

# **Vitamins and Minerals**

**Vitamins are organic compounds that people need in small quantities.**

Most vitamins need to come from food because the body either does not produce them or produces very little amounts.



**Different vitamins play different roles in the body**, and a person requires a different amount of each vitamin to stay healthy and to carry out a range of normal functions.

Having too little of any particular vitamin is known as **DEFICIENCY** and may increase the risk of developing certain health issues.

A collage of various food items including dairy products, meat, grains, nuts, vegetables, and baked goods. The central text is overlaid on a green background.

**Most people get all the nutrients they need by having a **varied and balanced** diet**



**Vitamins were obtained only from food until the 1930s when commercially made supplements of certain vitamins became available**





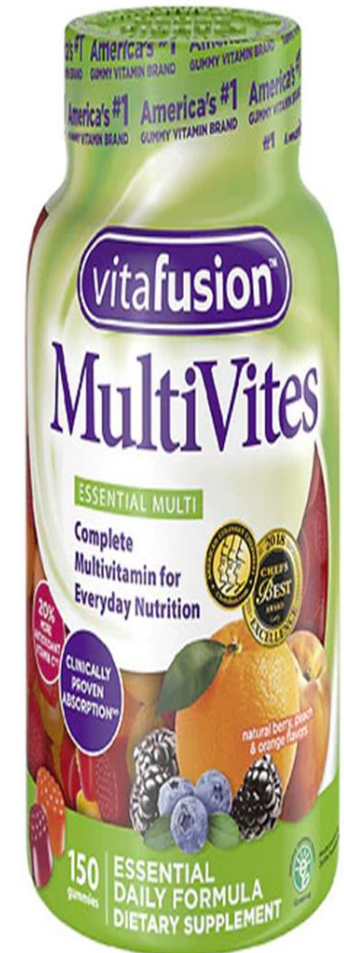
**There are**

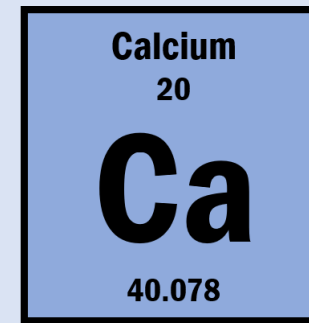
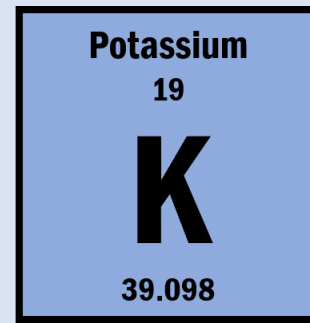
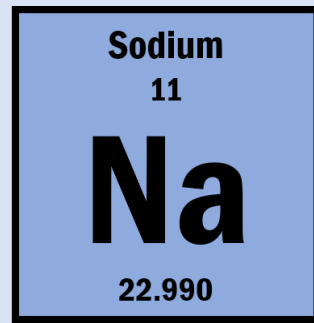
**13**

**essential vitamins**

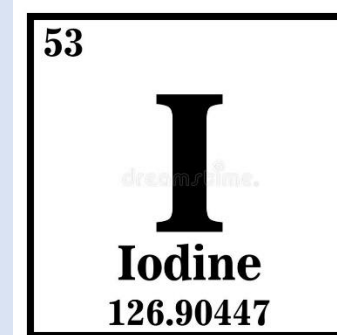
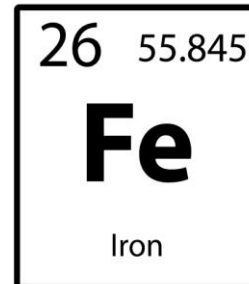
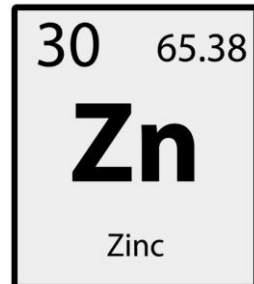
# Fat-soluble and water-soluble vitamins

**Vitamins are either soluble, or dissolvable, in fat or water**





**Minerals are inorganic elements present in soil and water, which are absorbed by plants or consumed by animals.**





# **Fat-Soluble Vitamins**

**A, D, E, K**

Fat-soluble vitamins are stored in **adipose tissues**.

