



# HME103-Principles of Nutrition

## Components in foods and their relationship with health: Vitamin-I

Lesson Code: HME103-Principles of Nutrition

Instructure: Assoc.Prof. Dr. Elif Feyza TOPDAŞ

[atauni.edu.tr](http://atauni.edu.tr)    Atauni1957

**Vitamins** are organic compounds that require very small amounts for cellular metabolic reactions and cause some problems in their deficiencies.

Vitamins work as regulators in the body. They are not used as energy or building materials in the body.

Each vitamin has a unique chemical structure. They differ from proteins and carbohydrates in this respect. For example, proteins have amino acids as a common structural unit. However, there is no common structure in vitamins.

### VITAMIN = "THE AMIN OF LIFE"

Vitamins were discovered in the early 1900s. Its name is "Vital Amin"; meaning life-giving nitrogen.



Different species need different vitamins. For example, humans and other primates need vitamin C, while dogs and cats do not.

Vitamin requirements are small amounts expressed in milligrams or micrograms.

Vitamins have specific functions in all body cells.

The effects of vitamins on human health can be divided into three groups:

1. Help growth
2. Helping to create healthy generations
3. Normal functioning of the nervous and digestive systems, proper use of nutrients and aid in body resistance.

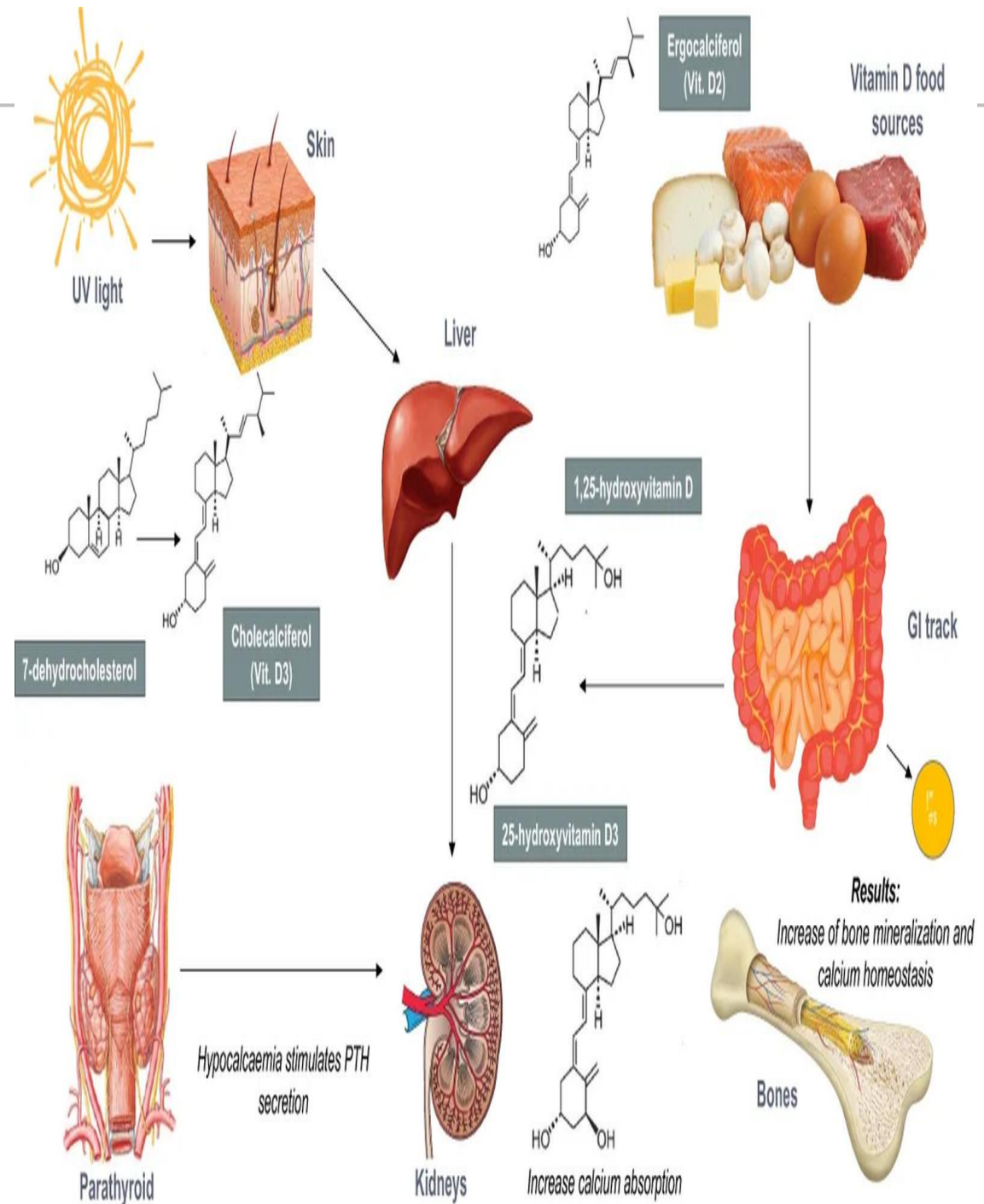


## SYNTHESIS

They are synthesized by plants and microorganisms.

