

The D Report

By
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Introduction

With vitamin D, the sunshine vitamin, garnering so much attention in the press recently, it is natural to wonder if this is just another nutrient fad which will fade, or if the attention is warranted. Fortunately, the growing body of evidence speaks for itself. And while vitamin D research is a fascinating and exciting journey, there is also a very urgent and alarming message that must be relayed. Furthermore, much confusion still exists among health care providers and consumers alike about vitamin D basics which I will address below. But before I do, consider this:

Adequate intake (AI- the new RDA) for vitamin D as determined by the Food and Nutrition Board is 200 IU (International Units) for infants to 50 year olds, 400 IU for 51 to 70 year olds, and 600 IU for those 71 and older. Yet, at noon on a sunny, summer day in Port Townsend, it is possible for most residents to make **10,000 IU** in fifteen minutes, or 50 times the AI, while wearing bathing suits and not using sunscreen! This same group under the same conditions in winter could not make any D, regardless of the amount of sunshine. I am going to explain just why this is and the discrepancy between the government recommendations and our bodies' actual requirements.

Vitamin D deficiency is a global phenomenon, verified through numerous studies throughout the world. The unfortunate consequences of medical and consumer groups recommending sun avoidance, indiscriminate sunscreen use, and minimal supplementation for the last few decades are catching up to all groups whether young, old, black, white, male, female, pregnant, trying to become pregnant, breastfeeding, etc. The list of acute and chronic diseases linked to vitamin D deficiency continues to grow: at least 17 types of cancers, high blood pressure, chronic pain, muscle weakness, stroke, asthma, diabetes, birth defects, depression, autoimmune diseases, osteoporosis, preeclampsia, colds, flus, and many more.

On a more personal note, having patients in most regions of the United States, I can affirm through my own testing over the years that deficiencies, often severe, exist among those in warm, sunny climates almost as regularly as northern latitudes such as the Pacific Northwest.

The good news is that determining whether you are deficient or not can be accomplished through a simple blood test. Even better, correcting a deficiency is straightforward, safe, cost-effective, and often results in greatly improved health. Though not an overnight process, most deficiencies can be corrected in several months with proper guidance. Understanding how to go about accomplishing this will help you make more informed health decisions.

The Basics

A Little Physiology

The main source of vitamin D comes from sun exposure. UVB rays penetrate the skin, striking cholesterol sitting near the surface. Through a series of reactions in the liver, kidneys, and throughout the body, this cholesterol becomes vitamin D3, or **cholecalciferol**, then a compound called **25(OH) D**, and finally a full fledged hormone called 1,25(OH)2D. Why is knowing this important?

Supplements

Vitamin D found in supplements can be either D3 or D2, ergocalciferol. Ergocalciferol is not found in the body, but cholecalciferol (D3) is, as seen above. Most vitamin D experts recommend D3 for this very reason, as well as the fact it has a longer shelf life and maintains more consistent blood levels. Speaking of blood levels, 25(OH) D, also shown above is the name of the test ordered to determine the amount of vitamin D circulating in your body, and whether this amount is adequate or deficient. But, I'll have more on this later. One important note for those practicing a vegan lifestyle, D2, is a non-animal source, whereas D3 is not.

Food Sources

Unfortunately, food sources containing vitamin D are not prevalent. If they were, deficiency would obviously not be so widespread. Many foods we think of as having vitamin D such as milk, bread, cereals, and such are simply fortified with it rather than containing any on their own. This leads to the problem of inconsistency and several studies have shown items like milk and infant formula do not contain the amount of vitamin D stated on the label, sometimes none at all. The table I have included shows mostly fatty animals as the best sources of this important nutrient.

Table 1. Vitamin D Content of Various Foods

<u>Food</u>	<u>Vitamin D Content</u>
High vitamin cod liver oil	3,450 IU (1 tablespoon)
Shitake mushrooms	100 IU of D2 (1/2 cup, ~3 oz)
Baked/broiled sockeye Salmon	740 IU (4 oz)
Baked/broiled chinook Salmon	411 IU (4 oz)
Sardines, canned in oil	250 IU (1.75 oz)
Steamed/boiled prawns	162 IU (4 oz)
2% Cow's milk	97 IU of D2 or D3 (1 cup)
Baked/Broiled Cod	63 IU (4 oz)
Boiled egg	22 IU

