

## VITAMIN D *THE SUNSHINE HORMONE*

Millions of people worldwide wear sunscreen and avoid the mid-day sun to protect against premature skin aging and skin cancer. Now, studies suggest staying out of the sun may unwittingly increase our chances of developing bone fractures, diabetes, multiple sclerosis, colon and breast cancers, and other health problems linked to low levels of vitamin D. Why? Most of the vitamin D our body uses is made in our skin when it is exposed to strong sunshine.

People began to realize the health benefits of sun exposure back in the early 1800s. A Polish physician named Sniadecki was one of the first to make the connection when he observed that large numbers of children who lived in the dimly lit narrow streets of heavily industrialized areas were suffering from rickets (soft deformed bones), while their counterparts who lived in rural areas with plenty of sunshine were not.

By the late 1800s, solariums were being built in northern Europe and parts of the United States in an effort to treat rickets, osteomalacia (adult rickets), smallpox, tuberculosis, and other diseases.

Vitamins are substances that are essential to the function of the human body but are not produced by the body. Hormones, on the other hand, are produced by the body and function as chemical messengers.

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*“With sun exposure, the skin can supply the vitamin D our body needs.”*

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While this sun connection was being explored, researchers and physicians were also achieving amazing results by using cod liver oil to treat rickets and other diseases.

As it turns out, the commonality between sun exposure and cod liver oil is the component now known as vitamin D, which is not really a vitamin at all, but a hormone.

Because cod liver oil was effective in treating diseases, it was assumed that the active substance was a vitamin. Upon further research, it was discovered that the chemical structure of vitamin D is very similar to that of cholesterol and the sex and adrenal hormones. And, like other hormones, it is actually produced in the human body.

## ***How Our Bodies Make Vitamin D***

With sun exposure, the skin can supply the vitamin D our body needs. Ultraviolet B (UVB) rays readily convert cholesterol stored in our skin into vitamin D3, which is ultimately converted to the active form of vitamin D.

When sufficient D3 is produced, the skin stops production, making a vitamin D “sun overdose” impossible. In the north, outdoor workers typically produce significantly more of vitamin D3 than they need in the summer, and their bodies can store this amount for months, drawing on it as needed. However, by the end of winter, most have used up all of their reserves.

In lieu of sunshine, vitamin D can also be obtained through the diet or supplements. There are two primary forms of vitamin D:

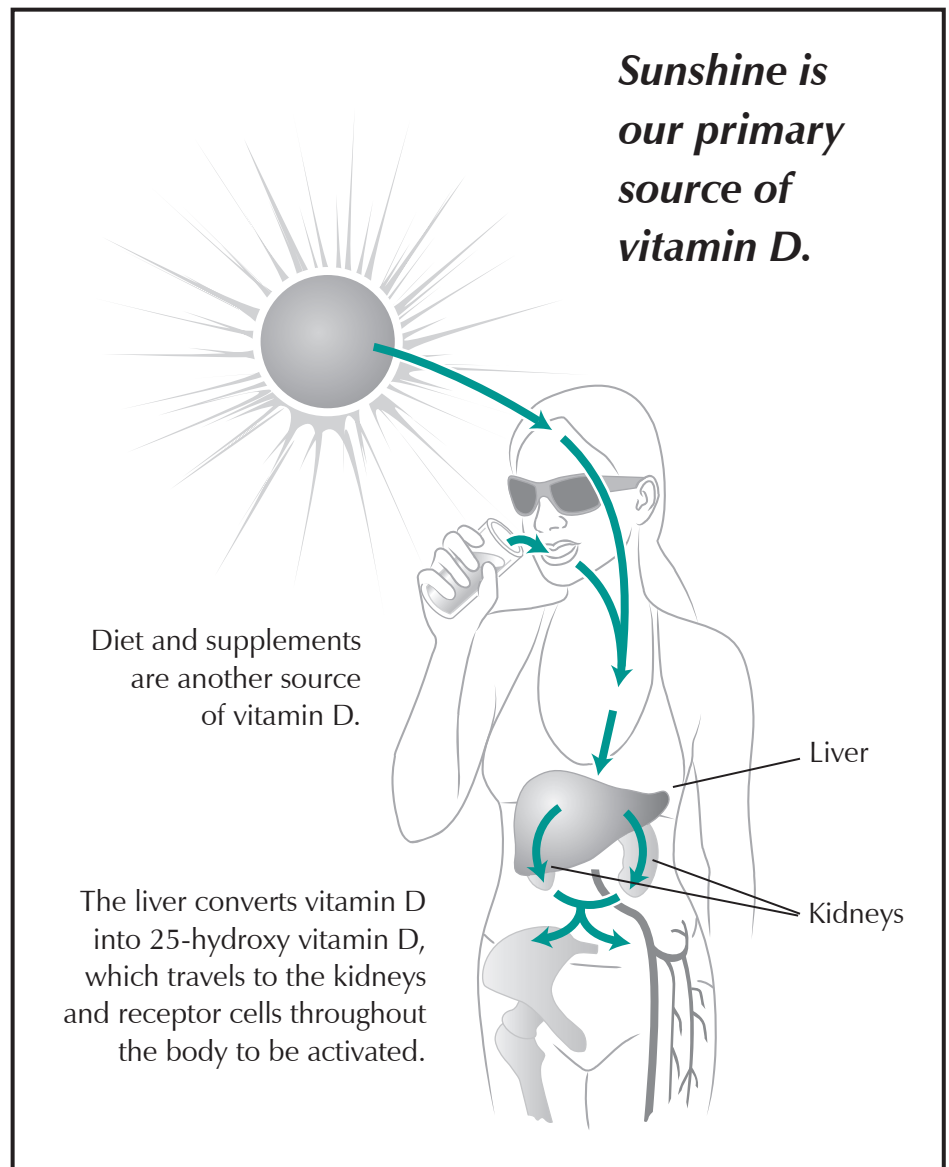
- D2, which is synthesized in plants
- D3, which sunlight triggers the conversion from cholesterol in animals.

