



VITAMIN D SUNSHINE AND SO MUCH MORE

IF THIS VITAMIN ISN'T
IN YOUR MEDICINE
CABINET, IT PROBABLY
SHOULD BE.

by LINDA B. WHITE, M.D.

What do the following conditions have in common: osteoporosis, multiple sclerosis, high blood pressure, diabetes and cancer? Give up? They all have been linked to vitamin D deficiency. More precisely, insufficient levels of vitamin D raise your risk of getting these diseases. *And* most of us probably are vitamin D deficient.

But isn't vitamin D the one that keeps bones strong? That's about all I was taught in medical school. Recently however, this field has exploded as scientists uncover the vitamin's far-reaching effects. Because it increases calcium levels, vitamin D indirectly fortifies bones and teeth. It also regulates

cells all over the body. These direct effects explain vitamin D's disparate roles, such as influencing insulin production and immune function, as well as helping prevent inflammation and cancer.

The scary thing is that vitamin D deficiency appears to be quite common. A recent British study found that 87 percent of volunteers had low blood levels of the vitamin in winter and spring, and 61 percent had low levels in summer and fall. Why the seasonal variation? Our chief source of vitamin D is sunshine.

Why We're D-ficient

In response to ultraviolet B (UVB) rays in sunlight, our skin transforms a

derivative of cholesterol normally found in the skin into vitamin D₃ (cholecalciferol). The liver, the kidney and other tissues further activate this molecule. Given that the skin is a veritable vitamin D factory, why is deficiency so rampant? History—ancient and recent—holds the answers.

Humans evolved near the equator and spent days outdoors, allowing the skin to generate ample amounts of this vitamin. About 50,000 years ago, some of our ancestors migrated toward the poles, where winter sunlight isn't intense enough for vitamin D production. However, their diet of vitamin D-rich fish compensated for the deficit.

But when the Industrial Revolution darkened the skies with pollution in the 18th century, people shifted to indoor labor, and rickets became prevalent. This manifestation of severe vitamin D deficiency causes skeletal deformities, such as bowed or knocked knees and bony knobs along the ribs, known as rachitic rosary. During the 1930s, the decision to add vitamin D to milk nearly eradicated rickets in the United States. But nowadays, kids and adults drink less milk and more juice and sodas, and sadly, rickets is making a comeback in American children according to a study released last year.

Starting about 30 years ago, another cultural shift deepened our vitamin D deficit: public health campaigns to avoid the mid-day sun, cover up and apply sunscreen. They were justified attempts to save our skins from sun-induced aging and cancer, but now we're not making enough vitamin D. These days, vitamin D deficiency has become commonplace, even in the tropics. For instance, a sampling of adults in sunny Honolulu, Hawaii showed that half were low in D.

Of course, we can take supplements, but current government recommendations are cautious—200 IU a day for young adults, 400 for people 51 to 70, and 600 for those over 70. Vitamin D expert Bruce W. Hollis, M.D., of the Medical University of South Carolina, says such doses might be enough to prevent rickets, but aren't sufficient to fulfill other important functions.

Most of us don't even meet these inadequate guidelines. A German study found that 80 percent of sampled adults didn't consume recommended amounts, and nearly 60 percent had low blood levels of vitamin D, a statistic that rose to 75 percent in women over 65 years old. Furthermore, those women with low blood levels of vitamin D were more likely to have high blood pressure, cardiovascular disease and type 2 diabetes.

Results of D-ficiency

So what are the consequences of too little vitamin D in your system? A whole host of chronic conditions.

Musculoskeletal function. Rickets was the first disease tied to vitamin D depletion. This severe deficiency during child-



Taking a 15 minute walk outside around lunchtime, when the sun is high, can help you get your daily dose of vitamin D.

hood can prevent kids from reaching their potential for full height and peak bone mass. (Bone mass peaks in early adulthood; after that it slowly declines.)

In adults, vitamin D deficiency can lead to osteoporosis (thin, brittle bones) and osteomalacia (rubbery demineralized bones). The latter causes bone pain, and both elevate the risk of broken bones.

Additionally, vitamin D deficiency causes muscle weakness and discomfort. One study found that patients with aches and weakness were often severely vitamin D deficient. Hollis says he's hearing from doctors that vitamin D supplementation often resolves these aches and pains, adding "A lot of 'fibromyalgia' is probably D deficiency."