The human organism meets its vitamin needs from food and vitamins synthesized by intestinal bacteria.

- The distribution of vitamins in foods varies.
- When foods are purified, their vitamin values decrease.
- Vitamins are also affected during the preparation, cooking and storage of food.



The recommended daily requirement for nutrients such as protein, fiber, vitamins and minerals that can meet the body's needs is called RDA (Recommended Dietary Allowance). In human nutrition, RDA is calculated as the average of several days, rather than daily.

### DEFICIENCY OF WATER-SOLUBLE VITAMINS

Deficiency of water-soluble vitamins occurs rapidly depending on nutrition. It may still take weeks for the deficiency to occur.

#### INITIALLY

There is sufficient amount of vitamin in tissues and body fluids.

#### VITAMIN DEFICIENCY IN THE DIET

The level of vitamin in tissues gradually decreases

#### AFTER 3 TO 4 WEEKS

Biochemical lesions appear (enzyme activities decrease)

#### AFTER 6 TO 8 WEEKS

Clinical lesions are seen (on the skin, tongue, etc.)



There is no difference in people's physical appearance after three to four weeks of vitamin-deficient diets. **It may be a symptom of general fatigue and weakness.**

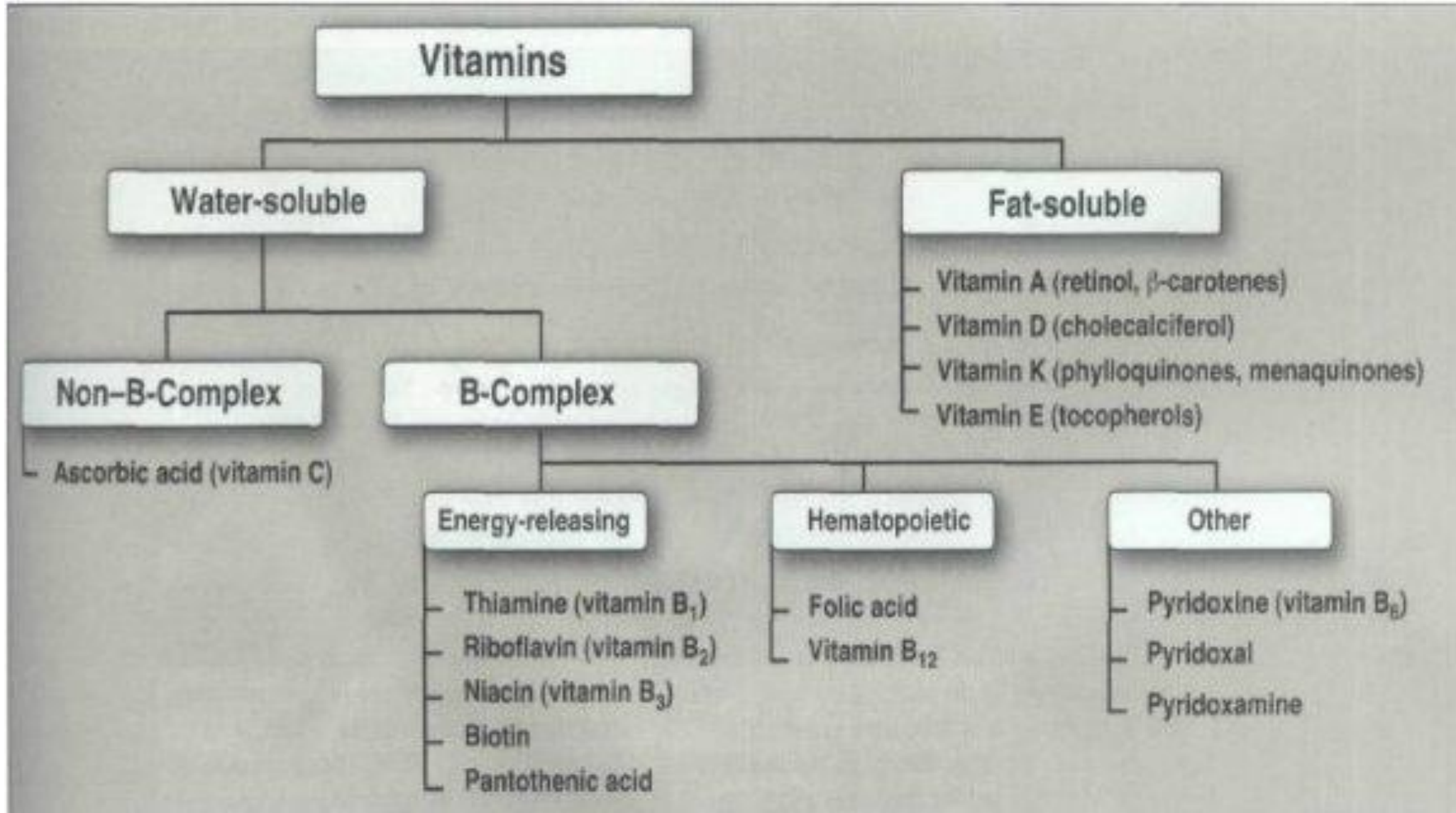
However, this deficiency can be determined by laboratory tests, especially by detecting low enzyme activities. The inability of enzymes to perform their activities sufficiently is one of the symptoms of vitamin deficiency.

