



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

# Vitamins





*Prepared by:*

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I LOVE YOU

I LOVE YOU

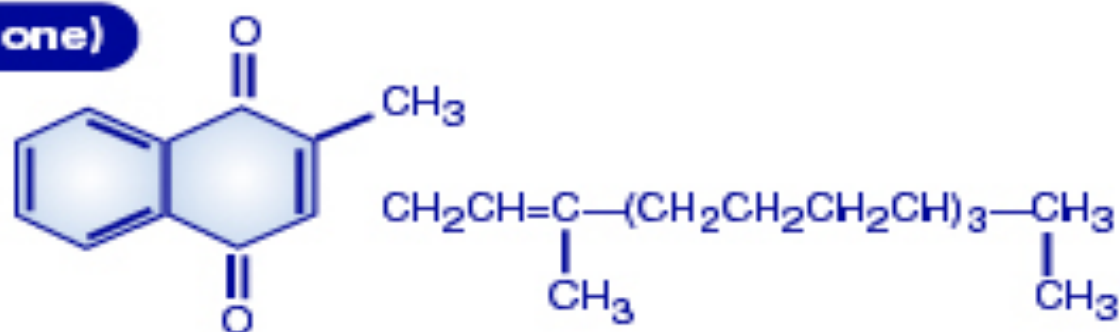
# Vitamin **K**



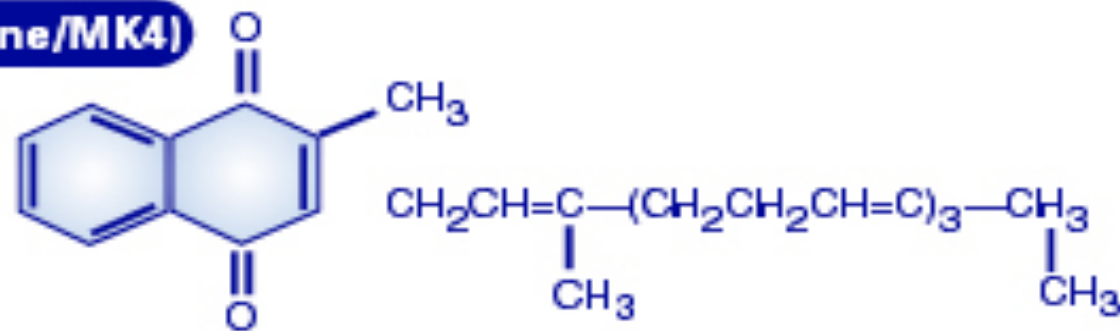
# *Vitamin K (Naphthoquinones)*

- *It is also called Anti-haemorrhagic vitamin.*
- *There are 2 types of vitamin K:*
- *Naturally occurring: vitamin K<sub>1</sub> and K<sub>2</sub>.*
- *Synthetic: vitamin K<sub>3</sub> (menadione).*
- *Phthiocol.*
- *All types of vitamin K contain a methyl group at carbon number 2.*
- *Activity is due to this methyl group.*
- *Substitution of this methyl group by other alkyl radicals or by hydrogen results in marked reduction in activity.*
- *Vitamin K<sub>1</sub> and K<sub>2</sub> differ only in the side chain while K<sub>3</sub> has no side chain and is more active.*

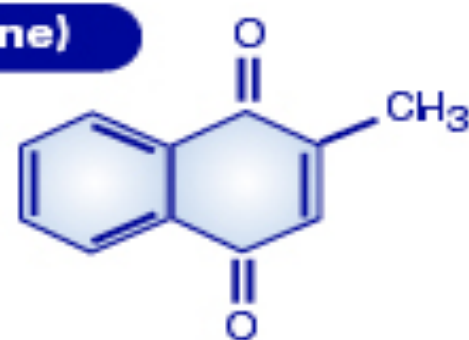
**K<sub>1</sub> (Phylloquinone)**



**K<sub>2</sub> (Menatetrenone/MK4)**



**K<sub>3</sub> (Menadione)**



The three forms of vitamin K.

- Properties:

- Vitamins K are soluble in fat solvents and insoluble in water.
- They are stable to heat.
- They are destroyed by light, alkali and alcohol.

