

Vitamin D

and Autoimmune Disease

The connection between vitamin D and autoimmune disease is becoming better established, and new information and recommendations are continually emerging.

By Jill Weisenberger, MS, RD, CDE

Vitamin D, the fat-soluble vitamin that aids calcium absorption and assists with bone growth and remodeling, is well known for its role in bone health. But that's just a small part of the vitamin D story. Today, researchers recognize that vitamin D is critical to immune function and a deficiency in vitamin D can play a role in the development of multiple health problems, including autoimmune diseases such as multiple sclerosis, rheumatoid arthritis, type 1 diabetes, Crohn's disease and others.

What is surprising is the number of people believed to be vitamin D deficient. Researchers estimate that in the United States, approximately 41 percent of men and 53 percent of women have blood levels of vitamin D too low for optimal health.¹ According to a recent report in *Pediatrics*, 70 percent of the population between ages 1 and 21 years has inadequate levels of vitamin D in the blood.² Generally, blacks and Hispanics have lower levels than whites.¹ And, individuals with one or more autoimmune diseases are especially likely to be vitamin D deficient.³

In autoimmune diseases, the immune system attacks itself instead of foreign pathogens only, such as bacteria and viruses. There are more than 80 known autoimmune disorders. And, while the causes and cures of most remain a mystery, scientists agree that both genetic and environmental factors play important roles. What's more, vitamin D may be one of those environmental factors.

Shedding Light on Vitamin D

In recent years, scientists have made a connection between vitamin D and autoimmune diseases after statistics showed that multiple sclerosis, Crohn's disease and other autoimmune diseases are more common in Canada, the northern United States and Europe than in southern areas where there is more sunlight, especially in the winter months. In fact, people who were born and lived the first 10 years of their lives in the South have a lower risk of developing multiple sclerosis at any time throughout their lives.⁴

Vitamin D is known as the sunshine vitamin because, unlike other vitamins, it is synthesized from cholesterol in the skin in the presence of the sun's ultraviolet rays. Therefore, those living in the northern latitudes are more likely to have lower vitamin D levels. In addition to season and latitude, a person's skin color, age, use of sunscreen and the length of time spent outdoors influence the synthesis of vitamin D in their skin.

Intrigued that both autoimmune diseases and low vitamin D levels are more common in the northern latitudes, researchers looked for more associations between vitamin D and autoimmune disease. They discovered that immune cells have vitamin D receptors that allow the vitamin to enter these cells, further supporting the connection. Researchers also have observed low vitamin D levels in patients with systemic lupus erythematosus, type 1 diabetes and Crohn's disease compared with the healthy population.^{4,5} In 2008, Hungarian researchers reported that patients with

early signs of and at high risk for autoimmune connective tissue diseases, such as rheumatoid arthritis, systemic lupus erythematosus and Sjogren's syndrome, were more likely to convert to the full-blown disease if they had low vitamin D status.⁶ And, they discovered that in patients with rheumatoid arthritis, vitamin D levels are associated with disease activity; the lower the vitamin D levels, the greater the disease activity.⁴

Which Came First?

The question is whether autoimmune diseases cause low levels of vitamin D, or whether poor vitamin D status leads to autoimmune disease. Though scientists are still teasing out the answers, Margherita T. Cantorna, PhD, associate professor at Pennsylvania State University, suggests that vitamin D levels modify other risk factors that lead to autoimmune diseases. "If you don't have other risk factors (genetic and environmental factors), you won't get autoimmunity even if vitamin D is very low," she explains. Likewise, maintaining adequate vitamin D status may slow or prevent the development of lupus, multiple sclerosis or any other autoimmune disorder in individuals who are at high risk for developing these diseases.

Unfortunately, once individuals are diagnosed with an autoimmune disease, vitamin D is unlikely to offer a cure. As such, these individuals and their physicians should discuss vitamin D supplementation in addition to, but not instead of, standard therapies. "Based on what we know, there should be benefits of vitamin D even in patients using other treatments," explains Cantorna. "Supplemental vitamin D may lessen the symptoms of multiple autoimmune diseases." Solid proof that vitamin D supplements help any

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autoimmune disease in humans, however, is not yet evident. Much more research is necessary, Cantorna cautions. Family members also should discuss vitamin D supplementation with their physicians, since autoimmune diseases run in families.

