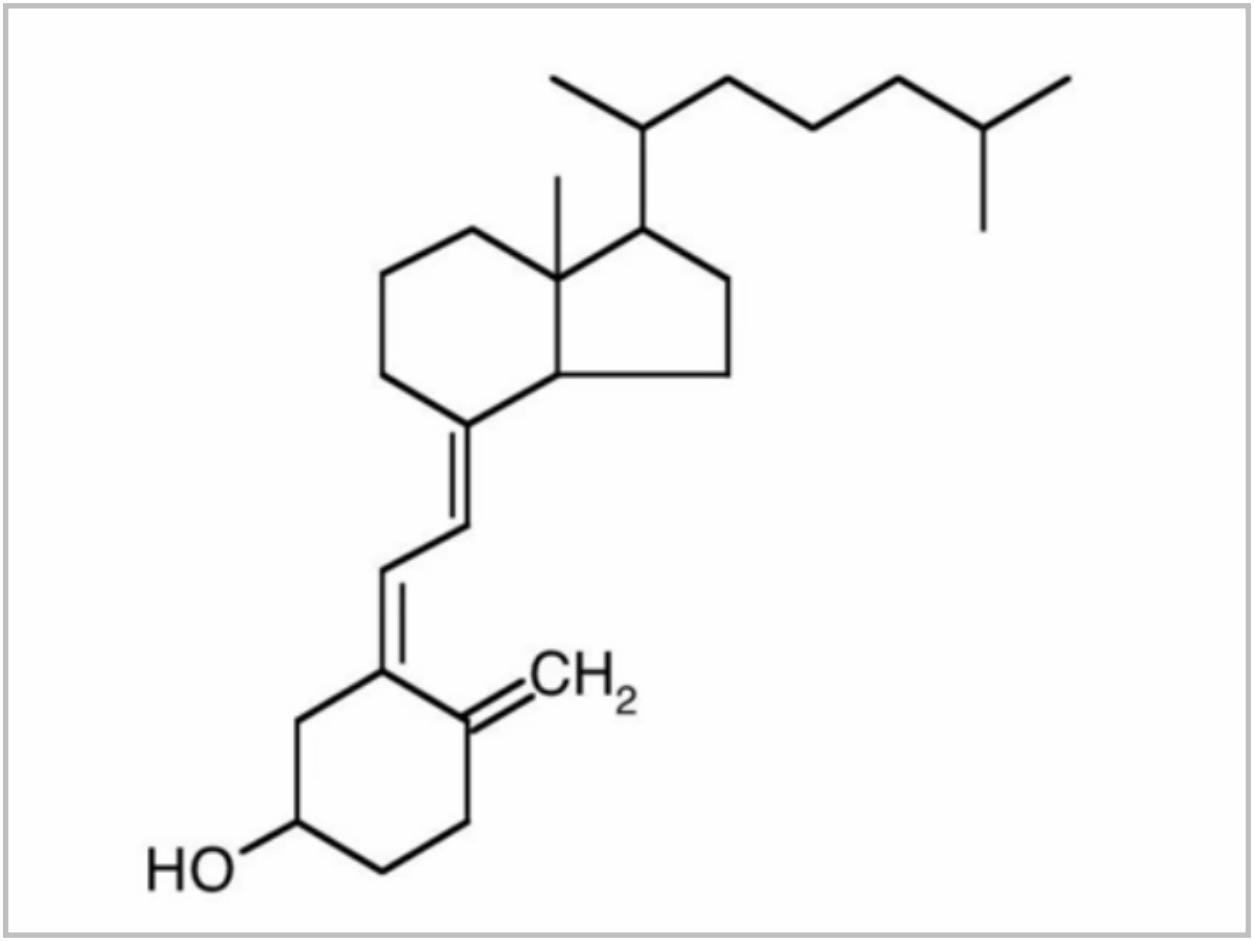
KRESSER INSTITUTE
FOR FUNCTIONAL AND EVOLUTIONARY MEDICINE

Supplementation: Vitamin D

Hey, everybody. In this presentation, we're going to talk about supplementing with vitamin D.



