

Water soluble vitamins



Vitamin B1

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Vitamin B Group

1. Vitamin B1 (Thiamine)

5. Vitamin B6 (Pyridoxine)

2. Vitamin B2 (Riboflavin)

6. Vitamin B7 or Vitamin H (Biotin)

3. Vitamin B3 (Niacin)

7. Vitamin B9 or Vitamin M or (Folic acid)

4. Vitamin B5 (Pantothenic acid)

8. Vitamin B12 (Cyanocobalamin)

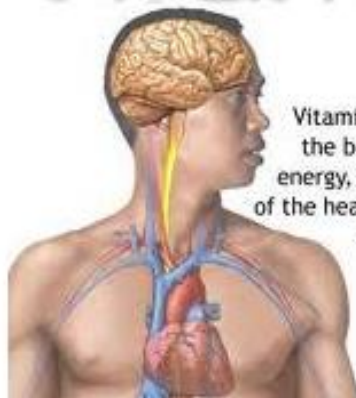
Water Soluble Vitamins

Vitamin B Group

Vitamin B1 (Thiamine)

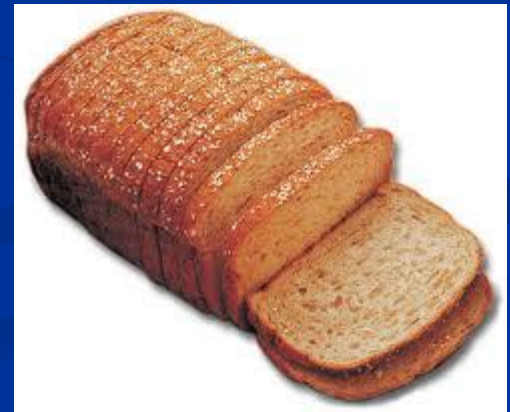


Vitamin **B1**



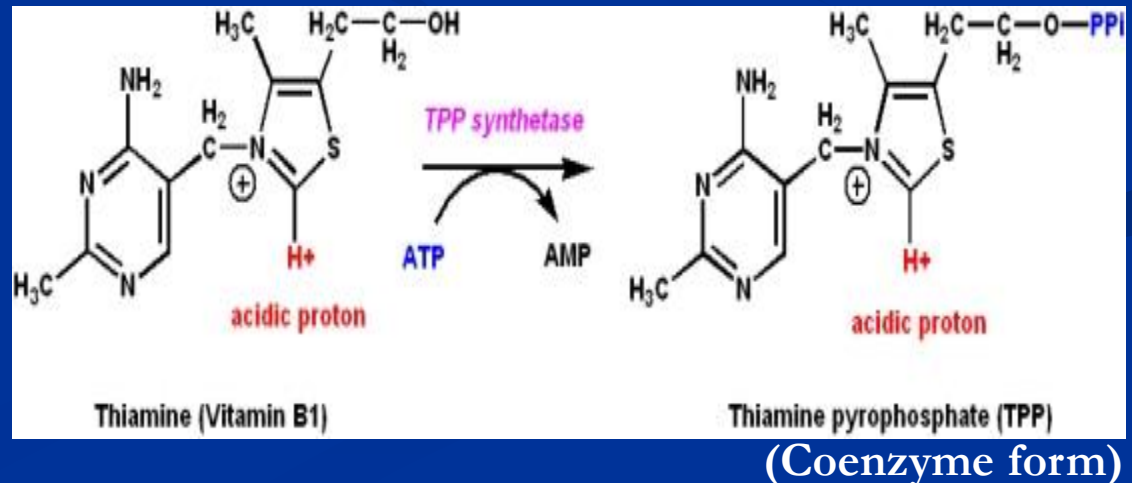
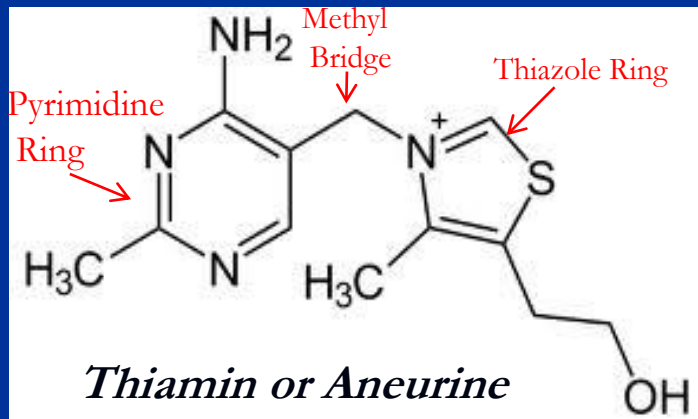
Vitamin B1(Thiamine) helps the body convert food into energy, and aids the function of the heart and cardiovascular system and the brain and nervous system

RDA: 1.5 mg
Water-soluble



Vitamin B1 (Thiamine)

- The 1st water-soluble B-vitamin family to be discovered.
- Since body reserve of thiamine is small (~30mg), a steady dietary supply of it is important to avoid deficiency.
- Because of its central role in energy production, most of thiamine is located in the muscles.
- Once thiamine absorbed, it is rapidly transformed into the active form, **thiamin pyrophosphate (TPP)** which acts as a coenzyme.