As a result of a long-term, approximately six-week, vitamin-deficient diet:

- **Cracking at the corner of the mouth**
- **Disorders in the digestive system and**
- **Muscle fatigue occurs.**



In general, vitamins are divided into two groups according to their dissolution properties: **fat-soluble** and **water-soluble**.



# Main properties of water-soluble vitamins



- They are found in the liquid parts of cells. For example, the mitochondria cell, which is responsible for oxidizing carbohydrates and fats to meet energy needs.
- It has been reported that excess water-soluble vitamins are unlikely to have toxic effects.

• Their residence time in the body is short and they are used or excreted within 48 hours. Therefore, water-soluble vitamins need to be taken more frequently.

• When taken in large amounts through diet or nutritional supplements, body homeostasis is activated and excess amounts of vitamins are excreted through urine.

Water Soluble Vitamins	
Vitamin:	Name:
B1	Thiamine
B2	Riboflavin
B3	Niacin
B5	Pantothenic Acid
B6	Pyridoxine
B7	Biotin
B9	Folate
B12	Cobalamin
C	Ascorbic Acid





## THIAMIN (B1):

It is the first identified vitamin among the B group vitamins.

Thiamine deficiency is common in societies that eat grains, especially rice. The reason was that the grains were refined in the 1800s, that is, the outer shell was removed. Traditionally, people with low income levels started consuming white rice. Thiamine deficiency occurred in the diet because thiamine is in the shell of the grain. Thus, a disease called **beriberi**, which causes muscle fatigue and nervous system disorders, became widespread.

**Beriberi** disease has caused the death of many people, especially in Sri Lanka. The word Beriberi means "extreme exhaustion, weakness" in Sri Lankan language.



## Thiamine requirement

Male over 19 years old	1.2 mg/day
Female over 19 years old	1.1 mg/day
Pregnancy	1.4 mg/day
Lactation	1.4 mg/day

## Sources:

- It is found in small amounts in almost every food.
- The richest sources of thiamine are the seeds of plants.
- However, since it is found more in the outer parts of the seeds and the embryo, its amount decreases in refined products.

High temperature disrupts the structure of thiamine.