These vitamins are not absorbed directly into the blood stream but are absorbed into the lacteals in the small intestine via chylomicrons, transported through the lymphatic system and then released into the blood stream

**Most excess fat-soluble vitamins are stored in the body for future utilization.**

# Vitamin

# A

# Vitamin **A**, also known as **retinol**

## **Important for:**

Helping in the **body's natural defense** against illness and infection (the immune system).

**Vision in dim light**

**Keeping skin** and the lining of some parts of the body, such as the nose, **healthy**

# Sources of vitamin A

Cheese

Eggs

Liver and liver products

# Sources of beta-carotene which the body can convert into retinol

- Yellow, red and green (**leafy**) vegetables, such as spinach, carrots, sweet potatoes and red peppers
- Yellow fruit, such as mango, papaya and apricots

# Daily requirements

The total vitamin A content of a food is usually expressed as **micrograms ( $\mu\text{g}$ )** of retinol equivalents (RE).

The amount of vitamin A adults aged 19 to 64 need is:

700  $\mu\text{g}$  a day for men

600  $\mu\text{g}$  a day for women

**Any vitamin A the body does not need immediately is stored for future use. This means you do not need it every day.**

# Vitamin

# D

# Vitamin D

## Important for:

Helps regulate the amount of calcium and phosphate in the body.

Keeps bones, teeth and muscles healthy.

A lack of vitamin D can lead to bone deformities such as rickets in children, and bone pain caused by a condition called osteomalacia in adults.



# Sources of vitamin D

Most people should be able to make all the vitamin D they need **from sunlight**.

The body creates vitamin D from direct sunlight on the skin when outdoors.

## **Other sources:**

- oily fish – such as salmon, sardines, herring and mackerel
- red meat
- Liver
- egg yolks

# Daily requirements

Children from the age of 1 year and adults need **10 micrograms of vitamin D a day.**

This includes pregnant and breastfeeding women, and people at risk of vitamin D deficiency.

# Vitamin

# E

# Vitamin E

## Important for:

Vitamin E helps maintain healthy skin and eyes, and strengthen the body's natural defense against illness and infection (the immune system).

*Vitamin E deficiency can cause nerve and muscle damage that results in loss of feeling in the arms and legs, loss of body movement control, muscle weakness, and vision problems. Vitamin E deficiency is genetic in origin and runs in families.*

# Sources of vitamin E

Plant oils – such as sunflower, soya, corn and olive oil

Nuts and seeds

Wheatgerm – found in cereals and cereal product

# Daily requirements

The amount of vitamin E:

- 4mg a day for men
- 3mg a day for women

# Vitamin

# K

# Vitamin **K**

## **Important for:**

Vitamin K is needed by the body for **blood clotting, helping wounds to heal.**



# Sources of vitamin K

Green leafy vegetables – such as broccoli and spinach

Vegetable oils

Cereal grains

People should be able to get all the vitamin K needed by eating a varied and balanced diet.

# **Water-Soluble Vitamins C and B Complex**

- Vitamin B1 (thiamine)**
- Vitamin B2 (riboflavin)**
- Vitamin B3 (niacin)**
- Vitamin B5 (pantothenic acid)**
- Vitamin B6**
- Vitamin B7 (biotin)**
- Vitamin B9**
- Vitamin B12 (cobalamin)**

Water-soluble vitamins are carried to the body tissues.

Unlike the fat-soluble vitamins, water-soluble vitamins are generally **NOT** stored in the body. For this reason, the body should try to get them regularly from the diet.

They are found in many plant and animal foods and in dietary supplements and **must be taken in daily.**

# **Thiamine**

## **(Vitamin B1)**

Also known as thiamine diphosphate, thiamine pyrophosphate is the most abundant form of thiamine in the body. (Other forms, Thiamine triphosphate, Thiamine mononitrate, Thiamine hydrochloride)

Coenzymes are small compounds that help enzymes trigger chemical reactions that otherwise would not happen on their own.

Like the other B vitamins, **thiamine** serves as a **coenzyme** in the body.

# Sources of Thiamin

The richest dietary sources of thiamine include **nuts**, seeds, whole grains, liver, pork, fish, and salmon.

# Thiamin (Vitamin B1) Deficiency

## Causes:

High blood sugar levels may increase thiamine elimination via urine, raising its requirements and the risk of deficiency.