Daily Required amount and Sources

- ❖ RDA (Recommended Dietary Allowance)is based on the number of calories in diet:

Energy requirement

- ❖ Adult male: 3000 k cal.
- ❖ Female: 2100 k cal
- ❖ Children : 1700-2000 k cal

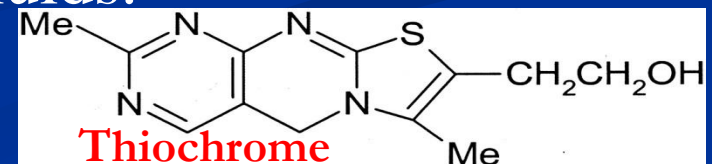
Vitamin B1 requirement

- 1.5 mg/day
- 1.1 mg/day
- 1mg/day

- ❖ Daily requirement increases with high carbohydrate intake and for hard worker or athletes.

Stability of Thiamine

- Stable in crystalline form but not so in solution.
- Destroyed by prolonged heat, baking soda (with heating), sulfite preservatives.
- Unstable in aqueous solutions with $\text{pH} > 5.0$. At $\text{pH} 8.0$ or above, thiamine turns yellow and is destroyed by a complex series of irreversible reactions.
- In strong alkaline solution with the presence of oxidizing agents, e.g. potassium ferricyanide, thiamine is converted to thiochrome, which is blue fluorescent compound and is used for fluoremetric determination of vitamin B1 in foods, pharmaceutical preparations, and biological fluids.



Functions of Vitamin B1

1. It act as co-enzyme (TPP) in carbohydrate metabolism (for glycolysis and Kreb's cycle enzymes: pyruvate dehydrogenase and α -ketoglutarate dehydrogenase), which enable **conversion of glucose into biological energy through oxidative decarboxylation reactions**. This role is important:

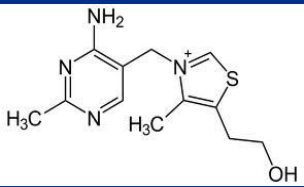
- To provide energy to the **brain**.
- To improve transmission of nerve impulses by providing **nerves** with energy.
- To increase the efficiency of the **heart** muscles.
- For the formation of **RBC's**.

2. It act as co-enzyme for transketolase which functions in:

- The pentose phosphate pathway to synthesize **NADPH**.
- The pentose sugars: deoxyribose and ribose are involved in **nucleic acids biosynthesis**.

Thiamine Antagonists

- **Oxythiamine** is a competitive inhibitor (Amino group in pyrimidine ring is replaced by hydroxyl group).
- **Neopyrithiamine** (It prevents the phosphorylation of hydroxy ethyl group that is essential for activity of the vitamin B1).
- **Thiaminase** (found in raw fish destroys vitamin B1).



Causes of Thiamine Deficiency

- **Malnutrition.**
- **A diet high in thiaminase-rich foods (raw freshwater fish, raw shellfish, ferns)**
- **Foods having anti-thiamine factors (tea, coffee etc.).**
- **Chronic consumption of alcohol**

Diagnostic Testing for Vitamin B1 deficiency

A diagnosis test for B1 deficiency can be determined by measuring **transketolase** levels of erythrocyte.

Diseases of Vitamin B1 deficiency

Beriberi is the deficiency disease caused by lack of thiamine resulted from malnutrition, alcoholism or other causes.

There are two major types of beriberi:

- A. Dry beriberi:** affect the nervous system
- B. Wet beriberi:** affects the **cardiovascular system** and ends by **Wernicke-Korsakoff syndrome** which affect the nervous system.

Dry Beri-beri

Symptoms:

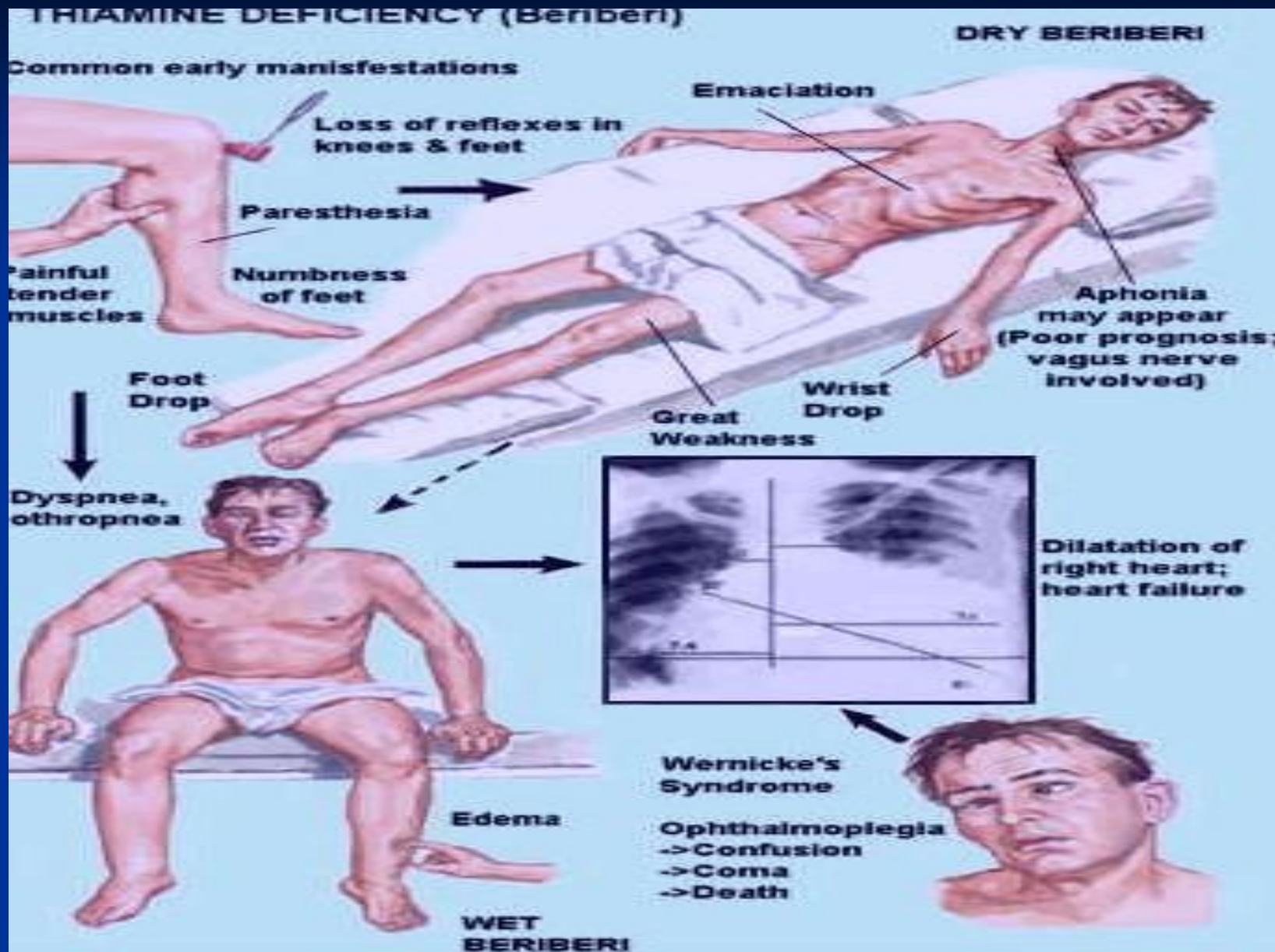
- Difficulty in walking
- Painful tender muscles
- Loss of sensation in hands and feet
- Loss of muscle function or paralysis of the lower legs
- Mental confusion/speech difficulties
- Vomiting and anorexia.

Wet Beri-beri

Symptoms :

- Dyspnea
- orthopnea
- Increased heart rate, enlarged heart, heart failure.
- Swelling of the lower legs.
- Wernicke–Korsakoff syndrome:
 - Ophthalmoplegia (paralysis of one or more extraocular muscles which are responsible for eye movements)
 - Confusion
 - Coma
 - Death if untreated.

Diseases of Vitamin B1 deficiency (BERI-BERI)



People at high risk of Vitamin B1 Deficiency

- **Heavy alcohol consumers** (Alcohol reduces absorption of thiamin and interferes with its conversion to TPP).
- **Much consumption of coffee and black tea** depletes thiamin stores in the body and hinder its absorption.
- **Patients having** liver cirrhosis, malabsorption syndromes, diabetes, kidney disease, or hypermetabolism.
- **The elderly peoples** with poor nutritional status and difficulties with absorption.
- **Folate deficiency** impairs absorption of thiamin.
- **Infants who are breastfed by thiamin deficient-mothers** can rapidly develop life-threatening signs of thiamin deficiency.

Use of Thiamine in prevention and Therapy

1. **Nerve disorders:** Supplemental thiamin may be effective in inflammatory nerve disorders (such as trigeminal neuralgia) and in diabetic neuropathy.
2. **Central nervous system disorders:** e.g. Alzheimer's disease, anxiety, and depression associated with anxiety.
3. **Heart failure:** Particularly in the elderly chronic heart failure that responds poorly to conventional medical therapy.
4. **Anemia:** Thiamin deficiency produces an anemia resembling that of folate or vitamin B12 deficiency (with macrocytosis) that responds to thiamin.
5. **Disease caused by heavy alcohol consumption.**

Vitamin B1- Drug Interactions

- **Oral contraceptives**, antibiotics, sulfa drugs, and certain types of diuretics may lower thiamine levels in the body.
- **Vitamin B1 may intensify** the effects of **neuromuscular blockers** that are used during some surgical procedures.
- B vitamins are best absorbed as a complex, and **magnesium** also **promotes the absorption of thiamine**.

Toxicity

- ❖ Thiamin is virtually nontoxic.
- ❖ Doses > 200mg may cause drowsiness in some people.
- ❖ Rare, but severe, allergic reactions may be happened with injectable thiamin.



THANX