

## **Vitamins**

Vitamin is defined as any of the group of organic compounds that are essential for normal growth and also for the nutrition and are required in small quantities in diet because they cannot be synthesized by the body. It is also said that:

"most people can get all the vitamins they need from a healthy diet".

The term known as vitamin is derived from the word vitamine that was coined in 1912 by Polish biochemist named Casimir Funk. He isolated a complex of micronutrients essential to life all of which he presumed it to be amines. When this presumption was determined later not to be true, the "e" was dropped out from the name and it became vitamin. All the vitamins were discovered or identified between 1913 and 1948 years.

The term called vitamin does not includes the three other groups of essential nutrients such as minerals, essential fatty acids, and essential amino acids. Most of the vitamins are not single molecules, but they are groups of related molecules called vitamers.

### **Categories of Vitamins:**

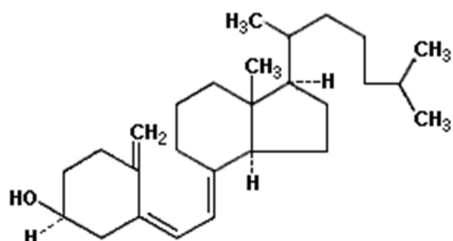
There are thirteen categories of vitamins which are required by human's metabolism are:

Vitamin A (including all-trans-retinol, all-trans-retinyl-esters, as well as all-trans-beta-carotene and other provitamin A carotenoids), vitamin B1 (thiamine), vitamin B2 (riboflavin), vitamin B3 (niacin), vitamin B5 (pantothenic acid), vitamin B6 (pyridoxine), vitamin B7 (biotin), vitamin B9 (folic acid or folate), vitamin B12 (cobalamins), vitamin C (ascorbic acid), vitamin D (calciferols), vitamin E (tocopherols and tocotrienols), and the vitamin K (quinones).

### **History of vitamins:**

Before the year 1935, there considers only one source of vitamins which was from food. If the intake of vitamins was lacking, the result will be vitamin deficiency and consequent diseases of the deficiencies. Then, the commercially produced tablets of yeast-extract vitamin B complex and semi-synthetic vitamin C became available now. This technique was followed in the 1950s by the mass production and the marketing of vitamin supplements which includes multivitamins to prevent vitamin deficiencies in the general people's population. The Governments mandated the addition of vitamins to staple the food items such as flour or milk, referred as food fortification, to prevent the vitamin deficiencies. Recommendations for the folic acid vitamin supplementation during the period of pregnancy reduces risk of infant neural tube defects.

### **Structure of vitamins:**



### **Effect on adult health maintenance:**

Once the growth and development are completed the vitamins remains essential nutrients for the healthy maintenance of the various cells, tissues, and also the organs that make up a multicellular organism. They also enables a multicellular life form to efficiently use chemical energy which is provided by food it eats, and to help process the proteins, the carbohydrates, and fats required for the cellular respiration.

### **Sources of Vitamins:**

For the most parts the vitamins are obtained from the diet, but also some are acquired by the other means. These includes microorganisms in the gut flora which produces vitamin K and also biotin, and one other form of vitamin D is synthesized in the skin cells when they are exposed to a certain wavelengths of ultraviolet light which is present in sunlight. Humans can also produce some vitamins from the precursors they consume. Examples includes vitamin A which is synthesized from beta carotene and niacin is synthesized from the amino acid tryptophan. The Food Fortification Initiative lists the countries which have mandatory fortification programs for the vitamins folic acid, niacin, vitamin A and vitamins B1, B2 and B12.

### **Anti-vitamins:**

The Anti-vitamins are the chemical compounds that inhibits the absorptions and actions of the vitamins. For example, avidin is a protein found in raw egg whites and inhibits the absorption of the biotin, and is deactivated by cooking. Pyriithiamine is another synthetic compound which has a molecular structure similar to the thiamine, vitamin B1, and inhibits the enzymes that use thiamine.

### **Fast facts of vitamins:**

Here are some of the key points about vitamins. More detail and the supporting ideas and information is in the main article.

1. There are 13 vitamins known.
2. The vitamins are either water-soluble or the fat-soluble.
3. The fat-soluble vitamins are very easier for the body to store than that of the water-soluble vitamins.