People with **alcoholism** are also at an increased risk for deficiency because of a **poor diet** and **impaired thiamine absorption**

# **Symptoms**

- 1- Anorexia,**
- 2- Weight loss,**
- 3- Impaired neural function,**
- 4- Mental problems,**
- 5- Muscle weakness and heart enlargement.**



# **Riboflavin**

## **(Vitamin B2)**

Riboflavin is the only water-soluble vitamin used as a food coloring. In fact, it is named for its color — the Latin word flavus means “yellow

Like thiamine, it is involved in the conversion of nutrients into energy. It is also required in the conversion of vitamin B6 to its active form, and in the conversion of tryptophan to niacin (vitamin B3).

# Sources of Riboflavin

Yeast extract is exceptionally rich in riboflavin.

Other rich sources

Eggs,

Leafy vegetables,

Broccoli,

Milk,

Legumes,

Mushrooms and meat.

# Deficiency

Riboflavin deficiency is **very rare** in developed countries. However, a **poor diet, old age, lung diseases and alcoholism** may increase the risk.

Severe deficiency results in a condition known as **riboflavinosis**, which is characterized by a sore throat, inflamed tongue, anemia, as well as skin and eye problems.

# **Niacin**

## **(Vitamin B3)**

The only B vitamin in the body that can be produced from another nutrient (from amino acid tryptophan).

**Nicotinic acid:** The most common form in supplements. Also found in both plant- and animal-sourced foods. High-dose nicotinic acid supplements may cause a condition called niacin flush.

**Nicotinamide (niacinamide):** Found in supplements and foods.

# Role and Function

All dietary forms of niacin are eventually converted into nicotinamide adenine dinucleotide (NAD<sup>+</sup>) or nicotinamide adenine dinucleotide phosphate (NADP<sup>+</sup>), which **act as coenzymes**.

Like the other B vitamins, it functions as a coenzyme in the body, playing **an essential role in cellular function and acting as an antioxidant**.

One of its most important roles is to drive a metabolic process known as **glycolysis, the extraction of energy from glucose (sugar)**.

# Sources of Niacin

Yeast extract is exceptionally rich in riboflavin.

Other rich sources

Eggs,

Leafy vegetables,

Broccoli,

Milk,

Legumes,

Mushrooms and meat.



# Deficiency

Niacin deficiency, known as **pellagra**, much more common in developing countries where people commonly follow diets that lack diversity.

The main symptoms of pellagra include inflamed skin, mouth sores, diarrhea, insomnia and dementia. **Like all deficiency diseases, it is fatal without treatment.**



High supplemental doses of niacin may cause **niacin**  
**flush**, nausea, vomiting, stomach irritation and liver  
damage.



# **Pantothenic Acid**

**(Vitamin B5)**

# Types

Coenzyme A

Acyl carrier protein

Calcium pantothenate

Panthenol

It is required for the formation of **coenzyme A**, which is necessary for the synthesis of fatty acids, amino acids, steroid hormones, neurotransmitters and various other important compounds.

# Vitamin B6

Vitamin B6 is a group of nutrients that are required for the synthesis of pyridoxal phosphate, a coenzyme involved in more than 100 different metabolic processes.



# Deficiency

**Vitamin B6 deficiency is rare. People with **alcoholism** are at the greatest risk**

# **Biotin**

# **(Vitamin B7)**



People often take biotin supplements to nourish their hair, nails and skin, although strong evidence for these benefits is lacking. In fact, it was historically called vitamin H after the German word haut, meaning “skin”



# Folate

# Vitamin B9

Vitamin B9 was first discovered in yeast, but later isolated from spinach leaves.

For this reason, it was given the names folic acid or folate, words derived from the Latin word folium, meaning “leaf.”

Vitamin B9 comes in several different forms

Folate

Folic acid

L-methylfolate

# Role and Function

Vitamin B9 acts as a coenzyme and is **essential for cell growth, DNA formation and amino acid metabolism.**

It is **very important during periods of rapid cell division and growth, such as in infancy and pregnancy.**

Additionally, it is **required for the formation of red and white blood cells, so deficiency may lead to anemia.**

**Pernicious Anemia** is one of the classic symptoms of vitamin B9 deficiency. It is indistinguishable from the anemia associated with vitamin B12 deficiency.

