitamin D status to at least 30 ng/mL, resulted in significant improvements.

Ten out of 13 had a decrease in the number of seizures, five of whom experienced more than a 50% reduction. Overall, the group had a 40% reduction in the number of seizures.

Lupus — According to researchers in Cairo,[36] most patients with systemic lupus erythematosus have some level of vitamin D deficiency, defined as a level of 10 ng/mL or less, or insufficiency, a level between 10 and 30 ng/mL.

Obstructive sleep apnea — In one study, 98% of patients with sleep apnea had vitamin D deficiency, and the more severe the sleep apnea, the more severe the deficiency.[37]

Falls, fractures, dental health and more — A 2006 review[38] looking at vitamin D intakes and health outcomes such as bone mineral density, dental health, risk of falls, fractures and colorectal cancer, found "the most advantageous serum concentrations of 25(OH)D begin at 30 ng/mL, and the best are between 36 to 40 ng/mL."

Obesity — Research[39] has shown vitamin D supplementation (4,000 IUs/day) combined with resistance training helps decrease your waist-to-hip ratio — a measurement that is far better at determining your risk for Type 2 diabetes and heart disease than body mass index.

Neurodegenerative diseases, including multiple sclerosis (MS).[40] Research shows MS patients with higher levels of vitamin D tend to experience less disabling symptoms.[41]

Assess Your Vitamin D and Magnesium Levels

The best way to optimize your vitamin D level is through sensible sun exposure. Unfortunately, this can be difficult for many, especially during the winter season and/or if you live in northern regions. If you cannot obtain sufficient amounts of vitamin D through sun exposure, taking a supplement is recommended.

Remember that the only way to determine how much sun exposure is enough and/or how much vitamin D3 you need to take is to measure your vitamin D level, ideally twice a year.

The D*Action Project by GrassrootsHealth is a cost-effective way to do this, while simultaneously progressing valuable research. To participate, simply purchase the D*Action Measurement Kit and follow the registration instructions included.

To assess your magnesium level, check your RBC magnesium level and track signs and symptoms of magnesium insufficiency to determine how much magnesium you need. Low potassium and calcium are also common laboratory signs indicating magnesium deficiency.

The Interplay of Vitamin D, Calcium, Magnesium and Vitamin K2

When supplementing, also remember to take synergistic effects with other nutrients into account. If you take high-dose vitamin D, you may also need to increase your intake of:

- Magnesium
- Vitamin K2
- Calcium

These four nutrients — vitamins D and K2, calcium and magnesium — all work in tandem, and rely on sufficient amounts of each to work optimally. Lack of balance between these four nutrients is why calcium supplements have become associated with increased risk of heart attack and stroke, and why some experience symptoms of vitamin D toxicity. Here's a summary of some of the most important correlations between these nutrients:

- Excessive vitamin D in combination with lack of vitamin K2 may cause overabsorption of calcium, which in turn may result in calcium deposits in your heart and kidneys. Part of the explanation for these adverse side effects is that vitamin K2 keeps calcium in its appropriate place — in your teeth and bones and out of soft tissues and arteries.

  While the optimal ratios between vitamin D and vitamin K2 have yet to be established, taking somewhere between 100 to 200 micrograms (mcg) of K2 is beneficial. Telltale signs of vitamin K2 insufficiency include osteoporosis, heart disease and diabetes. You're also more likely to be deficient if you rarely eat vitamin K2-rich foods (see listing below).

- Vascular calcification is also a side effect of low magnesium, so when taking vitamin D3, you need both vitamin K2 and magnesium to make sure everything is working properly.

- Maintaining an appropriate calcium-to-magnesium ratio is also important, as magnesium helps keep calcium in your cells so they can function better. Based

on your personal health needs an ideal ratio of calcium-to-magnesium may vary from 1-to-1 to an optimal 1-to-2.[42,43]

- Magnesium and vitamin K2 also complement each other, as magnesium helps lower blood pressure, which is an important component of heart disease.

Eat a Varied Diet and Get Sensible Sun Exposure

The take-home message is that anytime you're taking supplemental magnesium, calcium, vitamin D3 or vitamin K2, you must take all the others into consideration as well. While supplements can be helpful in some instances, your best and safest bet is to simply eat more calcium-, magnesium- and vitamin K2-rich foods, along with sensible sun exposure.

Food-derived nutrition is typically going to be the most beneficial, and this is particularly true for calcium. When you take a biologically foreign form of calcium, or when your body's ability to direct calcium to the right places becomes impaired (as when you are deficient in vitamin K2 and/or magnesium), calcium is deposited where it shouldn't be, such as in your arteries.

It's more likely your body can use calcium correctly if it's plant-derived calcium. Here's a quick summary of foods known to be high in these important nutrients:

- **Vitamin K2 —** Grass fed organic animal products such as eggs and butter, fermented foods such as natto, goose liver pâté and vitamin K2-rich cheeses such as Brie and Gouda
- **Magnesium —** Almonds and cashews, bananas, broccoli and Brussels sprouts, brown rice, free-range pastured egg yolk, flaxseed, grass fed raw milk, mushrooms, pumpkin seeds, sesame seeds, sunflower seeds and leafy green vegetables, especially spinach, Swiss chard, turnip greens, beet greens, collard greens, kale, Bok Choy and romaine lettuce

- **Calcium —** Raw milk from grass fed cows (who eat plants), leafy green vegetables, the pith of citrus fruits, carob and wheatgrass

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