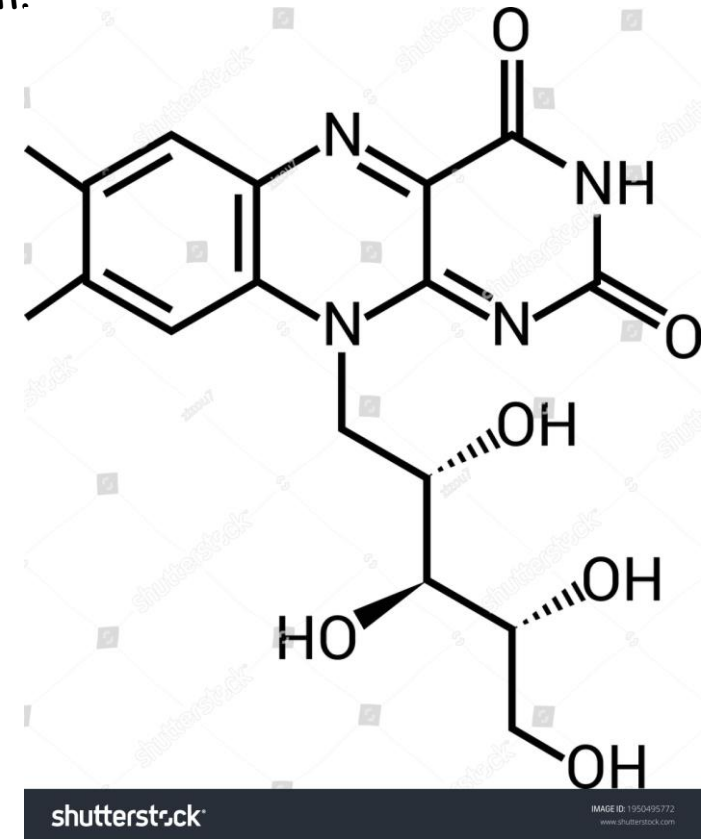


It functions as coenzyme in carbohydrate and energy metabolism.

Ribose (5-carbon sugar) +flavin (color pigment)

## DEFICIENCY

Riboflavin deficiency is often accompanied by deficiency of other B group vitamins. Growth failure is the most concrete symptom. In case of deficiency, a disease called "ariboflavinosis" occurs. Symptoms of this disease are a red tongue with erased papillae, lesions on the lips, and weakness.



## Riboflavin requirement

Male over 19 years old	1.3 mg/day
Female over 19 years old	1.1 mg/day
Pregnancy	1.4 mg/day
Lactation	1.6 mg/day

## Sources

Milk and dairy products are good sources of riboflavin. People can meet more than half of their riboflavin needs by drinking milk. In addition, whole grain products (with shell), yoghurt, eggs and yeast are also good sources of riboflavin. Riboflavin is added to refined grains.



It is more resistant to high temperatures than vitamin B1. However, it is very sensitive to light and alkalis.

## NIACIN (B3)

The name niacin is a term that includes nicotinic acid and nicotinamide. They function as coenzymes in the oxidation of carbohydrates, fats and proteins, especially to obtain energy. Niacin is also an important coenzyme in the synthesis of fats.

A small amount of niacin is also produced in our body from tryptophan.

### DEFICIENCY:

**Pellagra** occurs, also called 3D disease (dementia, diarrhea, dermatitis). It progresses with digestive and central nervous system disorders.

### REQUIREMENT:

Like thiamine, the need for niacin varies according to our body's energy needs.

Niacin requirement	
Male over 19 years old	16 mg / day
Female over 19 years old	14 mg / day
Pregnancy	18 mg / day
Lactation	17 mg / day

## SOURCES:

Niacin needs are easily met with a variety of foods.

- Yeast
- Dry beans
- Bulgur wheat
- Meat, chicken, fish
- Green vegetables
- Mushroom

Niacin is one of the vitamin that is most resistant to different conditions. It is very resistant to heat, light and oxidation. The main cause of loss in food processing is due to its water solubility.



An inability to absorb niacin (vitamin B<sub>3</sub>) or the amino acid tryptophan may cause pellagra, a disease characterized by scaly sores, mucosal changes and mental symptoms

## VITAMIN B6 (PYRIDOXINE)

Vitamin B6 plays a role in regulating body metabolism. It acts as a coenzyme, especially involved in the transfer of nitrogen from one amino acid to another in protein metabolism. It is also responsible for breaking down glycogen and converting it into glucose.

### DEFICIENCY:

B6 deficiency causes symptoms such as diarrhea, skin disorders and muscle fatigue that occur in other water-soluble vitamin deficiencies. In addition, since B6 is needed in the production of hemoglobin in red blood cells, its deficiency causes anemia.



## REQUIREMENT:

B6 requirement is linked to protein requirement and intake. The need for this vitamin increases in older people due to increased losses and malnutrition.