D's Many Benefits

Vitamin D is linked to more than autoimmune diseases and bone metabolism.

- **Mortality:** In a study of more than 13,000 Americans, researchers found that those with the lowest vitamin D levels in the blood were the most likely to die during the median 8.7 years of follow-up.¹⁴
- **Heart disease:** In the Framingham offspring study of more than 1,700 individuals, those with the lowest vitamin D levels were the most likely to have a heart attack or other cardiovascular event in the five-year study period.⁸
- **Type 2 diabetes:** Vitamin D may have roles in insulin secretion and action. Low vitamin D levels are linked to type 2 diabetes.⁸
- **Falls:** Several studies have shown that vitamin D supplements decrease falls among the elderly, possibly because of improved muscle function.⁸
- **Cancer:** In the National Health and Nutrition Examination Survey of more than 16,000 men and women, those with higher vitamin D levels were less likely to have colorectal cancer. In a separate study of nearly 1,100 men, higher vitamin D levels were associated with less total cancer cases. Some, but not all, studies demonstrate lower rates of breast and prostate cancers with higher vitamin D levels.⁸

Vitamin D Deficiency

Low levels of vitamin D are likely related to a combination of factors, including low vitamin D intake, poor absorption, genetic factors, time spent in direct sunlight and more. As little as five to 10 minutes of sunlight on the arms and legs or face and arms between 11 a.m. and 2 p.m. three times per week should provide adequate vitamin D status for an average healthy person. Unfortunately, although it is proven to reduce skin cancer, sunscreen decreases vitamin D synthesis in the skin. Sunscreen with a sun protection factor (SPF) of 15 reduces the production of vitamin D in the skin by 99 percent.⁷ Cloud cover, shade and pollution further inhibit vitamin D synthesis. And, while tanning beds are thought to provide vitamin D, they are an unreliable source.⁸ In addition, individuals with dark skin produce less vitamin D when exposed to sunlight than light-skinned people. And, as people age, they also are less efficient at synthesizing vitamin D from sunlight. For instance, a dark-skinned octogenarian living up north is at greater risk of being vitamin D deficient than a light-skinned young adult residing in the South.

What seems to be an adequate intake from food and supplements may be inadequate in people with fat malabsorption diseases, such as cystic fibrosis, or diseases of the gastrointestinal tract, such as Crohn's disease, ulcerative colitis and celiac disease, as each of these health problems causes decreased nutrient absorption. Gastric bypass surgery and small bowel resections also will limit nutrient absorption.

Carrying extra pounds raises the risk of vitamin D deficiency, too. The greater an individual's body fat, the more likely this fat-soluble vitamin will be trapped in fat stores instead of circulating in the blood and making itself available to the various cells and body systems.⁹

Some medications also increase an individual's risk of vitamin D deficiency. Corticosteroids, such as prednisone, and anti-seizure medications, such as phenobarbital and phenytoin, may impair vitamin D metabolism. In addition, the weight-loss drug orlistat (Xenical and Alli) and the cholesterol-lowering drug cholestyramine inhibit absorption of vitamin D and other fat-soluble nutrients.¹⁰

Whether from food or sun, vitamin D must be metabolized in both the liver and the kidney before becoming activated, so having diseases of either of these organs will further lower an individual's vitamin D status.

A blood test can determine the level of vitamin D circulating in a person's bloodstream. However, scientists are still

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debating the ideal amount. Many, however, believe the current recommendations are too low. Until researchers unravel this vitamin's roles in each body system, controversy is likely to remain. For now, many scientists recommend serum levels of at least 30 ng/ml.¹¹ With vitamin D so critical to multiple body systems, including the immune function, and with inadequate levels so common, individuals should consider asking their physician for this blood test.

D's Discovery

Scientists recognized the association between sunlight and bone health during the industrial revolution in Europe when pollution blocked direct sunlight. This caused children living in polluted areas to suffer growth abnormalities and a bone disease called rickets. On the other hand, children living in rural areas continued to grow properly. When the children with rickets received sunlight on the rooftop of a hospital for several months, their rickets improved.

