

How Vitamin D Keeps You Young and Thin

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STORY AT-A-GLANCE

- › Researchers found an association between vitamin D and leptin levels. The hormone leptin is secreted by fat cells in proportion to fat deposits, signaling the hypothalamus to regulate energy balance
- › Researchers have found those with nonalcoholic fatty liver disease (NAFLD) often present with vitamin D deficiency; however, the research into supplementation is not consistent, potentially because supplement doses are not high enough to affect a change
- › Vitamin D is metabolized in the liver and undergoes further hydroxylation in the kidney, producing 1,25 dihydroxyvitamin D3, upregulating a transcription factor used to reduce reactive oxygen species and decrease cellular aging
- › Vitamin D insufficiency is linked to several negative health conditions, including cancer and cardiovascular disease. While it is best to optimize vitamin D levels with safe sun exposure, if you find supplementation is necessary after a serum vitamin D test, also supplement with magnesium and vitamin K2 (MK-7)

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Your body needs vitamins and certain nutrients to grow and develop normally. Vitamin D is one of them. Although not technically a vitamin – it's actually a fat-soluble hormone that transforms into vitamin D in your body – it's important to several different bodily processes. It's not commonly found in foods, but is added to some processed foods. It's also available in supplement form.^{1,2}

Optimally, your body will make vitamin D when your skin is exposed to sunlight; hence, it's also known as the sunshine vitamin.³ As mentioned, it plays a number of roles in the body, including helping the gut absorb calcium necessary for strong bones,⁴ modulating cell growth and optimizing your neuromuscular and immune functions.⁵

To date, the best indicator of vitamin D status is your serum (blood) concentration of 25-hydroxy Vitamin D, also called 25-OH vitamin D.⁶ Blood test results serve as a biomarker of your exposure to vitamin D.⁷

Chronic deficiency results in bone diseases, such as rickets and skeletal deformities. Research has also demonstrated that insufficiencies⁸ are associated with disease.^{9,10} More recently scientists have been looking at the association between vitamin D and **leptin**,¹¹ a hormone which controls your hunger,¹² and the effects vitamin D may have on antiaging.¹³

Physiological Link Between Leptin, Vitamin D and Adipose

Canadian researchers looked at the association between elevated leptin levels, vitamin D deficiency and their relationship to adipose tissue.¹⁴ They enrolled 113 men with a sedentary lifestyle who had abdominal obesity, were not taking a vitamin D supplement or had dyslipidemia.

The participants were involved in a lifestyle modification program over one year during which they were individually counseled by a nutritionist and kinesiologist every two weeks for the first four months. The goal was to reduce their calorie intake by 500 calories per day and increase their daily physical activity and exercise.¹⁵

After the first four months, the participants continued to be counseled once a month. At the beginning and end of the one-year study, a CT scan was done to map adipose deposits. Cardiometabolic biomarkers were also measured.

The researchers found that after making lifestyle changes, participants showed an increase in their vitamin D levels that was inversely correlated with their leptin levels.¹⁶ In other words, as their vitamin D levels rose, their leptin levels fell.

The participants were taking more steps per day and their heart rates were lower at a treadmill pace lower than their maximum effort after one year. Additionally, the researchers found an association between levels of vitamin D and the volume in adipose tissue deposits.¹⁷

The scientists felt this supported a possible physiological link between the two measurements which was independent from fat cell deposits. This led to a recommendation for lifestyle modifications to lower leptin levels in the clinical management of vitamin D deficiency.¹⁸

Interaction of Leptin and Weight Management

The hormone leptin is directly connected to body fat and obesity, making it important for those who are struggling with weight management. It is an adipokine, or a cell signaling protein (cytokine) released by fat cells in proportion to the fat deposits.¹⁹ For a long time, fat tissue was considered to be the body's inert tissue for storing energy.²⁰

In 1994, the discovery of leptin marked an immediate change in an understanding of the function of body fat.²¹ There are two forms of fat tissue, white and brown. **Brown adipose** tissue is found more frequently in newborns, distributed above the collarbone and around the neck area.²² The primary function is generating heat.

White adipose tissue is located throughout the body, and sometimes referred to as subcutaneous or visceral fat.²³ One of the physiological functions of white fat is to regulate metabolism through the secretion of leptin.²⁴ Leptin sends signals to the hypothalamus, where it helps regulate your energy balance and turn on or turn off your hunger response.