4. Vitamins always contains the amount of carbon, so they are known as “organic.”

5. Food is the best source of vitamins, but some people may advised by the physicians to use various supplements.

## **VITAMIN A:**

### **Introduction of vitamin A:**

Vitamin A is the special name of a group of fat-soluble retinoids which includes retinol, retinal, and retinyl esters etc. Vitamin A is also involved in immune function, vision, reproduction, and the cellular communication. Vitamin A is very critical for vision as an essential component of rhodopsin which is a part of eye and a protein that absorbs light in the retinal receptors. And it also supports the normal differentiation and functioning of the conjunctival membranes and the cornea. Vitamin A also supports the cell growth and differentiation and play a critical role in the normal formation and the maintenance of the heart, lungs, kidneys, and other organs.

### **Two forms of vitamin A:**

The two forms of vitamin A are available in human diet. One is preformed vitamin A (retinol and its esterified form, retinyl ester) and the other is provitamin A carotenoids. **Preformed vitamin A** is found in the foods from animal sources which includes dairy products, fish, and meat etc. By far the most important **provitamin A** carotenoid is beta-carotene the other provitamin A carotenoids are I.alpha-carotene and II.beta-cryptoxanthin. The body of the organisms converts these plant pigments into vitamin A. Both provitamin A and preformed vitamin A must metabolized intracellularly to retinal and retinoic acid. The active forms of vitamin A, to support the vitamin’s important biological functions. Other carotenoids

which found in food, such as lycopene, lutein, and zeaxanthin, will not be converted into vitamin A.

### **Sources of Vitamin A:**

#### **Food:**

The concentrations of the preformed vitamin A are found highest in liver and fish oils. Other sources of preformed vitamin A are milk and eggs and which also include some provitamin A. Most dietary provitamin A comes from leafy green vegetables, orange and yellow vegetables, tomato products, fruits, and some vegetable oils. The top food sources of vitamin A in the U.S. diet include dairy products, liver, fish, and fortified cereals. The top sources of provitamin A include carrots, broccoli, cantaloupe, and squash.

### **Dietary supplements of Vitamin A:**

Vitamin A is available in various multivitamins and as one stand-alone supplement, often in the form of retinyl acetate or retinyl palmitate. A portion of the vitamin A present in some supplements is in the form of beta-carotene and the remainder is preformed vitamin A, Others contain only preformed vitamin A or only beta-carotene. Supplement labels usually indicate the percentage of each form of the vitamin. The amounts of vitamin A in stand-alone supplements range widely. Multivitamin supplements typically contain 750–3,000 mcg RAE (2,500–10,000 IU) vitamin A.

About 28%–37% of the general population uses the supplements which contain vitamin A. Adults who are aged 71 years or older and children who are younger than 9 are more likely than members of other age groups to take supplements containing vitamin A.

## **Reference:**

<https://ods.od.nih.gov/factsheets/VitaminA-HealthProfessional/>

## **Vitamin A Deficiency:**

Vitamin A deficiency is very rare in the United States. However, vitamin A deficiency is most common in many developing countries. Often because residents have limited access to foods containing preformed vitamin A which comes from animal-based food sources and also they do not commonly consume the available foods containing beta-carotene due to poverty and malnutrition. According to the WHO (World Health Organization), 190 million of preschool-aged children and 19.1 million pregnant women all around the world have a serum retinol concentration having value below 0.70 micromoles/L. In these countries, intake of low vitamin A is most strongly associated with the health consequences during periods of high nutritional demand for example, during infancy, childhood, pregnancy, and lactation.

In various developing countries, the vitamin A deficiency typically begins during the period of infancy. When infants do not receive adequate or sufficient supplies of colostrum or breast milk they got deficiency of vitamin A. Chronic diarrhea is a disease which also leads to excessive loss of vitamin A in young children. And also vitamin A deficiency increases the risk of diarrhea. The most common symptom of vitamin A deficiency found in young children and pregnant women is **xerophthalmia**. One of the early signs of the xerophthalmia is the night blindness, or also the inability to see in low light or darkness. The Vitamin A deficiency is very of the top causes of preventable blindness in children. People who have vitamin A deficiency and often have xerophthalmia with its characteristic

Bitot's spots have tends to have low iron status which can cause the disease known as anemia. Vitamin A deficiency also increases the severity and mortality risk of infections, particularly including diarrhea and measles mostly even before the onset of the xerophthalmia.