Lack of vitamin B9 may also lead to **birth defects of the brain or neural cord, collectively known as neural tube defects**





# **Cobalamin**

## **(Vitamin B12)**

Vitamin B12 is the only vitamin that contains a metallic element, namely cobalt.

For this reason, it is often referred to as cobalamin.

- Like all other B vitamins, vitamin B12 acts as a coenzyme.
- Adequate intake helps maintain brain function and development, neurological function, and the production of red blood cells.
- **Vitamin B12 is stored in the liver, so even if in small amounts, it may take a long time for deficiency symptoms to develop.**

Those who are at the greatest risk of deficiency are those who never or rarely eat animal-sourced foods. This includes **vegetarians and vegans**.

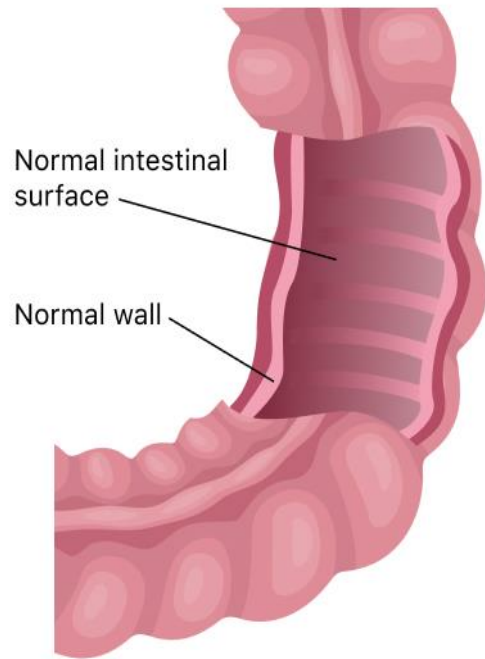
Deficiency may also develop in older people. Many require regular vitamin B12 injections.

Vitamin B12 absorption depends on a protein produced by the **stomach** called **intrinsic factor**. As people age, the formation of intrinsic factor may reduce or stop.