For instance, lower levels of leptin will trigger an increase in your appetite. But, because leptin is secreted in proportion to the amount of fat cells in your body, as you lose weight, your appetite increases with lower levels of the hormone.²⁵ This can make weight management more challenging.

As you produce more fat cells, they produce more leptin, which normally lowers the appetite. Your body does this to maintain a homeostatic level of fat deposits. However, with obesity, the body may become leptin resistant, which is a lack of sensitivity to the hormone.²⁶

When this happens, you may continue eating because you don't feel satisfied. The body then produces more leptin, which increases the levels and continues to drive resistance. Some people are born having a leptin deficiency; this signals uncontrollable hunger, increases energy intake and leads to both severe childhood obesity and delayed puberty.²⁷

Is There a Link Between Vitamin D and NAFLD?

Results of several studies evaluating links between vitamin D and nonalcoholic fatty liver disease (NAFLD) are not consistent, suggesting there may exist another factor not yet explored affecting the results of these studies, including the supplementation dosage of vitamin D that should be used.

A community-based study performed in Taiwan²⁸ sought to look at the association between levels of vitamin D and NAFLD. They studied concurrent symptoms of metabolic syndrome, high C-reactive protein and high levels of adipokines, including leptin.

Those who had viral hepatitis B or C, frequently drank alcohol, took a vitamin D supplement, steroid treatments, were pregnant or refused an abdominal ultrasound were excluded from the study. In the end, 564 individuals with fatty liver but no viral or alcoholic liver disease were included in the NAFLD group.

The control group contained 564 individuals matched for age and gender to the experimental group, who had normal ultrasound findings and liver function tests. The researchers found those who had deficient or insufficient vitamin D levels had a higher risk of metabolic syndrome.²⁹

However, they did not find that vitamin D insufficiency or deficiency, as defined by the study protocol, increased the risk of having NAFLD as compared to those who had a sufficient vitamin D level.³⁰ In this study, normal was considered 30 nanograms per milliliter (ng/mL), insufficiency was 20 to 30 ng/mL and those who had levels less than 20 ng/mL were considered deficient.

One systematic review of randomized controlled studies on the relationship between vitamin D deficiency and NAFLD found supplementation with vitamin D may improve symptoms.³¹ Another found epidemiological studies point toward an association and reinforce the rationale that supplementation may help manage NAFLD.³²

Other research finds the common coexistence of vitamin D deficiency and NAFLD may suggest a plausible treatment, but the limited number of prospective studies in humans and the lack of consensus in studies led the researchers to conclude it is premature to recommend supplementation with vitamin D for the specific treatment.³³

The inconsistent evidence may be related to the supplementation dosages used to measure change in those with NAFLD or nonalcoholic steatohepatitis (NASH).³⁴ NASH is a form of NAFLD, which includes hepatitis.³⁵ In one study using daily supplementation of vitamin D with 2000 IUs for six months, low levels of vitamin D were not corrected.³⁶

Vitamin D Plays a Role in Antiaging

Vitamin D is metabolized in the liver to form 25-hydroxy (OH) vitamin D. This then travels to the kidneys where further hydroxylation forms 1,25 dihydroxyvitamin D.³⁷ The authors of one study³⁸ looked at the hypothesis that 1,25 dihydroxyvitamin D₃ may have an antiaging effect.

They tested the theory that the vitamin would upregulate nuclear factor (erythroid derived 2)-like 2 (Nrf2), thus reducing reactive oxygen species and DNA damage.³⁹ In the body, reactive oxygen species are balanced by an antioxidant system regulated by pathways to ensure response. Nrf2 is found to be one regulator of resistance to oxidants.⁴⁰

Nrf2 has the effect of reducing reactive oxygen species and decreasing DNA damage. In combination with increasing cell proliferation and reducing cellular aging, researchers were able to demonstrate that mice deficient in 1,25 (OH)₂ D₃ survived only 3 months on average.