- Sources:

- Vitamin K<sub>1</sub> is present green leafy plants e.g. spinach and cabbage.
- Vitamin K<sub>2</sub>: is the product of metabolism of most bacteria e.g. normal intestinal bacteria so it is present in stools.
- Milk is a poor source.

- Absorption:

- By small intestine and needs bile salts.

- Excretion:

- Mainly in stools.
- Also by milk,
- Not excreted in urine or bile.

- Function:

- *Production of coenzyme Q which functions as electron carrier helping the oxidation in the respiratory chain and production of ATP.*
- *Helps the process of blood clotting since it is essential for formation of prothrombine and factors VII, IX and X by liver as it acts as a coenzyme for prothrombine synthesis.*

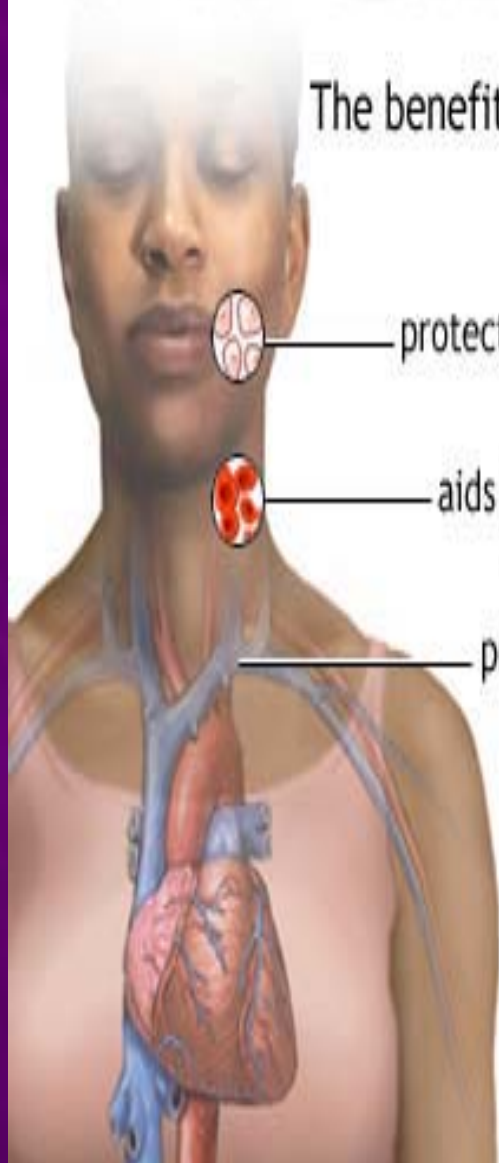
- Deficiency:

- *It leads to elongation of clotting time i.e. hemorrhagic manifestation in skin and mucous membranes.*
- *Deficiency does not occur as a result of dietary restriction as it is formed by bacteria of large intestine.*



# Vitamin E

The benefits of vitamin E:



protects cell membranes and tissues from damage by oxidation

aids in the formation of red blood cells and the use of vitamin K

promotes function of a healthy circulatory system

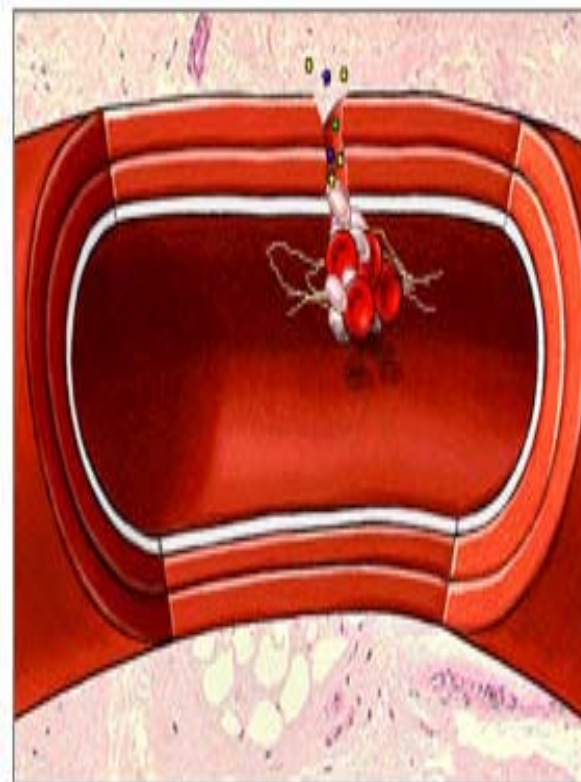
Adult RDA: 10 mg  $\alpha$ -TE

Fat-soluble

ADAM.