## SOURCES

- Meat, fish, chicken, organ meats
- Legumes
- Oilseeds
- Green vegetables (spinach, green radish leaves, etc.)
- Potatoes
- Among fruits, Bananas are good sources of pyridoxine.

### Vitamin B<sub>6</sub> (Pyridoxine)

Daily Requirement (RDA)

	<u>Men</u>	<u>Women</u>
Ages 19-50	1.3mg	1.3mg
Ages 51+	1.7mg	1.5mg
Pregnancy		1.9mg
Lactation		2.0mg



# VITAMIN B12 (COBALAMIN) AND FOLIC ACID (VITAMIN B9)

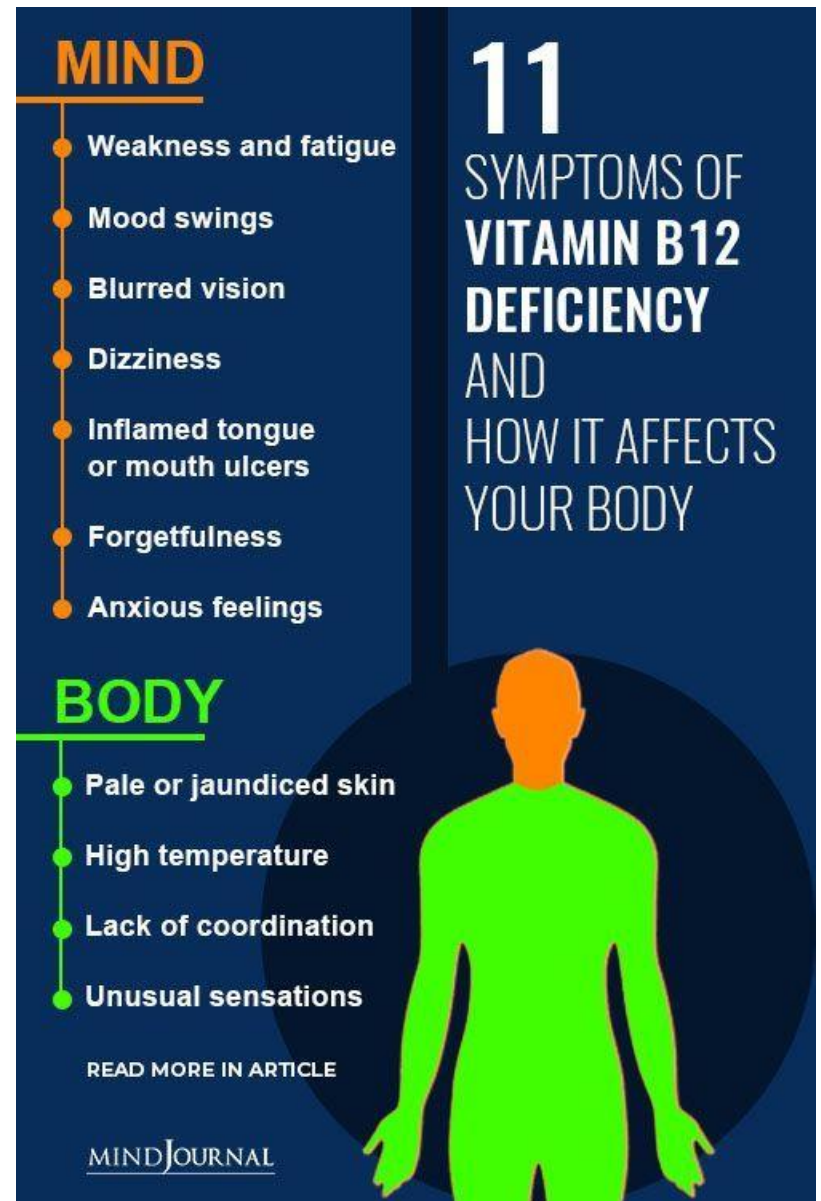
These two B group vitamins have similar functions, they are regulators and work especially for the copying of genetic material (DNA and RNA) inside cells. As a result, both of them have an important role in the formation and renewal of new cells. Vitamin B12 is also responsible for the production of myelin, which protects nerve cells.



## DEFICIENCY:

Cells that are renewed frequently in the body are immediately affected by B12 or folic acid deficiency. This includes red blood cells. Anemia develops due to B12 or folic acid deficiency. In this form of anemia, which is different from iron deficiency, large and immature blood cells enter the circulation.

