

Vitamin D

Vitamin D has been in the news frequently this past year, including an article in The New York Times on November 16, 2009. So what is this vitamin? Why is it important?

Most people have heard that vitamin D is important in bone metabolism but over the past decade there has been research that points to its importance in preventing a number of health problems.

“Rickets” which is a bone disorder in children caused by the lack of vitamin D was first described in the mid 1600’s. It was not until the early 1900’s that the chemical structure for vitamin D was discovered and linked to the development of rickets when there was a shortage of this vitamin.

Vitamin D plays a significant role with calcium in bone metabolism (the process of building up and breaking down bone in the body). Insufficient levels of vitamin D are common among adolescents and the elderly. Low levels contribute to the development of osteoporosis (thin, brittle bones) and are associated with an increased risk for fractures. Vitamin D is also associated with a decrease in immune functions, bone pain, and appears to be linked to colon cancer and heart disease. Studies have found associations between low vitamin D levels and an overall increased risk of death.

Sources of vitamin D

Vitamin D is a fat-soluble vitamin also known as calciferol. The two major forms of this vitamin are vitamin D2 (ergocalciferol) and vitamin D3 (cholecalciferol). Vitamin D is the only vitamin that can be manufactured by the body and therefore is sometimes referred to as a hormone as well as a vitamin.

The sun (UV-B irradiation) triggers a reaction in the skin that converts provitamin D to vitamin D3 which is then transported to the liver and kidneys for further processing. During the summer months, we absorb more UVB and thus produce more vitamin D. Excess vitamin D is stored in fat tissue.

Our diet is another source of vitamin D as it can be absorbed through our intestine. Vitamin D is found naturally in a few products. It is found in the following:

- **Dairy products**
 - **Cheese**
 - **Butter**
 - **Cream**
 - **Fortified milk**
- **Fish**
 - **Salmon, mackerel, sardines, herring, tuna**
 - **Fish oils such as cod liver oil**
- **Egg yolks**
- **Oysters**
- **Fortified cereal**
- **Margarine**
- **Fortified juices**

Vitamin D supplements contain either cholecalciferol (vitamin D3) or ergocalciferol (vitamin D 2). When taken as a supplement, some researchers have recommended that it be taken with meals. This is because oily or fatty foods will cause the release of bile into the stomach which will maximize absorption of the vitamin. Some studies indicate that cholecalciferol may work more efficiently and be superior to ergocalciferol.

Measuring Vitamin D levels

The level of vitamin D in your blood is measured by a 25(OH) D level. There is controversy regarding what is the optimal blood level of vitamin D. In general vitamin D levels of 30 to 60 are thought to be adequate.

- **Vitamin D insufficiency: 25(OH)D levels of 20 to 30 ng/ml**
- **Vitamin D deficiency: 25(OH)D levels of below 20 ng/ml**
- **Vitamin D toxicity: 25(OH)D levels of over 150 ng/ml**

Vitamin D deficiency

There are certain groups of people that have an increased risk for vitamin D deficiency. These groups include the following:

- **Solely breast-fed infants older than 2 months of age**
- **Individuals older than 50 years of age**
- **Persons living in residential care facilities**
- **Persons with problems absorbing fat, which includes those with:**
 - **Cystic fibrosis**
 - **Crohn's disease**
 - **Celiac disease**
 - **Some liver diseases**
- **Persons with kidney disease, especially those requiring dialysis**
- **Persons that have had gastric bypass surgery**
- **Darker-skinned individuals**
- **Persons using sunscreen (SPF8 or higher)**
- **Obese individuals**
- **Persons treated with certain drugs that may interfere with absorption or activity of the vitamin:**
 - **Antiseizure drugs such as phenytoin, phenobarbital, and carbamazepine**
 - **Drugs used to treat tuberculosis such as isoniazid and rifampin**
 - **Other drugs including corticosteroids, theophylline (an asthma drug), and cimetidine (Tagamet®) which decreases acid production in the stomach.**

Consequences of low vitamin D levels

Vitamin D is necessary for the proper absorption and utilization of calcium in building and maintaining bones. Chronic severe vitamin D deficiency in infants and children causes abnormal bones and is known as rickets. In adults, muscle weakness, bone pain, and osteoporosis are seen. This results in a much higher risk for fractures especially in the elderly due to falls. Studies suggest that low vitamin D levels may be a factor in loss of muscle mass and strength which also contributes to a higher risk of falls.

Other possible benefits of vitamin D

There are many ongoing studies regarding vitamin D. Researchers have found that vitamin D may play an important role in many diseases. In the future, vitamin D may be recommended for treatment of:

- **Psoriasis**
- **Hypertension**
- **Heart disease**
- **Type 1 diabetes mellitus**
- **Migraines**
- **Rheumatoid arthritis**
- **Multiple sclerosis**
- **Crohn's disease**
- **Many common cancers**

There have been studies that suggest vitamin D may increase our ability to fight off bacterial and viral infections. Vitamin D is involved in regulating cell growth and plays a role in how cells become normal functioning cells in our bodies.

Research is being done to study the role of vitamin D in cancer. Studies show that persons living in higher latitudes (your location north or south of the equator) such as the northern United States have an increased incidence of breast, colon, and prostate cancers. This may be linked to lower vitamin D levels due to lower sun exposure. At higher latitudes, the angle of the sun is lower and less sunlight actually hits the earth than at lower latitudes near the equator.

In some recent studies, researchers found that individuals with extremely low levels of vitamin D were twice as likely to die or suffer from a stroke as those with normal levels. They also had more heart disease and were twice as likely to develop heart failure.

Vitamin D Excess

In 1997, the National Academy of Sciences defined the Safe Upper Limit for vitamin D as 2000 units per day. Newer data indicates that higher doses are safe and are often recommended by health care providers. One

study showed that vitamin D toxicity occurred from an intake of over 10,000 units per day.

Excess vitamin D can cause:

- **High levels of calcium in the blood which can cause brain injury**
- **High levels of calcium in the urine which can lead to kidney stones**
- **Confusion**
- **Gastrointestinal problems such as anorexia (loss of appetite and inability to eat) and vomiting**
- **Muscle weakness**
- **Loss of calcium in bone with resultant bone pain**

General Guidelines for Vitamin D Repletion

Dosing of vitamin D depends on the nature and severity of the deficiency. In general, 800 to 1000 international units taken daily is adequate. Much higher doses may be needed in individuals with a decreased ability to absorb vitamin D.

Vitamin D supplements come in many forms including tablets, gel tabs, chewable forms, and liquid. It is an inexpensive supplement, often costing less than \$5.00 per month.

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