Vitamin D is a vitamin-like hormone, actually, that is largely produced in the skin when exposed to ultraviolet radiation. It's made from a cholesterol precursor called 7-dehydrocholesterol through exposure to sunlight. The active form is called D3 calcitriol, or 1,25(OH)D, and that is converted from D2 in the kidneys in small amounts. The most common lab-tested form is 25(OH)D, calcifediol. This is a prohormone, an inactive form. It needs to be converted into calcitriol to have the primary biological effects that vitamin D has. There is some recent research that suggests that simply measuring 25-D levels is not an adequate way of assessing biological vitamin D activity and can actually overdiagnose vitamin D deficiency in some populations.

The best-known role of vitamin D is increasing intestinal absorption of calcium. Vitamin D maintains calcium and phosphate levels in the blood. It enables proper mineralization of bone. It protects against osteoporosis, rickets, and fracture, and it plays a number of important roles in the body.

Vitamin D deficiency is associated with a pretty astonishing list of conditions, including heart attack, cancer, severe asthma, autoimmune disease, type 2 diabetes, and increased death from all causes. With vitamin D, as is the case with many nutrients, balance is key. Research suggests that too much can be just as big of a problem as not enough. There is little evidence that raising levels above 50 ng/mL provides any additional benefit, and there is quite a bit of evidence that it may be harmful, especially in the absence of adequate vitamin A and K2. You'll remember from the vitamin A presentation that all of the fat-soluble nutrients work together synergistically, and so an excess of one relative to the others can cause issues. Higher vitamin D levels have been linked with decreased bone density and increases in heart attacks, strokes, and particularly kidney stones.

Optimal blood levels of 25-OH Vitamin D

The optimal blood level of 25(OH) vitamin D is still controversial. An exhaustive review of nearly 1,000 studies by the Institute of Medicine suggested that a range of 25 to 50 ng/mL was ideal. However, vitamin D advocates such as Dr. Michael Holick have suggested a much higher range. Labs such as Quest and LabCorp have adopted this suggestion and use a reference range of 30 to 100 ng/mL. Yet there is almost no evidence that pushing vitamin D above 60 ng/mL has any benefit, and some studies suggest harm. What's more, randomized control trials investigating the effects of supplementing with vitamin D on many conditions have produced disappointing results. I will link to a **good article** in the notes of this week that summarizes the controversy and the issues.

Given the uncertainty, I think the optimal range for most people for 25(OH) vitamin D is between 35 and 60 ng/mL. Also, new evidence suggests that there is no one-size-fits-all approach to vitamin D. Some people may require more and some less. We will talk more about this on the subsequent slides.

There is some interesting evidence, as I mentioned a few slides back, that suggests the optimal vitamin D level may vary across populations, and levels that are currently considered to be deficient according to reference ranges may be sufficient for some populations. For example, blacks have lower 25(OH)D levels than whites, even in their ancestral latitudes. Nonwhites with abundant sun exposure in Hawaii have so-called low vitamin D status according to the reference range but no indication of low levels of biological vitamin D activity. People with nonwhite ancestry may be adapted to lower levels of 25(OH)D than people with white ancestry. For example, they may have a genetic variation in their ability to convert 25(OH)D to calcitriol, the more active form, 1,25(OH)2D. Calcitriol is a hormone made from vitamin D in the kidney that increases serum calcium by decreasing fecal, urinary, and bone calcium. It's primarily responsible for the biological effects of vitamin D. Also, nonwhites may require less parathyroid hormone to activate 25(OH)D in the face of inadequate calcium. So the research is still evolving here, but one thing is clear, and that is that we need more individualized assessment of vitamin D status rather than blindly applying the lab range to everyone without consideration of their ethnic background.