Humans can make use of both forms, and both are commonly found in supplements and fortified foods, although D3 is considered to be the more potent form (remember the earlier discussion of cod liver oil treatments).

However it arrives, inert vitamin D (either D2 or D3) is first converted in the liver, where it is turned into another inactive form called 25-hydroxy vitamin D. This is the “circulating” form that travels to the kidneys and through the bloodstream throughout the body, as shown in the figure below.

## ***The Importance of Vitamin D***

In the past decade, medical researchers have learned that vitamin D plays a much greater role in maintaining overall health than previously thought. Until recently, it was believed that vitamin D’s primary role



*The sun’s UVB rays on exposed skin trigger the conversion of cholesterol stored in the skin into vitamin D3. When activated, vitamin D3 helps to maintain bone health, immune system, and other essential body functions.*

was to maintain the proper balance of calcium and phosphorus needed to build and maintain healthy bones, and that it was activated only by the kidneys. However, research by Michael F. Holick, MD, PhD, revealed that nearly all cells in the body contain vitamin D receptors, which allow them to convert circulating (inactive) vitamin D<sub>3</sub> into the active hormone. When we have enough vitamin D in our bloodstream to regulate calcium, the “extra” vitamin D is recruited and activated by cells all over the body.

In addition to its role in bone health, vitamin D also regulates dozens of genes and is involved in normal cell division, immune function, insulin secretion, blood clotting and blood pressure. Given all these roles, maintaining sufficient levels of vitamin D is crucial to overall health. However, Dr. Holick estimates that 30-50% of Americans are actually vitamin D deficient.

### **Why Are So Many People Now Vitamin D Deficient?**

While no one has proven why deficiency is on the rise in the developed world, the problem has grown in the last 20 years, in tandem with a noted decline in sun exposure. Few people today spend significant time outdoors, and fewer still go outdoors without sun protection. In addition, geography, season, skin color, age, body weight, and medications can all influence your body's abil-

ity to produce enough vitamin D (see box on page 4).

People are living longer, and older people do not produce vitamin D from the sun as effectively as when they were younger. Many people also now avoid dairy products, one of the most popular fortified foods. And, many more people now suffer from obesity, which also increases the risk of a vitamin D deficiency.

### **Measuring Vitamin D**

The recommended way to evaluate your vitamin D status is to measure the level of 25-hydroxy vitamin D circulating in your blood. This is a fairly stable measurement that indicates how much vitamin D is present in storage, ready for conversion to the active form of vitamin D. Because this activation can occur inside cells and organs, the activated form is not easy to measure or evaluate.

Levels of 25-hydroxy vitamin D are measured in nanograms per milliliter (ng/mL) and typical “normal” levels start around 20 ng/mL. However, many researchers and healthcare practitioners now believe that the optimal range may actually be 1.5 to 3 times that amount. Talk to your healthcare practitioner about ordering this test to determine your vitamin D level before starting any supplement.

The Vitamin D Council, ([www.vitamindcouncil.com](http://www.vitamindcouncil.com)) also provides access to kits for home testing 25-hydroxy vitamin D. Keep in mind, because of seasonal differences in sunshine, testing in the late winter will typically yield your lowest level, and testing in late fall will establish your peak level. Any supplementation should be monitored and adjusted for seasonal variations.

### **Signs of Deficiency**

Many people who are deficient in vitamin D exhibit symptoms that are easily confused with other conditions. For example, chronic pain in muscles, joints, and bones is often misdiagnosed as fibromyalgia, chronic fatigue, or myalgia. Muscle weakness is apparent when a person has to rock back and forth to get up out of a chair, or are so unsteady when they walk that they need to hang on to something.

When pressure applied to the breast bone causes pain, this may be a symptom of osteomalacia. A deficiency of vitamin D and the ensuing musculoskeletal weakness contributes to a higher risk of falling. And, because the bone structure is weakened, breaks are more common.

Seasonal affective disorder (SAD) is another potential sign of vitamin D deficiency. SAD can be misdiagnosed as depression or bipolar

disorder. It is often remedied by exposure to sunshine, UVB rays, or vitamin D.