## **6 Health Benefits of Vitamin A:**

### **1. Most important is it protects your eyes from Night Blindness and Age-Related Decline:**

Vitamin A is very essential for preserving your eyesight because this vitamin is needed to convert the light that hits your eye into an electrical signal that can be sent to your brain. In fact, one of the first or important symptoms of vitamin A deficiency is the night blindness which is known as nyctalopia.

The age-related macular degeneration (AMD) is the leading cause of blindness in the people of developed world. Though its exact cause is unknown but it is thought to be the result of cellular damage of the retina, attributable to oxidative stress.

### **2. It May Lower the Risk of Certain Cancers:**

Cancer is occurring when the abnormal cells begin to grow or divide in a very uncontrolled way. As the vitamin A plays very important role in the growth and development of your cells that's why its influence on cancer risk and role in cancer prevention is of interest to scientists.

### **3. Vitamin A Supports a Healthy Immune System:**

This Vitamin plays a very vital role in maintaining your body's natural defenses by including the mucous barriers in your eyes, lungs, gut and the genitals which helps to trap bacteria and other infectious agents. It is also involved in the production and the function of white blood cells, which

helps to capture and clear bacteria and other pathogens from your bloodstream.

#### **4. It Reduces Your Risk of Acne:**

Acne is a chronic or inflammatory skin disorder. People having this condition develop painful spots and blackheads, most commonly on the face, back and chest.

#### **5. It Supports Bone Health:**

Eating enough vitamin A is also necessary for the proper bone growth and development, and also a deficiency in this vitamin has been linked to poor bone health.

#### **6. It Promotes the Healthy Growth and Reproduction:**

Vitamin A is very essential for the maintenance of a healthy reproductive system in both men and women, as well as ensuring the normal growth and development of embryos during pregnancy. The Rat studies examining the importance of vitamin A in male reproduction have shown that the deficiency blocks the development of sperm cells and cause infertility.

### **VITAMIN D:**

#### **Introduction of vitamin D:**

The vitamin D is a fat-soluble vitamin that is naturally present in very few foods, added to others. They are also present and available as a dietary supplement. It is also produced endogenously and extremely when the ultraviolet rays from sunlight strike the skin and trigger vitamin D synthesis. The Vitamin D is also obtained from the sun exposure, food, and supplements is biologically inert and must undergo two hydroxylations in the body for activation. The first occurrence is in the liver and converts the vitamin D into 25-hydroxyvitamin D also known as calcidiol. The second



occurs primarily in the kidney and produces the physiologically active 1,25-dihydroxyvitamin D also known as calcitriol.

### **Sources of Vitamin D:**

#### **Food:**

A very few foods present in nature contains vitamin D. The flesh of fatty fishes for example salmon, tuna, and mackerel and the fish liver oils are among the best sources. There is small amounts of vitamin D which are found in beef liver, cheese, and egg yolks. The Vitamin D present in these foods is primarily in the form of vitamin D3 and its metabolite. Some of the mushrooms provide vitamin D2 in variable amounts. The mushrooms with enhanced levels of vitamin D2 from being exposed to ultraviolet light under controlled conditions are also available worldwide.

#### **Dietary supplements:**

In the supplements and fortified foods, vitamin D is also available in two forms, D2 (ergocalciferol) and D3 (cholecalciferol) these two differ chemically only in their side-chain structure. **Vitamin D2** is manufactured by the UV irradiation of ergosterol in yeast, and **vitamin D3** is manufactured by the irradiation of 7-dehydrocholesterol from lanolin. These two forms have traditionally been regarded as equivalent based on their ability to cure the rickets and indeed, most of the steps involved in the metabolism and actions of vitamin D2 and vitamin D3 are very identical. Both the forms effectively raise serum. Firm or solid conclusions about any different effects of these two forms of vitamin D cannot be drawn. However, it appears like that at nutritional doses vitamins D2 and D3 are equivalent, but at high doses vitamin D2 is very less potent.

#### **Vitamin D Deficiency:**

The nutrient deficiencies are usually as the result of dietary inadequacy, impaired absorption and their use, increased requirement, or increased excretion. A vitamin D deficiency can occur when usual intake is lower than recommended levels over time. The exposure to sunlight is very limited. The kidneys cannot convert 25(OH)D into its active form, or absorption of vitamin D from the digestive tract is very inadequate. Vitamin D-deficient diets are associated with the milk allergy, lactose intolerance, ovo-vegetarianism, and veganism.