Eventually, scientists learned that sunlight and a compound produced by it (named vitamin D) could both eradicate and prevent rickets.¹⁵ By the 1930s, vitamin D was the new miracle vitamin added to numerous foods, including milk, hot dogs, peanut butter and even a variety of Schlitz beer marketed as the beer with sunny energy in both summer and winter. Today, milk and some cereals and juices are fortified with vitamin D in the United States.

D in the Diet

Food is an unreliable source of vitamin D. Oily fish, such as salmon, tuna, mackerel and sardines, and UV-irradiated mushrooms are good sources. Egg yolks supply moderate amounts. Fortified foods provide most of the vitamin D in the American diet. In the U.S., most milk is vitamin D fortified. Some fruit juices, yogurts, breakfast cereals and margarines also are fortified. Many people assume that because milk is a good source of added vitamin D that other dairy products also supply this vitamin. But, cheese, ice cream and some yogurts are not good sources of vitamin D because they are generally not made with fortified milk. Individuals who drink soymilk regularly should make sure their brand is fortified with both vitamin D and calcium.

How Much Is Enough?

The current vitamin D recommendations were set in 1997. These recommendations established the Adequate Intake (AI) for infants, children and adults under 51 years to be 200 IU of vitamin D. The AI increases to 400 IU for adults between the ages of 51 and 70 and to 600 IU for those over age 70.¹⁰

But, with so much new research about vitamin D's many roles, the Food and Nutrition Board (FNB) at the Institute of Medicine has established an expert committee to re-evaluate adequate vitamin D intakes. Many experts believe the recommended intake levels will increase, and the FNB report is expected by midyear.

Yet, some experts and expert panels are not waiting for the FNB report. In fact, in 2008, the American Academies of Pediatrics recommended that all infants, children and adolescents receive a minimum of 400 IU beginning the first days of life.¹¹ Other scientists recommend 1,000 IU daily. John Jacob Cannell, MD, executive director of the Vitamin D Council, suggests as much as 5,000 IU for healthy adults.¹² Currently, however, the FNB set the maximum upper limit at 1,000 IU for infants and 2,000 IU for everyone else.¹⁰

Despite this, individuals should not jump on the D bandwagon too quickly. The vitamin looks promising, but concrete evidence is scant, and not enough is known about the side effects of higher-than-usual doses. Because there are so many unanswered questions, all individuals should speak with their physician before supplementing.

When Diet and Sun Aren't Enough: Picking a Supplement

Vitamin D supplements are available both by prescription and over the counter. Vitamin D₃, or cholecalciferol, is the form your body makes in response to ultraviolet light. In plants, ultraviolet light triggers the synthesis of vitamin D₂, also called ergocalciferol. Vitamin D₃ may be more potent,¹³ so this is the form many recommend. Individuals should be certain to ask the proper dosage for their specific concern.

Too Much of a Good Thing

The body cannot synthesize too much vitamin D from spending time in the sun, and individuals are unlikely to consume too much through food, except perhaps from large amounts of cod liver oil.¹⁰ However, taking supplements long term is associated with toxicity symptoms. Common symptoms of vitamin D overload include nausea, vomiting, poor appetite, constipation and weakness.¹⁰ More seriously, high vitamin D levels can raise calcium concentrations in the blood, resulting in confusion and abnormal heart rhythms. Phosphorus levels also may rise, and both calcium and phosphorus may become deposited in the kidneys and other soft tissues.¹⁰

According to the Natural Medicines Comprehensive Database, individuals with kidney disease, sarcoidosis, histoplasmosis, lymphoma, overactive parathyroid gland or ather-

osclerosis (hardening of the arteries) must take extra precautions. Vitamin D supplements could make any of these conditions worse or lead to an increased risk of kidney stones.

As with any nutrient supplement, vitamin D can interfere with medications, including certain cholesterol drugs, diuretics (water pills), heart medications and aluminum-containing antacids. Individuals are advised to talk to both a physician and pharmacist about nutrient-drug interactions. ■

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