

# Benefits of Vitamin D

There is a vast body of science showing the many health benefits of vitamin D. You may be surprised to learn the important role that vitamin D plays in your health.

## Maintains Your Calcium Balance

Maintenance of blood calcium levels within a narrow range is vital for normal functioning of the nervous system, as well as for bone growth, and maintenance of bone density. Vitamin D is essential for the efficient utilization of calcium by the body.<sup>1</sup>

## Aids Your Cell Differentiation

Cellular differentiation results in the specialization of cells for specific functions in your body. In general, differentiation of cells leads to a decrease in proliferation. While cellular proliferation is essential for growth and wound healing, uncontrolled proliferation of cells with certain mutations may lead to diseases like cancer. The active form of vitamin D, inhibits proliferation and stimulates the differentiation of cells.<sup>1</sup>

## Boosts Your Immunity

Active vitamin D is a potent immune system modulator. There is plenty of scientific evidence that vitamin D has several different effects on immune system function that may enhance your immunity and inhibit the development of autoimmunity.<sup>8</sup>

## Has a Role in Insulin Secretion

The active form of vitamin D plays a role in insulin secretion under conditions of increased insulin demand.<sup>9</sup> Limited data in humans suggests that insufficient vitamin D levels may have an adverse effect on insulin secretion and glucose tolerance in type 2 diabetes.<sup>10-12</sup> More studies are needed on the role of vitamin D and diabetes.

## Blood Pressure Regulation

Adequate vitamin D levels may be important for decreasing the risk of high blood pressure.<sup>13-15</sup> Again, more studies on vitamin D and hypertension are necessary.

## Vitamin D and Diseases

According to the National Institutes of Health, vitamin D may play a role in the following diseases.

### Vitamin D and Osteoporosis

Osteoporosis is most often associated with inadequate calcium intake. However, a deficiency of vitamin D also contributes to osteoporosis by reducing calcium absorption.<sup>33</sup> While rickets and osteomalacia are extreme examples of vitamin D deficiency, osteoporosis is an example of a long-term effect of vitamin D insufficiency.<sup>34</sup> Adequate storage levels of vitamin D help keep bones strong and may help prevent osteoporosis in older adults, in those who have difficulty walking and exercising, in post-menopausal women, and in individuals on chronic steroid therapy.<sup>35</sup>

Vitamin D deficiency, which is often seen in post-menopausal women and older Americans, has been associated with greater incidence of hip fractures.<sup>39-41</sup> In a review of women with osteoporosis hospitalized for hip fractures, 50 percent were found to have signs of vitamin D deficiency.<sup>35</sup> Daily supplementation with 20 800 IU of vitamin D may reduce the risk of osteoporotic fractures in elderly populations with low blood levels of vitamin D.<sup>42</sup> The Decalys II study examined the effect of combined calcium and vitamin D supplementation in a group of elderly women who were able to walk indoors with a cane or walker. The

women were studied for two years, and results suggested that such supplementation could reduce the risk of hip fractures in this population.<sup>43</sup>

## **Vitamin D and Cancer**

Laboratory, animal, and some preliminary human studies suggests that vitamin D may be protective against some cancers. Several studies suggest that a higher dietary intake of calcium and vitamin D correlates with lower incidence of cancer.<sup>44-51</sup> In fact, for over 60 years researchers have observed that greater sun exposure reduces cancer deaths.<sup>33</sup> The inverse relationship between higher vitamin D levels in blood and lower cancer risk in humans is best documented for colon and colorectal cancers.<sup>44-50</sup> Vitamin D emerged as a protective factor in a study of over 3,000 adults who underwent a colonoscopy to look for polyps or lesions in the colon. There was a significantly lower risk of advanced cancerous lesions among those with the highest vitamin D intake.<sup>52</sup>

Additional clinical trials need to be conducted to determine whether vitamin D deficiency increases cancer risk, or if an increased intake of vitamin D is protective against some cancers. Until such trials are conducted, it is premature to conclude you should take vitamin D supplements for cancer prevention.

## **Vitamin D and Alzheimer's Disease**

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Alzheimer's disease is associated with an increased risk of hip fractures because many Alzheimer's patients are homebound, frequently sunlight deprived, and older.<sup>56</sup> With aging, less vitamin D is converted to its active form. One study of women with Alzheimer's disease found that decreased bone mineral density was associated with a low intake of vitamin D and inadequate sunlight exposure.<sup>57</sup> More investigation on vitamin D and Alzheimers Disease is necessary.