# Vitamin K

Vitamin K benefits blood clotting



Adult RDA:  
70  $\mu$ g

Fat-soluble

ADAM.

## Causes of deficiency:

- *Excess intake of vitamin A.*
- *Newly born infants because their intestines are sterile.*
- *Liver disease.*
- *Failure of absorption: if absorption of vitamin K is interfered with as a result of deficiency of bile salts this occurs if the flow of bile from gall bladder to intestine is prevented e.g. stone in common bile duct (obstructive jaundice).*
- *Failure of synthesis by intestinal bacteria as in prolonged use of oral antibiotics.*

## Requirements:

- *No dietary requirement in man under physiological conditions. An exogenous supplement is required only in:*
- *Administration of excess vitamin A.*
- *Biliary obstruction.*

*Water soluble vitamins*

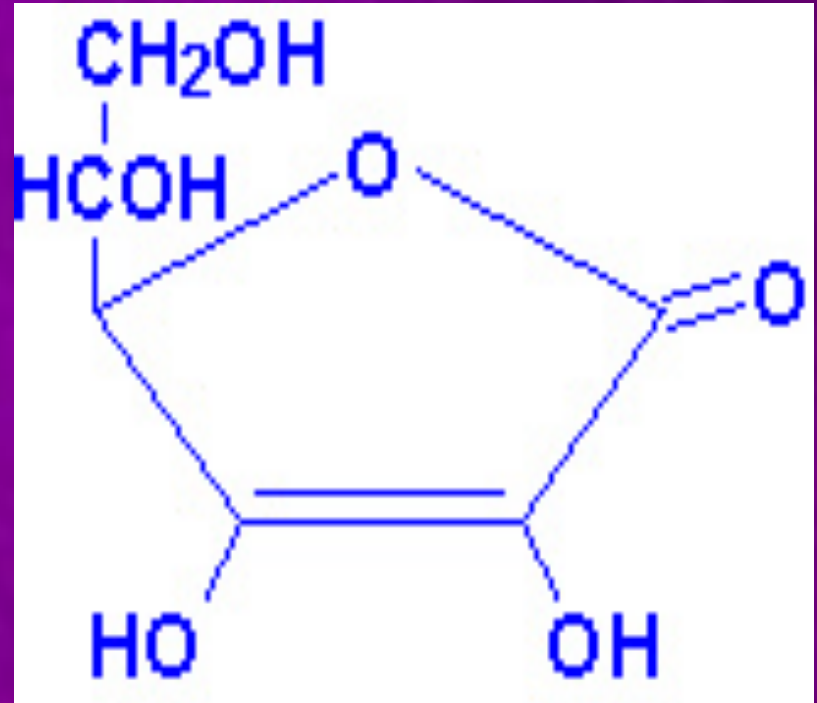
# Vitamin C



- *Vitamin C or L-ascorbic acid  
antiscorbutic vitamin*

- *Chemistry:*

- *It is endiol-lacton of acid (en = unsaturation, diol= 2 hydroxyl group).*
- *L-ascorbic acid is a sugar acid.*
- *It contain 2 asymmetric carbon atom at C4 and C5.*



## Properties

- *It is soluble in water and insoluble in fat solvents.*
- *It is a comparatively strong acid owing to dissociation of the enolic hydrogen at C3 and not to the carboxyle group which is tied in lactone ring.*
- *It is a strong reducing agent due to liberation of the hydrogen atoms from endiol hydroxyle groups (C3 and C2).*
- *It is optically active (contains 2 asymmetric carbon atoms).*
- *L-ascorbic acid is the biologically active form, but the stereoisomer, D-ascorbic acid is not.*
- *It is destroyed by heat, light, change in pH and change in temperature*

- Source:
  - *Animal sources:* e.g. liver and adrenal. Milk is a poor source of vitamin C.
  - *Plants:* e.g. leafy vegetables, green peas and beans, germinated seeds, green and red peppers, tomatoes and citrus fruits.
- Absorption:
  - Readily from the small intestine, peritoneum and subcutaneous tissues.
- Distribution:
  - Widely distributed throughout the body in local concentration roughly paralleling the metabolic activity of the organ e.g. pituitary, corpus luteum, adrenal cortex, liver, brain, gonads, kidney, spleen, thyroid .....etc.

