



## VITAMIN D

# Few of us get enough—and that has consequences

BY J. TIMOTHY DIEGEL, MD

**M**any, if not most, Americans spend most hours during the day inside without sun exposure. Shift workers at night get no sun exposure. Most workers have a commute during which they are not exposed to the sun; they then sit in an office for eight or more hours, commute home, sit for dinner inside and later watch television. Children are inside for most of the school day and spend free time on various screens—phones, tablets or television. Neighborhood sports, fishing, scouting and just exploring often seem to be activities of the past. When we are outdoors, we tend to use various UV protective lotions and sprays to block sun exposure and help prevent common skin cancers, some of which can be life-threatening. This minimal sun exposure for adults and children results in less vitamin D production in the skin.

Vitamin D deficiency is widespread in the United States and throughout the world. The global prevalence of low vitamin D levels is of great concern, especially in certain subgroups of the population.

### Benefits of vitamin D

Vitamin D, a steroid hormone, maintains calcium homeostasis and bone

metabolism. It is an immune modulator with many genetic regulatory epigenetic pathways. In most human tissues, the vitamin D receptor mRNA is present and has been found to regulate up to 1,000 genes. Vitamin D also controls both innate and acquired immunity. Benefits of vitamin D include:

- *Both prevention and therapy of seasonal epidemic influenza.*
- *Beneficial immune effects*, especially in treating respiratory tract infections.
- *Treatment for worldwide chronic lung diseases*, including chronic obstructive pulmonary disease, cystic fibrosis, asthma and idiopathic interstitial pneumonias. As an example of vitamin D's impact on lung disease, sun rays have been used for therapy for tuberculosis. Since the early 1900s, in the high-altitude "sanitoriums" in Europe and spa-type resorts in the low latitudes in the United States, this "sun treatment" was considered beneficial. Adequate vitamin D levels, prior to the onset of medical treatment, enhanced the innate response of the T cells and other immune cells. As an adjunct therapy, it also reduced the more serious effects of TB infections.
- *Vitamin D metabolites stimulate the expression of anti-microbial peptides* found in inflammatory blood cells in addition to the epithelial cell lining of the respiratory tract. They play a major role in protecting the lungs from infection. A

meta-analysis revealed that supplementation with 4000 International Units (IU) of vitamin D reduced the need for antibiotic treatment in frequent respiratory infections.

### Vitamin D deficiency

Vitamin D insufficiency exists when blood levels are below 30 ng/ml (nanograms/milliliter). Vitamin D deficiency, which is under 20 ng/ml, is the level where the parathyroid hormone increases. Its metabolites modulate chemokines and other cytokines that mediate viral entry and bacterial adhesions into respiratory epithelial cells.

Low levels of vitamin D are associated with developing and worsening some cancers, diabetes, cardiovascular diseases, chronic diseases and autoimmune diseases. There is a strong association between low vitamin D levels in patients and the acquisition of the COVID-19 disease in the United States and elsewhere in the world.

More recently, published studies have shown that vitamin D deficiencies are associated with many autoimmune diseases such as multiple sclerosis (MS), rheumatoid arthritis, lupus and other chronic diseases including depression, asthma, cancers, upper respiratory tract infections and HIV/AIDS. This effect of vitamin D is due to the ligand properties of binding to the cell membrane and nuclear receptors forming an activated transcription process that regulates many genes. Influenza appears to be less infectious with a strong immune system.

### Sun, Vitamin D and supplements

Above the latitude of 37° degrees North (and 37° degrees South) there is insufficient UVB radiation to induce cutaneous vitamin D synthesis, especially in the winter months. The Twin Cities are at 45 degrees latitude. Many studies have shown a significant difference in the prevalence of MS based on latitude (see Map). A Minnesota study found the difference of MS ranged from 112/100,000 in the southern United States to 192/100,000 in the East-

ern states. Similar differences have been found worldwide.

Influenza infections are more common in the winter months when the sun is less intense. The onset of the SARS-CoV-2 pandemic started in the winter. Most of the cities in Italy with some of the highest death rates from COVID-19 are above 40 degrees latitude. A recent study of elderly Italian women revealed that 76 percent had vitamin D levels lower than 12 ng/ml and 27 percent had levels lower than 5ng/ml.