Weakened muscles increase the risk of falls and fractures—a dangerous combination for the elderly. The research shows that, although the recommended dose of 400 IU a day doesn't prevent falls and fractures in older adults, doses over 800 IU do. In fact, consuming 700 to 800 IU of vitamin D a day (plus or minus calcium) could prevent a quarter of hip fractures in older people, according to a study published in the *Journal of the American Medical Association*.

Cancer. Vitamin D deficiency has been linked to several types of cancer, including breast, prostate, colon and melanoma. In fact, for more than 60 years, research has found that people living at higher latitudes with less exposure to sunlight showed an increased risk of cancer mortality. Adequate vitamin D levels seem to protect against some cancers. In a recent study, researchers followed healthy postmenopausal women whom they assigned to take either 1,400 to 1,500 milligrams a day of supplemental calcium, plus 1,100 IU a day of vitamin D₃, or placebo for four years. After the first year, vitamin D led to a 57 percent reduction in cancer.

Cardiovascular disease. In addition to cancer and bone disease, vitamin D may also be healthy for your heart. Vitamin D levels are inversely associated with the risk of high blood pressure and congestive heart failure. Exposing people with high blood pressure to ultraviolet light has been shown to improve the condition.

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Asthma. Preliminary studies show that vitamin D also may help alleviate respiratory problems, such as asthma. According to one study published in the *American Journal of Clinical Nutrition*, children of mothers with lower intakes of vitamin D during pregnancy are more likely to develop asthma.

Autoimmune disorders. Vitamin D reduces inflammation and plays a role in the maturation of the immune system. Deficiency is common in autoimmune diseases where the immune system attacks normal cells, such as type 1 diabetes, rheumatoid arthritis and multiple sclerosis (MS). Emerging research shows that vitamin D may have a preventive effect. One study examined two large groups of women for 10 years and found a reduced risk of MS was associated with vitamin D supplementation. A study of Finnish children taking 2,000 IU a day (10 times the current recommendation) showed they had a decreased risk of developing type 1 diabetes. In an analysis of the Iowa Women's Health Study, women consuming higher levels of vitamin D showed a reduced risk for rheumatoid arthritis.

Mental health. Psychiatrist John Cannell, M.D., founder of the nonprofit Vitamin D Council (www.vitaminDcouncil.com), says that vitamin D may contribute to several emotional disorders. In a study of elderly people, mood and think-

SPF 8 sunblock reduces the skin's vitamin D production by 95 percent



ing skills deteriorated with lower levels of D. Cannell points out that seasonal affective disorder (SAD) is a type of depression whose onset follows the waning daylight of autumn and winter. An Australian study found that vitamin D supplements lifted the mood of people with SAD.

How to Get Enough D

Expose yourself. Sunscreens block UVB waves, the wavelength that stimulates the skin's vitamin D production. According to Michael F. Holick, M.D., Ph.D., of the Boston University School of Medicine, a sunblock with SPF 8 reduces the skin's vitamin D production by 95 percent. "If you wear sunscreen 'properly,' you'll become vitamin D deficient," he says.

But what about skin cancer? Despite rampant sunscreen usage, skin cancer rates have risen. One reason is that, until recently, sunscreens didn't impede deeply penetrating UVA light, and presumably, our false sense of security led to more time in the sun and an increase in skin cancer.

What should you do? "Be sensible," Holick advises. "Know your own skin

sensitivity." For instance, if you turn pink after 30 minutes in the summer sun, then spending five to 10 minutes (in a bathing suit) in the sun should generate plenty of vitamin D. After that, apply sunscreen, cover up and seek shade. (For more information, check out Holick's book, *The UV Advantage*, and his Web site,

www.uvadvantage.org.) For those who work indoors all day, Walter Willett, M.D., of Harvard Medical School, recommends taking a 15 minute walk outside around lunch time when the sun is high to get your daily dose of vitamin D on your face and arms. (Complete cloud coverage cuts UV energy in half, and shade reduces it by 60 percent.)

Eat D-licious foods. Only a few foods contain much vitamin D. Hollis stresses that simply drinking a glass of fortified milk a day will fall far short of your needs. Sources of vitamin D include cod liver oil (1,360 IU per tablespoon); oily fish such as salmon, sardines and mackerel (about 350 IU per 3.5 ounces); eggs (about 20 IU per yolk); and fortified milk, soy milk and orange juice (98 IU per 8-ounce serving). (*We're currently testing pasture-raised chicken eggs for vitamin D as part of our 2007 egg testing project. See "Meet Free-range Eggs," October/November 2007 for the initial results.* —MOTHER.)