Sun Exposure and Artificial Light

Humans have evolved with the sun and it plays an integral role in our well being. Remembering this will serve us well in developing a more rational relationship with both sunlight and artificial light. A general rule of thumb is that if your shadow is longer than you are, the light is inadequate for vitamin D production. Moreover, if you live above 37 degrees latitude, from November to March it is impossible to manufacture vitamin D from the sun due to the angle at which the earth moves around it. The steeper the angle (summer in the northern hemisphere), the more easily UVB rays penetrate the skin. As the angle becomes less acute, as in winter, vitamin D production is either impaired or impossible. Finally, as you move towards the equator below 37 degrees latitude, year round vitamin D from the sun becomes available.

One other option for those of us wishing to avoid one more supplement is to use either a tanning bed (90 percent have some UVB light) or a stand-alone UVB lamp 1-2 times per week. Though this may sound controversial, research consistently shows users of either tanning beds or UVB lamps burn less due to the controlled nature of exposure, and therefore have a lower incidence of skin cancer.

The idea is not to burn anyway, but to stop using the lamp or bed before the skin begins to turn pink. Besides, once you start to burn your body begins breaking down any extra vitamin D it may have made so there is certainly no greater benefit to be achieved from a dosage standpoint.

Sunscreen Use and Other Barriers

Sunscreen is one of the single biggest factors in creating vitamin D deficiencies in developed countries. SPF 8 reduces production of vitamin D by 92.5%, while SPF 15 reduces it by 99%. How many people do you know using anything less than SPF 15 or 30 nowadays?

One logical solution to this problem is to expose your skin to sunlight for 10-15 minutes if you are white, and longer if you have darker skin, then apply the sunscreen. Or better yet, protect your skin with clothing after this amount of time and skip the sunscreen altogether.

Please don't misinterpret me. I don't want skin cancer any more than the next person. But, there is something wrong with potentially substituting 17 other cancers as well as a long list of additional chronic diseases for the peace of mind which comes from preventing skin cancer, a highly curable form.

A quick word about skin pigmentation: the darker your skin the longer your exposure requirements to make the same amount of vitamin D. For example, studies show someone with darkly pigmented skin needs around 6 times the amount of sunlight exposure as a lightly pigmented individual.

Other barriers to UVB light include cloud cover, glass, pollution, and clothing. Obesity, though not a barrier, increases vitamin D requirements by roughly 50 percent because it seems to be preferentially stored in fat tissue rather than utilized in the rest of the body. Lastly, due to aging of the skin, a 70 year old has around a 75 percent lower ability to produce vitamin D.

Groups at Risk of Deficiency

Now that you hopefully understand where we get vitamin D from, it is important to discuss what circumstances bring about a deficiency of this essential nutrient. Obviously, those working indoors have more limited exposure to the sun than outdoor laborers or lifeguards, for example. I alluded to the detrimental role sunscreen can play in inhibiting vitamin D production, as well as the aging process, skin pigmentation, and obesity, but there are other players as well.

Because ingested vitamin D in the form of foods or supplements is absorbed in the small intestine, people with small bowel disorders such as Celiac disease are usually deficient in not only vitamin D, but all fat-soluble vitamins. This includes individuals who have undergone small bowel surgeries and gall bladder removal, which leads to reduced output of bile, and therefore fat absorption. With more than 500,000 gall bladder procedures performed each year the numbers start to add up. Similarly, medications that interfere with cholesterol absorption reduce assimilation of vitamin D.

Due to how vitamin D is activated and turned into a hormone in the liver and kidneys, those with kidney and liver disease generally are at greater risk of deficiency. Often very high doses are required to optimize levels.

Thanks to advice given and followed in the last 30 years, we now have a generation of vitamin D deficient mothers giving birth to deficient newborns, and in turn breastfeeding with deficient milk. To make a bad situation worse, rather than treat the cause and supplement the mother with enough vitamin D to ensure adequate content in her breast milk, both mother and infant are recommended paltry amounts all but guaranteeing future problems related to insufficient intake. If you sense some irritation you would be right.

Remember, official U.S. recommendations are the same for a 300 pound male, a 130 pound pregnant woman, and a 7 pound infant. Do you think this is in need of revision? In an encouraging voice of reason the Canadian Pediatric Society now recommends 2,000 IU daily of vitamin D for breastfeeding and pregnant women. Sounds like a step in the right direction to me.