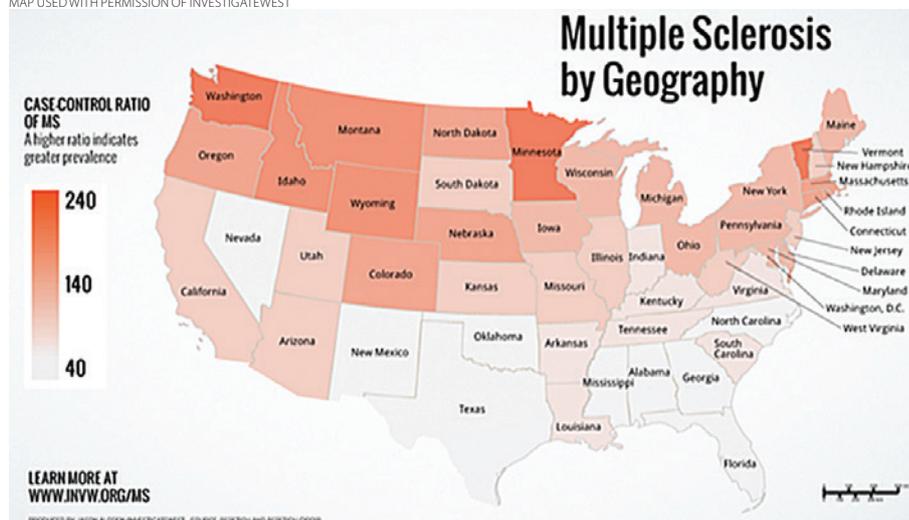
Most elderly people have less body exposure to sunlight due to their inability or lack of opportunity to recreate outdoors; this is especially true for nursing home residents. Older adults, with thinner skin, produce about 25 percent less vitamin D than young adults. This indicates the need to obtain vitamin D from supplements. In addition to the immune modulator effects of vitamin D, the elderly have weaker bones due to vitamin D deficiency, which also causes poor calcium absorption and metabolism.

Obesity is also a high-risk factor for vitamin D deficiency. Since vitamin D is a fat-soluble vitamin, it is sequestered in the body's fat cells. As a result, there is less bioavailability in the circulation of the body. This means obese patients have fewer opportunities to reap the benefits of vitamin D from sun exposure or diet. Supplementation is the only answer for these patients.

People with dark skin are unable to metabolize vitamin D in their skin sufficiently because the sun's UVB radiation is blocked by the melanin property of their skin. Individuals with dark skin tend to have less binding protein to vitamin D, so blood tests may show an inaccurate lower result than the real total of vitamin D in the tissues of the body. Supplementation of 4000 International Units (IU) of vitamin D3 for a year was found to eliminate the difference in the vitamin D levels between Black men and White men.

Many clinicians are not aware that vitamin D regulates so many genes and has immune-modulation functions. Since many of the vitamin D studies are *associa-*

MAP USED WITH PERMISSION OF INVESTIGATEWEST



Cases of multiple sclerosis are more common in areas where residents get less sun—and therefore less vitamin D—throughout the year. The Twin Cities, latitude 45 degrees, has a high ratio of cases per 100,000 population.

*tive* and not *causative*, these studies may not be accepted by some physicians and other clinicians. This is probably the reason that some clinicians don't recommend vitamin D, since it hasn't been "proven."

Many individuals may feel that vitamin D is "just one of those vitamins." Lay people are not exposed to the many research studies that explain the benefits of vitamin D and therefore don't realize that a supplement may be helpful. Now with the SARS CoV2 virus prevalence, it is a serious decision not to take vitamin D supplements unless the level is tested and found to be very adequate. Most people should consider taking supplements due to the many preventive and therapeutic health benefits. The risks and costs are minimal. Vitamin D does need magnesium to help with its metabolism. Magnesium can be obtained from food but many nutritionists recommend a supplement since it is also common to be deficient in magnesium in the United States.

The morbidity and mortality rate for COVID-19 is higher for the elderly, the obese and those with dark skin. These are the same populations associated with unusually low vitamin D levels.

The medical community has an opportunity to connect the dots for the general public. It would be prudent for everyone to take enough vitamin D to reach the target level of 40-60 ng/ml. Especially those with cultural clothing choices that limit skin exposure, those living in low

latitudes, patients with immune-compromised pathology and those with chronic diseases should be advised to supplement with vitamin D. A basic daily multivitamin pill does not provide enough vitamin D to ensure adequate levels in the blood; for high-risk groups, especially, a stronger vitamin D supplement should be very beneficial. MM

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