However, when the diets of the mice were supplemented with dietary calcium and phosphate, it prolonged their lifespan to more than eight months. These same types of mice were then supplemented with exogenous 1,25 (OH)₂ D₃, and it resulted in prolonging the average life of the experimental mice to more than 16 months.⁴¹

The researchers suggest the data demonstrate 1,25 (OH)₂ D₃ plays a part in extending life through the upregulation of Nrf2 and the subsequent inhibition of oxidative stress and DNA damage.⁴²

The role that Nrf2 may play in a number of different conditions is now being explored, such as its effects on cardiovascular risk in metabolic disease,⁴³ cancer⁴⁴ and chronic diseases.⁴⁵ Some are also evaluating the role Nrf2 transcription factor may have in protecting against Type 2 diabetes.⁴⁶

Vitamin D Insufficiency Linked to Negative Health Conditions

According to research⁴⁷ published in June 2018, an estimated 40% of Americans are deficient in vitamin D. This means that they have a vitamin D blood level that is lower than 50 ng/mL. "Sufficiency" means having a level of 50 ng/mL or higher.

Seventy-seven percent of American adults and teens are deficient in vitamin D when a sufficiency level of 30 ng/mL is used.⁴⁸ However, the sufficiency level recommended by the National Institutes of Health is not nearly high enough to prevent some chronic illnesses,⁴⁹ which is currently recommended at greater than or equal to 20 ng/mL of serum vitamin D.⁵⁰

Optimizing your vitamin D levels has been shown to have a powerful effect on health, helping to protect against a wide variety of diseases, including dry eye, cardiovascular

disease, [Alzheimer's disease](#) and obesity. You'll find more of the health conditions affected by vitamin D in my past article, "[Top 5 Signs of Vitamin D Deficiency](#)."

What Affects Your Vitamin D Level?

There are several factors that influence your personal vitamin D levels. By knowing and understanding these, you may determine the best way to attain optimal levels.

According to Harvard Health publishing, these are the top six factors:⁵¹

Geography – The farther away you are from the equator, the less UVB light you get during the winter months.

Air pollution – Carbon particles in the air will slow vitamin D production as they absorb UVB rays.

Sunscreen – Liberal use of sunscreen may prevent sunburn, but it also lowers vitamin D production.

Skin color – People with dark skin need more UVB exposure than those with light skin.

Weight – Body fat absorbs vitamin D, as it's a fat-soluble vitamin. Obesity is correlated with low vitamin D levels, which may also affect bioavailability.

Age – Older individuals will produce less vitamin D than younger people.

Optimize Your Vitamin D Levels

Although it is best to optimize your vitamin D levels with safe sun exposure, you may need additional supplementation if you are affected by one or more of the factors discussed above.

Research⁵² involving a community-based group of 3,667 participants with a mean age of 51.3 years, produced data that suggest it would require 9,600 IUs of vitamin D per day to get 97.5% to reach 40 ng/mL.

However, individual requirements vary widely based on a variety of factors, and you need to take whatever dosage required to get you into the optimal range. The only way to gauge how much you need is to have your levels tested, ideally twice a year.

You should test once in the early spring, after the winter months to make sure you took enough throughout the winter, and again in the early fall when your level is at its peak. You are aiming for a level between 60 and 80 ng/mL, with 40 ng/mL being the lowest cutoff for sufficiency.^{53,54} In fact, new research in 2018 showed that the optimal levels for cancer prevention are between 60 and 80 ng/mL.

Aside from determining your ideal dose of vitamin D3, you also need to make sure you're getting enough vitamin K2 (to avoid complications associated with excessive calcification in your arteries), calcium and magnesium.

Research^{55,56} has shown that taking high doses of vitamin D with an insufficient magnesium level reduces your body's ability to utilize vitamin D. Magnesium is required for the activation of vitamin D so, when it's low, vitamin D may be stored in its inactive form.

This may help explain why so many people may need rather high doses of vitamin D to optimize their levels. According to this review, as many as 50% of Americans taking vitamin D supplements may not get significant benefit due to insufficient magnesium levels.

It's vital that you take vitamin D with sufficient amounts of vitamin K2 (MK7) as both are required to slow the progression of arterial calcification.⁵⁷ **Vitamin K2** in the MK-7 form has been found to be bioactive. It regulates atherosclerosis, cancer, inflammatory diseases and osteoporosis.⁵⁸

Vitamin K2 may lower the risk of damage to the cardiovascular system by activating a protein that prevents calcium from depositing in the walls of your blood vessels.⁵⁹

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