Before I leave this topic, I want to mention a recent study done where breastfeeding mothers took either 400 IU or 6400 IU of D3 daily. Vitamin D content of breast milk was then measured. Mothers on 400 IU increased D3 content by 57 percent from 45 to 78 IU. However, those on 6400 IU increased D3 by over 1000 percent from 82 to 873 IU. Who said breast milk isn't a good source of vitamin D?

Testing and Interpretation

Once you order a 25(OH) D test and get your results, it is vital that you don't simply look to see if you are in the reference range and call it a day. Reference ranges do vary from lab to lab, but more up-to-date laboratories use a range between 30 and 100 ng/ml. Please do not confuse ng/ml (nanograms per milliliter) with nmol/l (nanomoles per liter) which some labs utilize. They are not the same, but just so you know 32 ng/ml equals 80 nmol/l.

The goal I have with most patients is to achieve a value of at least 50 ng/ml. This is generally the number where your body begins to store vitamin D. There are circumstances where we try to reach values of 80 ng/ml or greater, as the literature confirms there are benefits to be derived in certain diseases.

If possible, testing twice a year in the fall and spring for the first couple of years is extremely helpful. Blood values are usually at their highest in the fall due to sunlight exposure over the summer. Therefore, knowing just how much additional D is needed to get through winter is quite useful.

On a similar note, testing in spring demonstrates just how well you have held up through a period without UVB exposure. If by this time your blood level is still low (< 50 ng/ml), you need to make adjustments in supplemental D, food sources, or seek out some sun.

Lastly, I will often order additional tests to obtain a more comprehensive view of interactions among closely related nutrients and hormones like phosphorus, calcium, parathyroid hormone, and 1,25(OH) D₂.

Dosage

Rather than make a blanket recommendation for everyone reading this report, I would rather you base dosage on both a lab result and body weight. Roughly, for every 25 pounds of body weight, 1000 IU of D₃ is needed to maintain healthy levels. Furthermore, someone taking 2000 IU of D₃ per day in addition to accounting for food sources, sun exposure, etc., would raise 25(OH) D by 20 ng/ml. For every 100 IU/day added thereafter, it raises 25(OH) D by approximately 1 ng/ml.

In my practice, I regularly suggest 5000-10,000 IU of D₃ per day for most adults, though there are times when this number is less, and other times when it is more. For infants and children, as little as 1000 IU or as much as 2000-4,000 IU may be required, depending on whether the mother supplements with vitamin D, the child's level of health, and so on. In general, supplementation is discontinued during the summer months and resumed at the beginning of fall, unless blood levels are low enough it warrants year-round intake.

Safety

One of the most frequent questions I get about vitamin D is whether or not it is toxic due to its fat-soluble nature. In nearly all cases, the answer is no. Vitamin D toxicity is very rare and reported cases were from accidental ingestion ranging from 60,000 IU in a 2 year old to 5,000,000 IU in an adult. In all cases 25(OH) D levels were 150 ng/ml or above and calcium values increased significantly. 10,000 IU can be taken daily for months without toxicity. Again, it is important to keep in mind that vitamin D is not stored appreciably until blood values reach 50 ng/ml and above. And I have a hard time finding people with values greater than 50 ng/ml unless they have been supplementing for some time or spend a considerable amount of time in the sunlight. Vitamin D levels should be monitored closely in those with tuberculosis, sarcoidosis, lymphoma, and other granulomatous disorders.

If taking vitamin D in the form of cod liver oil, one should pay close attention to dosage. Because vitamin A can compete with vitamin D in the body, too high of A intake can inhibit the beneficial effects vitamin D has to offer. Those individuals with small bowel disorders discussed earlier, actually benefit from all of these fat soluble vitamins, including vitamins E and K.

Clinical Indications

Next, I will touch on several important topics involving treatment with vitamin D. If pharmaceutical medications achieved the kind of results discussed below that vitamin D can, free of side effects, we would all be scrambling for them.

Bone Health

By now many of you are familiar with D's role in keeping strong bones to avoid osteopenia and osteoporosis. But, there is also a frequently overlooked condition that is extremely uncomfortable. Allow me to give a very brief explanation. Vitamin D aids in the absorption of several minerals, including calcium which makes up the largest mineral constituency in the bone. When vitamin D is insufficient for prolonged periods of time, bones swell, producing pain and becoming more fragile. This is called osteomalacia. As bone density decreases and bones deteriorate, osteoporosis can occur. Both of these can be reversed in many cases, though not always with vitamin D alone.