Vitamin D can be obtained from three sources: food, sun, and supplements. A mix of all three of these sources tends to work best for most patients. For food sources, most people are going to only get about 10 percent of their vitamin D requirement from food. The sources are similar to vitamin A, so once again, nature knows best. We're talking about cod liver and cod liver oil, so again, you can eat the cod livers, canned cod livers in their own oil, or you can take one teaspoon of extra-virgin cod liver oil per day, which contributes about 400 IU of vitamin D. Fatty fish such as marlin, herring, fatty tuna, rainbow trout, salmon, sardines, and mackerel have between 250 and 1,000 IU of vitamin D per three-and-a-half-ounce serving, so that can make a substantial contribution. Egg yolks, particularly pastured egg yolks, can contribute some vitamin D and about

four to six times more vitamin D than conventional eggs, so that's yet another reason to choose pastured eggs. Mushrooms do contain some vitamin D, but it's primarily vitamin D2 rather than D3. They're a healthy food for a number of reasons, but they're not a great source of vitamin D.

For UV exposure, sunlight has been the primary source of vitamin D for humans throughout our evolutionary history. Unfortunately, most modern humans get very little sun exposure due to indoor work environments, long sleeves and pants covering the skin, and living far from the equator. It's also been shown that stress, inflammation, obesity, and old age can reduce the efficiency of vitamin D production from sunlight.

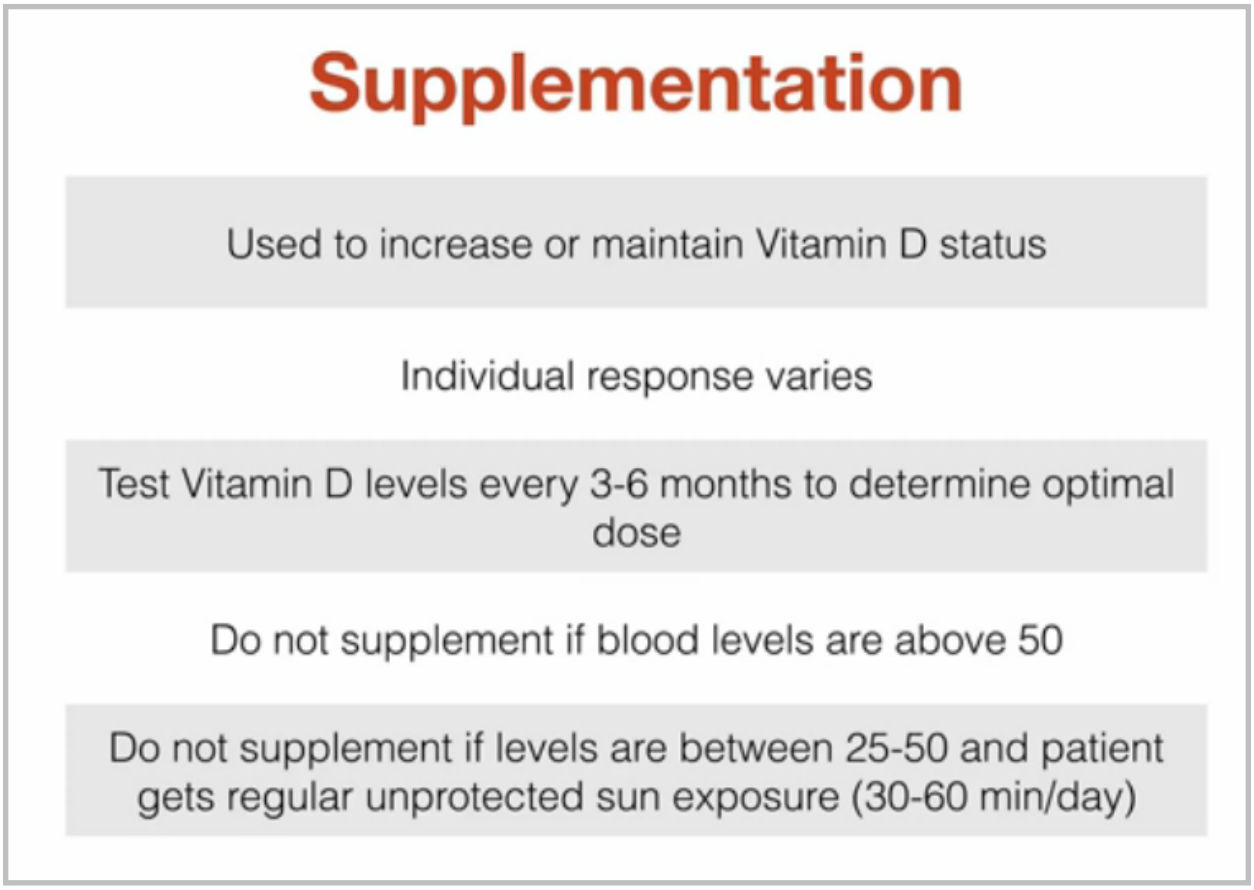
For a typical person, full-body exposure to midday summer sun will produce around 10,000 IU of vitamin D in about half the time it takes the skin to turn pink, but that's for a Caucasian person with relatively average skin tone. That amount of time could be as little as 15 minutes in someone with pale skin, or it could be as much as two hours in someone with much darker skin.