Shiitake mushrooms can be an exceptional source of vitamin D, as noted in research published in Paul Stamets' book, *Mycelium Running*. Shiitake mushrooms grown and dried indoors have only 110 IU of vitamin D per 100 grams. But when the same mushrooms were dried in the sun, the vitamin D content rose to 21,400 IUs per 100 grams. Even more surprising, when the same mushrooms were dried with their gills facing up in the sun, their content rose to 46,000 IU!

Take supplemental D. Most North Americans can't maintain healthy blood levels of D from sunlight and good diet. Therefore, many experts recommend 800 to 1,000 IU a day—several times the current government guidelines of 200 to 600 IU.

The exact amount depends upon several

Shiitake mushrooms dried gills up in the sun have a whopping 46,000 IU of vitamin D!



things. If you're dark-skinned, live at higher latitudes, spend little time outdoors, or wear a burka, you'll obviously need more than a Caucasian lifeguard. And if you're already deficient in vitamin D, you'll need hefty doses just to get your blood levels up to normal.

If you're pregnant or nursing, you'll also need more. Hollis and colleagues are currently researching the effects of different vitamin D doses in pregnant women of various races. Until the results of that trial are finalized, he can't recommend more than 2,000 IU per day.

When asked how much vitamin D they normally take, Hollis says he takes 4,000 IU a day, while Holick says his whole family takes 1,000 IU of D₃ a day. Holick also spends reasonable amounts of time outdoors.

Be aware that many supplements provide vitamin D as ergocalciferol (vitamin D₂), rather than cholecalciferol (vitamin D₃). D₃ is the form naturally occurring in our bodies and is more effective.

No one really knows how much vitamin D might be too much. However, vitamin D toxicity is exceedingly rare. The Food and Nutrition Board sets the upper level for daily dietary intake at 50 micrograms or 2,000 IU, though Hollis thinks this may not be enough to maintain health at northern latitudes. Accumulated research demonstrates 10,000 IU vitamin D₃ to be a more realistic upper limit of consumption.

Who's at Risk?

The only way to measure vitamin D blood levels is to check a form of vitamin D called 25-hydroxyvitamin D. Doctors don't routinely perform this test, and Holick thinks universal screening would be too expensive. If you're at risk for, or already have symptoms of, deficiency, then you might want the blood test. Just who's at risk? Research shows the following populations face greater risk of vitamin D deficiency:

Dark-skinned people. Melanin both darkens skin and absorbs ultraviolet light, which protects against sun damage and limits vitamin D production. Holick's research shows that 80 percent of African-Americans studied in Boston over age 65

were vitamin D deficient—at the end of summer! (Boston is at 42 degrees latitude, see below.)

Northerners. People who live at higher latitudes where winters are long and dark run a higher risk of vitamin D deficiency. Holick notes that even fair-skinned people living above 37 degrees latitude make little vitamin D during the winter. (San Francisco is just above 37 degrees latitude).

Older adults. The skin production of vitamin D and its activation in the kidneys declines with age. Further, the elderly typically spend more time indoors. Rampant vitamin D deficiency in this age group contributes to osteoporosis and falls.

Breast-fed infants. Research in Iowa by Hollis and colleagues found that vitamin D deficiency, including severe deficiency, was common among breast-fed infants not taking vitamin D supplements. Vitamin D deficiency in nursing mothers is the reason breast milk is D deficient. Unfortunately, early-life deficiency can have lifelong consequences.

People with intestinal disorders. Disorders that interfere with fat absorption include celiac disease, Crohn's disease, pancreatic insufficiency, liver disease or cystic fibrosis. Fat-soluble vitamins such as D are absorbed from the intestine with dietary fat, so people with reduced ability to absorb fat may need vitamin D supplements.

Sun avoiders. People who cover up for religious, cultural or health reasons also run the risk of deficiency. Clothing blocks UVB waves, interfering with or preventing the skin's formation of vitamin D.

The obese. In a British study, obese people were twice as likely as those of normal weight to be low in vitamin D. Hollis explains it's because fat sponges up vitamin D and stores it, but doesn't release it. 🌳

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