Chronic diseases, such as periodontal disease, loose teeth, and high blood pressure, can also be signs of vitamin D deficiency.

A compromised resistance to infection is also sometimes associated with inadequate vitamin D, which we now know is critical for immune system function.

Of particular interest to women of child-bearing age is a report from Dr. Ellie Campbell, who noted that many of her female patients who were struggling with infertility also tested remarkably low in vitamin D. When these women were given supplements to restore their vitamin D levels, they were able to get pregnant.

Polycystic ovary syndrome, another prevalent cause of infertility, is also associated with low vitamin D levels, Dr. Campbell reports. In addition, PMS and dysfunctional bleeding may also be associated with a vitamin D deficiency.

As noted earlier, women who breastfeed can deplete their vitamin D reserves. Subsequently, their breast-fed infants also tend to be vitamin D deficient.

Several studies have also shown that vitamin D deficiency is common among

## Vitamin D Deficiency: Who's at Risk?

- People with very little sun exposure have the highest risk.
- People living above the 35th parallel. From November to April, the sun is not strong enough for any vitamin D<sub>3</sub> production.
- People who wear clothing that covers most of their bodies.
- Hospital inpatients, residents of institutions, and shut-ins.
- Sunscreen users and people with darker skin who reside in sun-deprived areas.
- People living in areas with high air pollution.
- Elderly people because age significantly reduces, but does not eliminate, the skin's ability to create vitamin D<sub>3</sub>.
- Obese people because obesity causes vitamin D<sub>3</sub> to be stored in fat, which makes it less available for use.
- People with celiac disease, Crohn's disease, cystic fibrosis and other conditions that impair the body's ability to absorb vitamin D.
- People taking medications that reduce cholesterol absorption or otherwise interfere with the body's vitamin D conversion process.
- People with chronic kidney disease or liver failure.
- Breast-fed infants when mothers are vitamin D deficient.
- Breast feeding mothers may become more deficient as the breast milk takes up the stored vitamin D.

post-menopausal women, probably due to age-related decline in vitamin D production, as well as changes in body composition.

## ***Optimizing Levels of Vitamin D***

Most sources recommend exposure to the sun as the best source of vitamin D. However, it is possible to damage the skin by burning before enough vitamin D is produced, so it is important to avoid over-exposure. Approximately 10 to 15 minutes of daily exposure to the midday sun with bare arms and legs is typically recommended.

Tanning beds may also be an acceptable means of obtaining vitamin D; however the ultraviolet A rays that cause tanning (and burning) predominate, so again exercise caution to avoid overexposure.

After sunning or tanning, the skin oils that contain cholesterol will continue to be converted into vitamin D for approximately 48 hours. For this reason, bathing or showering should be delayed for as long as possible to allow the conversion process to run its course. Additionally, chlorine in swimming pools will strip the skin oils and negate the vitamin D conversion process.

## **Vitamin D Supplements**

For many people, optimal vitamin D levels may require a combination of sun exposure, dietary sources of vitamin D, and supplements as needed.

The vitamin D3 that is identical to the sun-activated vitamin D in the human body is only available from animal sources. Pigs create vitamin D from the sun in the same way as human beings. Ruminant animals such as cows, sheep, and goats get vitamin D from eating green grasses or lichen. Fish get vitamin D from eating algae. However, the richest sources of vitamin D are organ meats, skin, fat, intestines and eggs, which are often excluded in our modern diets.

Vitamin D2 can be obtained from vegetable sources such as mushrooms, lichen and yeast; however it is considered to have only about a third of the biological activity of vitamin D3.

Having recognized the danger of rickets and osteomalacia, many governments allow for the fortification of foods with vitamin D2 or D3. Small amounts of vitamin D are often added to milk and orange juice, for example.

Supplements of vitamin D2 or D3 are also available by prescription and over-the-

counter. Vitamin D can be administered as an injection, or applied to the skin, or taken orally (absorbing best with a fatty meal).

Most multivitamins and standard vitamin D tablets contain 400 IU per day, an amount that some say is insufficient for most people. According to Dr. Holick, much evidence suggests the recommended vitamin D3 intake needs to be increased to 800-1,000 IU per day. Dr. Cannell maintains that adults with no sun exposure may require up to 4,000 IU per day, depending on their size and skin color.

## ***Benefits***

Smaller trials and observational studies suggest that optimizing vitamin D levels may help prevent a wide range of diseases associated with low levels of vitamin D, including:

- various forms of cancer
- cardiovascular disease
- hypertension
- diabetes
- multiple sclerosis
- rheumatoid arthritis
- inflammatory bowel disease
- periodontal disease
- autoimmune diseases
- chronic pain
- influenza.

To achieve these benefits, it is important to work with your healthcare practitioner to monitor your vitamin D levels.

Optimizing your vitamin D levels with adequate and sensible sun exposure, dietary sources, and supplements as needed, offers real benefits. Vitamin D contributes significantly to overall health, throughout your life stages.

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