If a person suffers from B12 deficiency, nerves may be damaged and even paralysis may occur due to problems in myelin sheath formation. It is therefore important to determine the cause of anemia.



### MIND

- Weakness and fatigue
- Mood swings
- Blurred vision
- Dizziness
- Inflamed tongue or mouth ulcers
- Forgetfulness
- Anxious feelings

### BODY

- Pale or jaundiced skin
- High temperature
- Lack of coordination
- Unusual sensations

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## DEFICIENCY:

If folic acid deficiency occurs at the beginning of pregnancy, it can cause serious birth defects in the future. **Research has shown that taking folic acid before and throughout pregnancy is effective in preventing disorders in the nervous system.** These are a type of birth defect involving the spinal cord and often lead to paralysis.

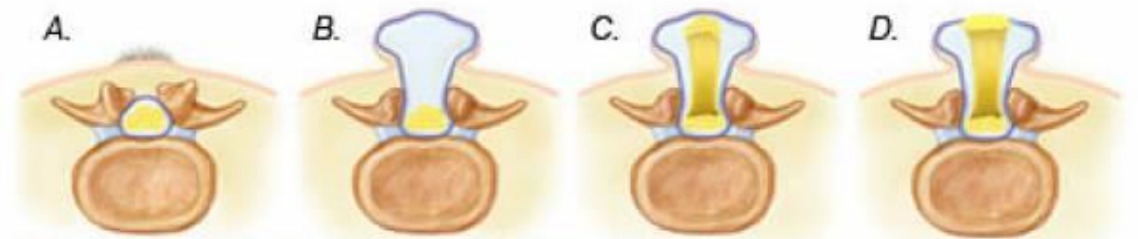
### Neural Tube Defect (NTD)

*The use of 600 µg folic acid for 3 months before pregnancy is recommended against the development of NTD.*



Normal newborn vertebra

- A. Spina bifida occulta
- B. Spina bifida with meningocele
- C. Spina bifida with meningomyelocele
- D. Spina bifida with myeloschisis



The needs for these vitamins in women increase during pregnancy and lactation.

Stomach acid production decreases with aging and vitamin B12 absorption also decreases.

Vitamin B12 and Folic acid requirement		
	B12	Folic acid
Male/Female over 19 years old	2.4 f/g/day	400 f/g/day
Pregnancy	2.6 f/g /day	600 f/g/day
Lactation	2.8 f/g/day	500 f/g/day

## Foods rich in folic acid

Liver, citrus fruits and their juice, leafy vegetables such as spinach and asparagus. Grain foods and breakfast cereals are fortified with folic acid.

## Foods rich in vitamin B12

Animal foods are rich in B12. These; red meat, fish, poultry, dairy products and soy milk, soy products and some breakfast cereals fortified with B12.



## Biotin (Vitamin H):

This vitamin takes part in fatty acids and amino acid metabolism. Humans meet a small part of their biotin requirement from diet. However, the need is mainly met by biotin synthesized by some bacteria in the intestinal flora.

The daily requirement for biotine is 100-300  $\mu\text{g}$ . The most important sources of biotin are; animal foods such as meat, milk, liver, kidney, egg yolk and plant foods such as vegetables and mushrooms



## VITAMIN C (ASCORBIC ACID)

Vitamin C is responsible for regulation. Specifically, it takes part in a chemical reaction that produces collagen protein. This collagen protein acts as the "glue" that holds your bones, connective tissues, lung tissues, blood vessels, and teeth together.

As it is known, vitamin C deficiency has a devastating effect. Vitamin C also helps iron absorption. The bioavailability of iron also increases with the presence of vitamin C.

There is information that scurvy (scurbut) disease due to vitamin C deficiency was recognized in 1500 BC.

- Vitamin C is called ascorbic acid because it is antiscorbutic.



## SOURCES:

### Vitamin C

How much is enough?

Daily requirement:

Men  
= 90 mg per day

Women  
= 75 mg per day



Get your fill from a balanced diet



**Smokers = +35 mg per day**

Especially oxygen, long-term heating accompanied by oxygen and light are the main factors that cause the breakdown of vitamin C. Ascorbic acid is also broken down enzymatically.

Vitamin C is easily obtained from foods. Many fruits, especially citrus fruits (oranges, grapefruits, tangerines), are excellent sources of this vitamin. Vegetables such as peppers, tomatoes and broccoli are also good sources of vitamin C.