## **Other Diseases Vitamin D Deficiency May Affect**

### **Autoimmune Diseases - Diabetes, Multiple Sclerosis and Rheumatoid Arthritis**

Diabetes mellitus, multiple sclerosis, and rheumatoid arthritis, are each examples of autoimmune disease. Autoimmune diseases occur when the body launches an immune response to its own tissue, rather than a foreign pathogen. Treatment with vitamin D has beneficial effects in animal models of all of the above mentioned diseases. Studies have found that the prevalence of diabetes, multiple sclerosis, and rheumatoid arthritis increases as latitude increases, suggesting that lower exposure to sun light and associated decreases in vitamin D synthesis may play a role in the development of these diseases.

The results of several studies also suggest that adequate vitamin D intake may decrease the risk of autoimmune diseases. Evidence from animal models and human studies suggests that maintaining sufficient vitamin D levels may help decrease the risk of several autoimmune diseases, but more studies are needed to draw any solid conclusions.

### **Vitamin D and Hypertension (High Blood Pressure)**

The results of epidemiological and clinical studies suggest an inverse relationship between serum vitamin D levels and blood pressure. Data from epidemiological studies suggest that conditions that decrease vitamin D synthesis in the skin, such as having dark skin and living in temperate latitudes, are associated with increased prevalence of hypertension.<sup>71</sup> In randomized controlled trials of vitamin D supplementation, a combination of 1,600 IU/day of vitamin D and 800 mg/day of calcium for eight weeks significantly decreased systolic blood pressure in elderly women by 9% compared to calcium alone,<sup>73</sup> but supplementation with 400 IU/day or a single dose of 100,000 IU of vitamin D did not significantly lower blood pressure in elderly men and women over the next two months.<sup>74, 75</sup> At present, data from controlled clinical trials are too limited to determine whether vitamin D supplementation will be effective in lowering blood pressure or preventing hypertension.

## Vitamin D Toxicity

It is very rare to have a vitamin D overdose. Vitamin D toxicity induces abnormally high serum calcium levels (hypercalcemia), which could result in bone loss, kidney stones, and calcification of organs like the heart and kidneys if untreated over a long period of time. When the Food and Nutrition Board of the Institute of Medicine established the tolerable upper intake level (UL) for vitamin D, published studies that adequately documented the lowest intake levels of vitamin D that induced hypercalcemia were very limited. Because the consequences of hypercalcemia are severe, the Food and Nutrition Board established a very conservative UL of 2,000 IU/day (50 mcg/day) for children and adults.<sup>28</sup> (see table below)

Research published since 1997 suggests that the UL for adults is overly conservative and that vitamin D toxicity is very unlikely in healthy people at intake levels lower than 10,000 IU/day.<sup>36, 76, 77</sup> Vitamin D toxicity has not been observed to result from sun exposure.

Certain medical conditions can increase the risk of hypercalcemia in response to vitamin D, including primary hyperparathyroidism, sarcoidosis, tuberculosis, and lymphoma.<sup>36</sup> People with these conditions may develop hypercalcemia in response to any increase in vitamin D nutrition and should consult a qualified health care provider regarding any increase in vitamin D intake.

## Tolerable Upper Intake Level (UL) for Vitamin D

Infants 0-12 months - **1000 IU**

Children 1-18 years - **2000 IU**

Adults 19 years and older - **2000 IU**

## Vitamin D Drug Interactions

**The following medications increase the metabolism of vitamin D and may decrease serum D levels:** Phenytoin (Dilantin), fosphenytoin (Cerebyx), phenobarbital (Luminal), carbamazepine (Tegretol), and rifampin (Rimactane).

**The following medications should not be taken at the same time as vitamin D because they can decrease the intestinal absorption of vitamin D:**

Cholestyramine (Questran), colestipol (Colestid), orlistat (Xenical), mineral oil, and the fat substitute Olestra. The oral anti-fungal medication, ketoconazole, inhibits the 25(OH)D3-1-hydroxylase enzyme and has been found to reduce serum levels of 1,25(OH)D in healthy men. The induction of hypercalcemia by toxic levels of vitamin D may precipitate cardiac arrhythmia in patients on digitalis (Digoxin).<sup>78, 79</sup>

## Vitamin D3 Supplements

It is not always practical to get your vitamin D from sunshine, and quite difficult to get adequate amounts from your diet so for many people, a vitamin D supplement is a practical way to ensure adequate levels of this important protector are always available in your bloodstream.

Since a large body of science shows vitamin D works closely with calcium and magnesium, it is best to take your vitamin D in combination with calcium and magnesium to maintain a proper balance. Recent literature also shows most calcium supplements have too little vitamin D to be effective. And some of them use synthetic vitamin D2. A much better form is natural **vitamin D3** which stays in your system longer and with more effect.

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