

## Vitamin D Deficiency

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Most of us would not imagine that in 21<sup>st</sup> century America there still exist nutritional deficiencies such as **rickets**. Yet cases of rickets in infants, children, and teens attributable to inadequate vitamin D intake and decreased exposure to sunlight continue to be reported.

Even most physicians are unaware of the true and worsening scope of the problem, believing rickets to be a relic of a bygone era.

Rickets is a state of **extreme vitamin D deficiency**, leading to markedly low levels of calcium and phosphorous in the body. When calcium, phosphorous, and vitamin D are not present in sufficient amounts, growing bones and teeth cannot calcify normally, and become weaker, softer, and slower to grow. A state of deficiency occurs for months before signs and symptoms of rickets develop.

Until the middle of the 20<sup>th</sup> century rickets was one of the leading causes of childhood death and deformity in the United States and other developed countries. Today, it is still among the most frequent childhood diseases in developing countries.

In recent decades, there has been a significant reappearance of vitamin D deficiency and rickets as a result of multiple factors. Those at higher risk for developing rickets include:

- breast fed infants whose mothers were not exposed to enough sunlight during pregnancy, and whose insufficient exposure continues
- breast fed infants who themselves are not exposed to enough sunlight
- premature infants
- children and teens not consuming enough fortified milk
- dark-skinned individuals (1 in 5 healthy pre-school aged black and Hispanic children are deficient in Vitamin D, and almost 1 in 2 black and Hispanic newborns),
- and individuals living in latitudes above 37.5 degrees, such as in Oregon.

Vitamin D is essential for normal absorption of calcium from the gut. Possible signs and symptoms of prolonged deficiency include:

- bone pain or tenderness
- muscle weakness
- poor growth and motor development
- irritability
- weak teeth
- bowed legs
- a curved spine
- chest deformities,
- and an increased tendency for fractures. Permanent bends or disfiguration of the long bones can result.

Significantly low body calcium can also lead to **severe muscle spasms**, referred to as **tetany**, and possibly seizures. Respiratory weakness and weakened heart muscles are known to occur.

Vitamin D deficiency not only may lead to rickets, but also increases a child's risk of developing **type 1 diabetes**, and **multiple sclerosis**. Vitamin D deficiency has also been related to **breast, prostate, and colon cancer** in adults. An estimated 50 to 70,000 U.S. citizens die prematurely each year as a result of cancer related to insufficient vitamin D.

Vitamin D is primarily made in the skin after exposure to ultraviolet radiation, particularly UV-B rays. Modern conditions of dress, lifestyle, and recommendations regarding sunscreen and sun avoidance to reduce the risks of cancer may prevent a large proportion of people from making healthy amounts of this vitamin.

Everyone knows that decreased sunlight exposure occurs during the winter months, especially from November to March. What most don't know is that during these months, in latitudes above 37.5 degrees (*north of a line roughly from San Francisco to Washington, D.C.*), almost *no* UV-B rays reach the earth. During winter, dietary sources of vitamin D therefore become crucial for individuals living north of this line.

Decreased sunlight may occur in other seasons when sunlight is partially blocked by clouds, air pollution, or shade. Lifestyle choices that decrease time spent outdoors further limit sunlight exposure, as does the recommendation to use sunscreen on exposed body surfaces during the summer months.

Vitamin D production is also decreased for individuals with darker skin pigmentation, due to higher concentrations of melanin. Melanin is a natural sunscreen. It blocks UV-B rays, thereby reducing the risk of cancer. By blocking UV-B rays, however, melanin also reduces the production of vitamin D in the deeper skin layers.

### **How Can Vitamin D Deficiency Be Prevented?**

The prevention of vitamin D deficiency and rickets rests on three foundations: **diet, sunlight, and supplementation if necessary**. A sufficient amount of ultraviolet sunlight each day, and adequate supplies of calcium and phosphorous in the diet, is essential for all children older than 6 months. Darker-skinned children need to be exposed longer to the ultraviolet rays.

From the months of **March through October**, exposure to **10 minutes of direct sunlight each day** between the hours of 10 a.m. and 3 p.m. for light-skinned individuals allows for production of adequate vitamin D. At least one-fifth of the body's surface should be exposed. Allow a child 10 minutes of sun exposure before applying sunscreen with an SPF of  $\geq 15$ .

For **darker-skinned individuals**, such as African- and Asian-Americans, **30 to 60 minutes is necessary**. Keep in mind that longer exposure does *not* further increase vitamin D production.

Sufficient vitamin D levels can also be achieved through dietary supplementation. Vitamin D3 (cholecalciferol) is the preferred form since it is more readily absorbed than vitamin D2. Especially during the winter months in higher latitudes, increasing consumption of vitamin D-containing foods – such as **fortified milk, cheese, breakfast cereals, and tofu** – is important.

**Egg yolks**, and **oily fish including tuna, sardines, salmon, mackerel, herring and cod**, all are good sources of vitamin D. Frying fish reduces active vitamin D content by at least half, whereas baking reduces it not at all.

**As for breastfeeding infants, the recommended adequate intake of vitamin D cannot be met with human milk as the sole source of vitamin D.** This is not a defect in the evolution of human breast milk, but is instead a result of the modern-day infant's – and his mother's – decreased exposure to sunlight.

Of lactating women who continue to take their prenatal vitamins after delivery, 30% are still vitamin D deficient, and therefore unable to provide adequate vitamin D for their baby.

Therefore, **for the breastfed infant, vitamin D supplementation should begin in the first few weeks of life.** This is especially crucial in dark-skinned infants, and during the winter months. Vitamin supplementation should begin at **400 IU** (international units) daily, **800 IU if dark-skinned or if premature.**

Infants who are formula-fed and who consume at least 30 ounces per day of formula do not need supplemented. Young infants who are not yet consuming this amount of formula daily should also receive 400IU of vitamin D daily.

As of 2010, studies are finding that MOST U.S. infants are still not consuming adequate amounts of vitamin D. Only 1 in 10 to 1 in 20 infants exclusively breast fed are getting 400IU daily. Belief is still too common among nursing mothers that breast milk provides infants with adequate vitamin D. More often than not, it does not, even if the lactating mother is continuing to take her daily prenatal vitamin.

Finally, any individual unable to daily consume healthy quantities of eggs, fish, and fortified dairy products, or who is unable to receive adequate amounts of daily sunlight exposure, should also receive a daily vitamin D supplement, either alone, as cod liver oil, or contained within a multivitamin. Discuss with your doctor or nurse the recommended amount for you or your child.