University of Fallujah
College of Medicine

Vitamin B complex

Lecture : 6

Stage : 2nd Stage

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Learning Objectives

-Understand the basic roles of vit B complex

-Understand the structures and classification of vitamin B.

-Identify the clinical roles of vitamin B

vitamin B-complex

The vitamin B-complex refers to **essential water-soluble vitamins**

Each member of the B-complex has a unique structure and performs unique functions in the human body, and often coexists in the same foods.

Vitamins B1, B2, B3, and biotin participate in different aspects of energy production,

vitamin B6 is essential for amino acid metabolism, vitamin B12 and folic acid facilitate steps required for cell division.

- **The Vitamins B-complex are family due to :**
- **1-**They are found together in the **same food**.

- **2-**Do **similar work** in the body, maintain healthy skin and muscles tone enhance immune and nervous system functions and promote cell growth and divisions.

- **3-**Symptoms of one vitamins **deficiency** may be **undistinguishable** from others.

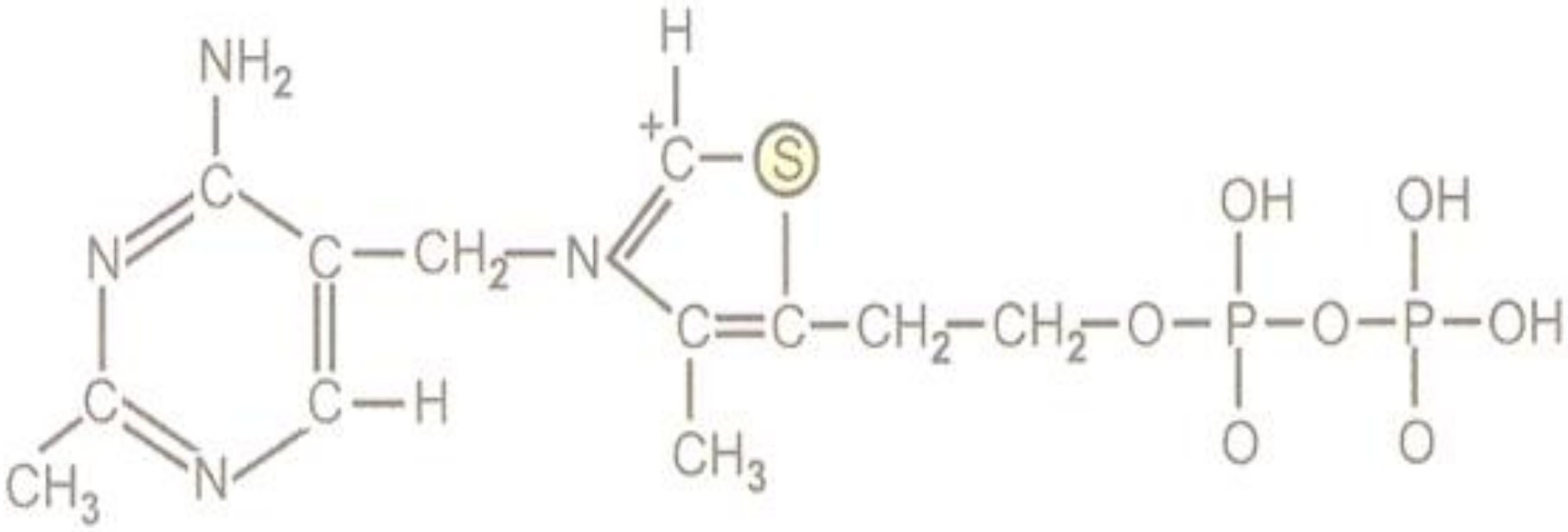
Thiamine (vitamin B_1)

- **Thiamine** or **vitamin B_1**, **("sulfur-containing** vitamin") **We need vitamin B1 so that the body can use carbohydrates as energy - it is essential for glucose metabolism.**
- **Vitamin B1 also plays a key role in nerve, muscle and heart function.**

Mammals, including **humans cannot synthesize**.

Absorption of vitamin B1 involves a specialized pH-dependent, Na^+- independent carrier mediated mechanism.

- Thiamine is a colorless compound Its structure contains an amino pyrimidine ring and a thiazole ring with methyl and hydroxyethyl side chains linked by methylene bridge.



Structure of thiamine

- **Absorption**

Thiamine is released by the action of phosphatase and pyrophosphates in the upper small intestine.

At low concentrations, the process is carrier-mediated, and, at higher concentrations, absorption **occurs via passive diffusion**.

Active transport is greatest in the **jejunum and ileum.** The cells of the intestinal mucosa have **thiamine pyrophosphokinase activity**.

The **majority of thiamine present** in the intestine is in the **pyrophosphorylated form** .

The uptake of thiamine by the mucosal cell is likely coupled in some way to its **phosphorylation/dephosphorylation.**

• Bound to serum proteins

The majority of thiamine in **serum is bound to proteins, mainly albumin**. Approximately **90% of total thiamine in blood is in erythrocytes**.

A specific binding protein called **thiamine-binding protein (TBP)**.

Excretion

Thiamine and its acid metabolites (2-methyl-4-amino-5-pyrimidine carboxylic acid, 4-methyl-thiazole-5-acetic acid, and thiamine acetic acid) are **excreted** principally **in the urine**

Deficiency

- Thiamine derivatives and thiamine-dependent enzymes are present in all cells of the body, thus a thiamine deficiency would seem to adversely affect all of the organ systems. However, the **nervous system is particularly sensitive to thiamine deficiency, because of its dependence on oxidative metabolism**.
- Thiamine deficiency commonly presents subacutely and can lead to metabolic coma and death. A lack of thiamine can be caused by malnutrition, a diet high in thiaminase-rich foods (raw freshwater fish, raw shellfish, ferns) and/or foods high in anti-thiamine factors (tea, coffee, betel nuts) and by grossly impaired nutritional status associated with chronic diseases, such as alcoholism, gastrointestinal diseases, HIV-AIDS, and persistent vomiting.

- **Assay for Thiamine Deficiency:**

- **The measurement of erythrocyte (red blood cell) transketolase activity.**
- **Red blood cells**, which lack mitochondria, have no alternative means of generating NADPH save the pentose phosphate pathway. Also, NADPH is required to reduce glutathione in order to maintain the normal structure of red blood cell and maintain hemoglobin in the ferrous state. **Therefore, the pentose phosphate pathway is essential in red blood cells. .**