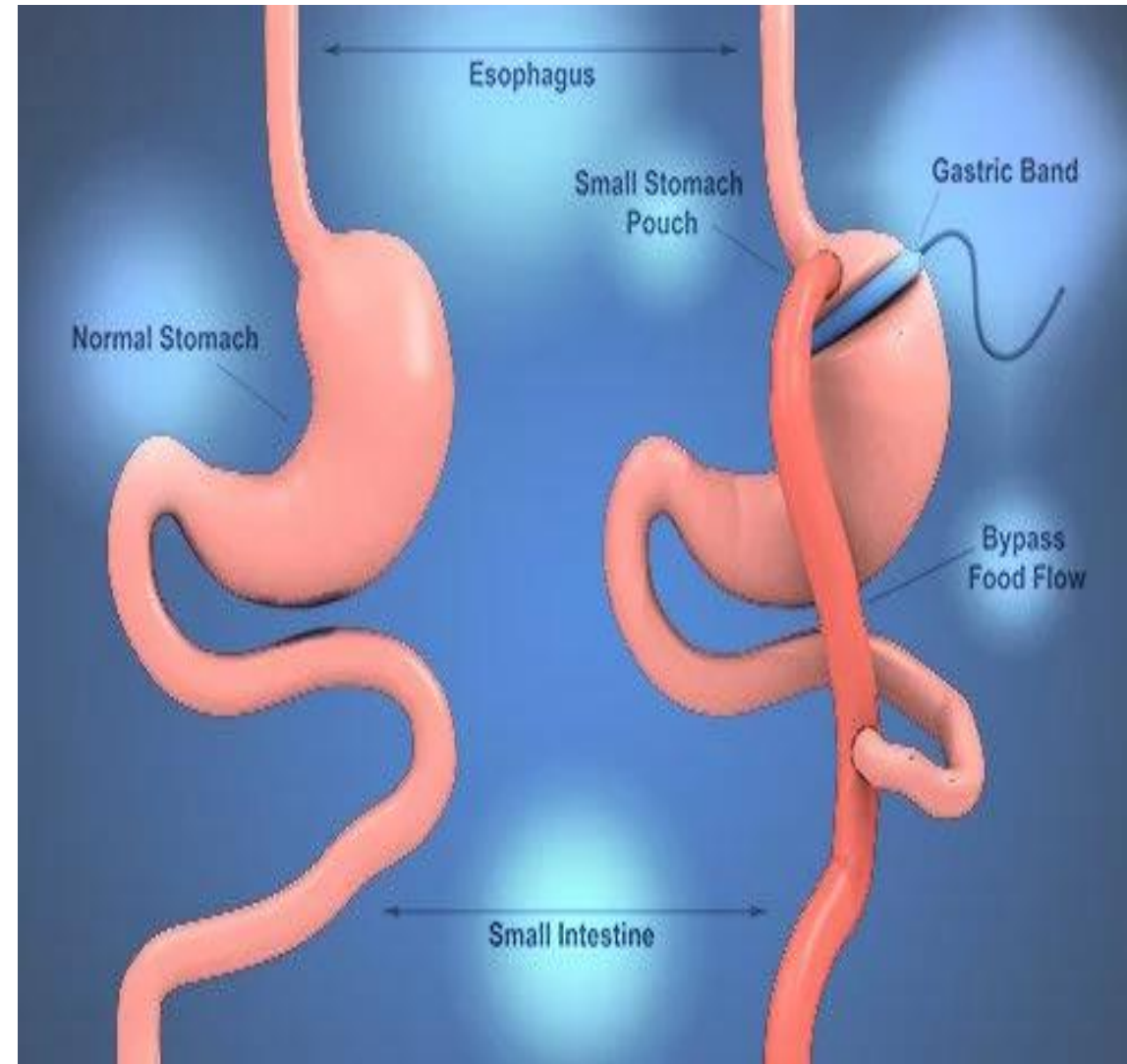
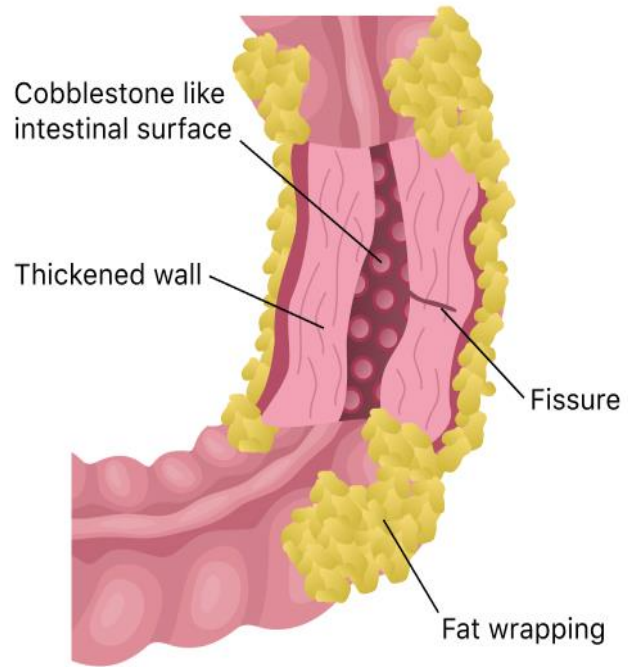
Other risk groups include those who have had **weight loss surgery or suffer from Crohn's disease or celiac disease**.

# Crohn's Disease

Normal Intestine



Crohn's Disease



# Vitamin C





**Vitamin C is the only water-soluble vitamin that does not belong to the vitamin B category.**

**It is one of the body's main antioxidants and is required for collagen synthesis.**

**The most common form is known as ascorbic acid.**

**Unlike the B vitamins, vitamin C doesn't act as a coenzyme,**

**The main dietary sources of vitamin C are fruits and vegetables.**



# Role and Function

- Antioxidant defenses
- Collagen formation: Without vitamin C, the body is unable to synthesize collagen, the main protein in connective tissue.
- As a result, deficiency affects the skin, tendons, ligaments and bones.
- Immune function: Immune cells contain high levels of vitamin C. During an infection, its levels are quickly depleted.

# Scurvy

May develop in people who follow restrictive diets or eat almost no fruits or vegetables.

People with drug addiction or alcoholism are also at greater risk.

Characterized by the breakdown of connective tissue.



The first symptoms of deficiency include fatigue and weakness. As scurvy becomes worse, people may experience spotted skin and inflamed gums.

Advanced scurvy may cause loss of teeth, bleeding gums and skin, joint problems, dry eyes, swelling and impaired wound healing. Like all vitamin deficiencies, scurvy is fatal without treatment.