The diseases known as **Rickets** and **osteomalacia** are the classical vitamin D deficiency diseases. Mostly in children the vitamin D deficiency causes rickets, a disease characterized by a failure of bone tissue to properly mineralize which results in soft bones and skeletal deformities. **Rickets** was first described in the mid-17th century by British researchers. In the late 19th and early 20th centuries, German physicians noted that there is consuming 1–3 teaspoons/day of cod liver oil could reverse or cure rickets. The fortification of milk with vitamin D beginning in the 1930s has made rickets a rare disease in the United States.

### **Groups at the Risk of Vitamin D Inadequacy:**

Obtaining the sufficient vitamin D from natural food sources alone is very difficult. For many of the people who consume vitamin D-fortified foods and, arguably, being exposed to some sunlight are essential for maintaining a healthy vitamin D status. In some other groups the dietary supplements might be required to meet the daily need for vitamin D. These include:

1. Breastfed infants.
2. Older adults.
3. People with limited sun exposure.

4. People with dark skin.
5. People with inflammatory bowel disease and other conditions causing fat malabsorption.
6. People who are obese or who have undergone gastric bypass surgery.

### **Health benefits of vitamin D:**

#### **1. Healthy bones:**

Vitamin D plays a very significant role in the regulation of calcium and maintenance of phosphorus levels of the blood. These factors which are vital for the maintaining healthy bones. Most of People need vitamin D to allow the intestines to stimulate and also to absorb calcium and reclaim calcium that the kidneys would otherwise excrete it. Vitamin D deficiency in children causes the rickets.

Similarly, in adults, vitamin D deficiency manifests as **osteomalacia** which is termed as softening of the bones. Osteomalacia results in poor bone density and muscular weakness.

The vitamin D deficiency can also present in the form of another disease called **osteoporosis**, for which over 53 million people in the United States seeks treatment or face an increased risk.

#### **2. Reduced risk of flu:**

The vitamin D had a very protective effect against the influenza virus. However, the authors also looked at other studies where the vitamin D did not have this effect on flu and flu risk. Further research is very necessary to confirm the protective effect of vitamin D on the flu.

#### **3. Healthy infants:**

The Australian study reveals that it comes from of egg intake. Eggs are very common early source of vitamin D. The children who started eating eggs after the age of 6 months were more likely to develop food allergies than children who started between 4–6 months of age.

#### **4. Healthy pregnancy:**

Doctors associate that poor vitamin D status with gestational diabetes and bacterial vaginosis in pregnant women.

It is also very important to note that in 2013 study, researchers associated high vitamin D levels during pregnancy and with an increased risk of food allergy in the child during the first 2 years of their life.

#### **5. Vitamin D reduces depression:**

The research has shown that the vitamin D might play an important role in regulating mood and warding off the depression. In one study, scientists found that people with depression who received vitamin D supplements noticed that there is an improvement in their symptoms.

#### **6. Vitamin D boosts weight loss:**

If we consider adding vitamin D supplements to your diet if you're trying to lose weight or prevent the heart diseases. You can find a great selection of vitamin D supplements on various websites.

In once study, people who are taking a daily calcium and vitamin D supplement were able to lose more weight more than subjects taking a placebo supplement. The scientists said that extra calcium and vitamin D had an appetite-suppressing effect. In another study those overweight people who took a daily vitamin D supplement improved their heart disease risks.

#### **Major sources of vitamin D:**

Plentiful food sources of vitamin D include:

1. fatty fish, such as salmon, mackerel, and tuna
2. egg yolks
3. cheese
4. beef liver
5. mushrooms
6. fortified milk
7. fortified cereals and juices

**How much do we need vitamin D:**

There are some controversy over the amount of vitamin D needed for healthy functioning for life. Recent research indicates that you need more vitamin D than was once you could thought.

Normal blood serum levels range from 50 to 100 micrograms per deciliter in the blood. Depending on your blood level, you may need more vitamin D than you thought.

**The recommendations for vitamin D are:**

1. children and teens needs 600 IU.
2. adults up to age 70 needs 600 IU.
3. adults over age 70 needs 800 IU.
4. pregnant or breastfeeding women needs 600 IU.

**Importance of vitamins in our life:**

Vitamins allows our body to grow and develop properly. They also play a very important role in bodily functions which includes metabolism, immunity and digestion.

According to research there is the best way to meet our vitamin needs is to eat a balanced diet containing a variety of foods. If you can't meet your needs through food only then you may also take or require dietary supplements.