So in addition to skin color, there are several other factors that affect the production of vitamin D from sunlight. One of those is, of course, latitude. Another is the time of year, which affects the solar angle, how high in the sky the sun is; the time of day, which also affects the solar angle; and then the amount of skin exposed.

You know, we went through a period of time in the mid-to-late or particularly late-20th century where I think we were most terrified of getting any sun exposure at all, and the advice that was given to us was to slather sunblock on the minute we stepped outside the door and wear a big-

brimmed hat so we never get any sun exposure. It turns out that that advice was faulty, and there is some evidence that not getting any skin exposure could be in some ways as harmful to our health as getting too much skin exposure, so again, there is kind of a Goldilocks amount of sun exposure. The key is to get a little bit of sun exposure, enough to produce the required amount of vitamin D. Sun exposure also has some other benefits, such as an increase in nitric oxide production, but also avoiding sunburn, which is definitely a risk factor for skin cancer. If you look at skin cancer, there is a bell curve of cancer rates that is dependent on UV exposure, so too little sun exposure is a risk factor for skin cancer, and too much sun exposure is a risk factor, so just a moderate amount throughout the year and avoiding sunburn is the best approach for most people.

Tanning beds are an option for patients who live far from the equator or can't get adequate exposure during the colder months, but you have to exercise a lot of caution with tanning beds because it's very easy to get burned, not sunburned but burned from the light. A lot of the staff are poorly educated about that risk at those places, and you want to seek out a bed that has both UVA and UVB light, which is not always easy to find. It's an option, but it has to be used with caution.



In terms of supplementation, this can be used if the vitamin D status is not adequate from food and UV light. People often ask what is the best dose of vitamin D. There is no best dose of vitamin D, or put a different way, the best dose of vitamin D supplement is the one that is required to

maintain a level between 25 to 50 ng/mL. So this is completely individual, and this is one of the biggest mistakes I see clinicians making. They'll often prescribe a certain dose of vitamin D to a patient and not tell them to ever stop, and the patient continues to take that dose. Let's say it's 5,000 IU, and for people who absorb it well and are sensitive to it, a year down the line their vitamin D level might be 100. I've seen that many times in practice, and that can be a toxic level of vitamin D that produces kidney stones, calcifies the arteries, and increases the risk of heart disease. So the way to do this is to test your patients' blood levels and then give them an initial dose that is based on their blood level, so if their level is very low, you would start with a higher dose, such as maybe 10,000 IU. If their level is just moderately low, you could start with a lower dose such as 4,000 to 5,000 IU. Then you have to retest. You'd retest in 60 to 90 days and see where their level is, and you adjust the dose accordingly. You have to retest at different times of year because in the summer, especially if they get regular sun exposure, their supplementation needs will either reduce or completely go away. They have to be aware of this kind of thing when they're using supplements and when you're prescribing them.

In terms of recommended supplements, we talked about extra-virgin cod liver oil in the vitamin A unit. It's a great choice for both vitamin A and D, and since they work together, it's good to get them together. If the patient can't tolerate cod liver oil for any reason, you can use vitamin D drops. These are probably a little better absorbed than capsules, especially in patients with digestive issues. Some of the companies sell D drops that also contain some K2, such this Thorne product here on the slide. You can dose vitamin D daily, which some patients prefer, or you can take a larger dose weekly. According to the scientific literature, there is no difference between how you do that. It's purely a matter of patient preference.

Okay, that's it for now. See you next time.