Studies show that fractures are reduced by 50 percent when adequate blood levels are achieved. Just as important, falls which most often lead to fractures to begin with were reduced by 72 percent in women when even a low blood level (30 ng/ml) was obtained.

Colds and Flus

It is no coincidence that the cold and flu season corresponds with times of decreased vitamin D levels in the body. Fascinating research reveals the potent antimicrobial properties vitamin D possesses which further explains how it helps prevent and treat colds, flus, respiratory infections, and asthma. A study published in 2007 placed 208 post-menopausal African-American women on either placebo or 800 IU of D₃ for 2 years, followed by 2000 IU during the third year. Those taking vitamin D had 1/3 the incidence of influenza. And this was using a very conservative dosage in a population known to require higher amounts of vitamin D. Nonetheless, every fall we try to raise people's awareness of this correlation and optimize levels of D ahead of time when possible.

Cancer

Vitamin D receptors are found all over the body, but especially in places such as breast tissue, colon, prostate gland, ovaries, and kidneys. It makes sense then, that if these tissues have specific requirements for this nutrient, going so far as to develop a place for vitamin D to dock, a lack of vitamin D could cause potential problems.

There is no doubt that most cancers are multi-factorial, but again the benefits of D should not be ignored. Breast cancer incidence is reduced by 83 percent when blood levels reach 50 ng/ml. Colon cancer is reduced by 60 percent when achieving a value of 43 ng/ml; ovarian cancer by 17 percent with 47 ng/ml of D, endometrial cancer by 37 percent with a blood level of 50 ng/ml, and so forth. This is pretty effective medicine for something that is free if you get it from the sun, or at most \$6-10 a month in pill or liquid form.

Heart Health

Cardiovascular disease continues to be the leading cause of death in the United States. Vitamin D has a clear role to play in reducing this likelihood of death. When even a low level of 35 ng/ml of 25(OH) D was achieved in a recent study, heart attacks were reduced by 30 percent. People living at higher latitudes also increase their risk of hypertension, but treatment with D3 and UVB rays has been shown to normalize blood pressure. Low vitamin D can also lead to higher triglyceride values and contributes to obesity. Lastly, vitamin D decreases inflammatory markers often associated with cardiovascular disease.

Autoimmune Conditions

The greater prevalence of diseases like multiple sclerosis (MS), Crohn's disease, and type 1 diabetes in northern latitudes is now well established. Vitamin D is taking a more central role in prevention and treatment of these diseases. An 80 percent decrease in the incidence of type 1 diabetes was found in a study published in the *Lancet* in 2001. Participants took 2000 IU of vitamin D during their first year of life, then were followed for 30 more years to assess development of type 1 diabetes.

In analyzing the Nurses' Health Study I and II, risk of MS was decreased by 41 percent in women taking just 400 IU of vitamin D. While another small study using high-dose vitamin D over a 28 week period resulted in either a decline in the number of brain lesions or complete resolution.

Chronic Pain

This is often a feature of vitamin D deficiency and can be either local or general pain. The sensation can vary between soreness in the muscles to a deep-seeded bone pain, a common sign of osteomalacia. Other causes certainly account for chronic pain, but it is very rewarding for the patient and practitioner to see long standing pain disappear with proper treatment. One noteworthy study involved 360 patients in Saudi Arabia presenting to spinal and internal medicine clinics with unexplained low back pain. Testing showed 83 percent of this group had abnormally low 25(OH) D levels. Patients were given either 5,000 or 10,000 IU of D3 daily for 3 months. By the end of treatment, 95 percent (341 people) had complete resolution of pain, a striking example of what D could potentially do for you.

Conclusion

I hope this report offers a sampling of the vast functions vitamin D has in the body and its ability to positively impact your health. Much more could have been added including exciting research into autism and vitamin D, schizophrenia, and other conditions. If you are interested, I encourage you to keep up to date with vitamin D developments by visiting www.vitamindcouncil.org. There you will find presentations, papers, links to vitamin D experts throughout the world, and a collection of many, many studies done on various topics using vitamin D. Study references can be supplied upon request via e-mail.

A note about the author:

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