- **Metabolism:**

- *Biosynthesis of ascorbic acid occurs in certain animals as rat.*
- *No synthesis in man.*
- *Synthesis occurs from D-glucose.*
- *Catabolism to oxalic and L-threonic acid.*

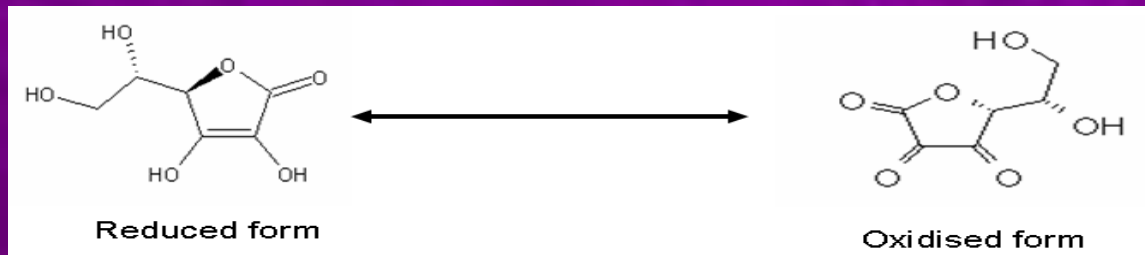
- **Excretions:**

- *About 50-75% of ingested ascorbic acid undergoes metabolic conversion to inactive compounds. The remainder is excreted as such in urine.*
- *Also excreted in milk in active form.*

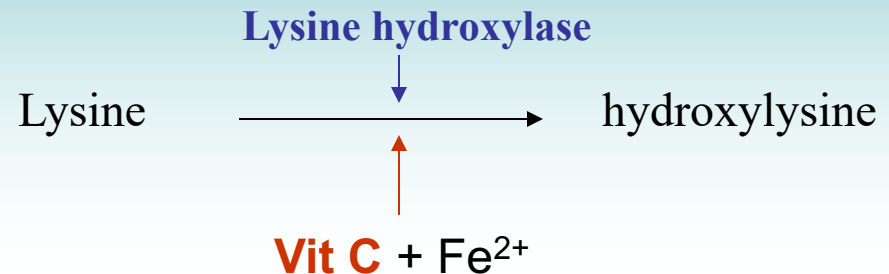
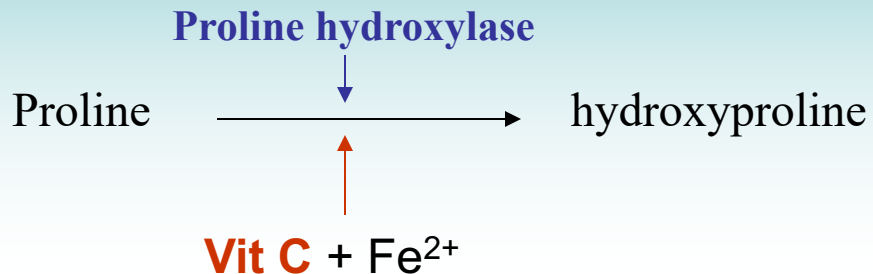


- Function

1-It acts as a hydrogen carrier in oxidation reduction reaction.



2-It is important for formation and maintenance of normal collagen as it is required for conversion of proline and lysine to hydroxyproline and hydroxylysine (amino acids found in collagen).



3-It is essential for bone, teeth and blood cell transformation.

4-it plays a role in tyrosin metabolism.

5-it helps in iron absorption by converting iron to its reduced state (ferrous) in the stomach.

6-It enhances the utilization of folic acid by aiding the conversion of folate to tetrahydrofolate.

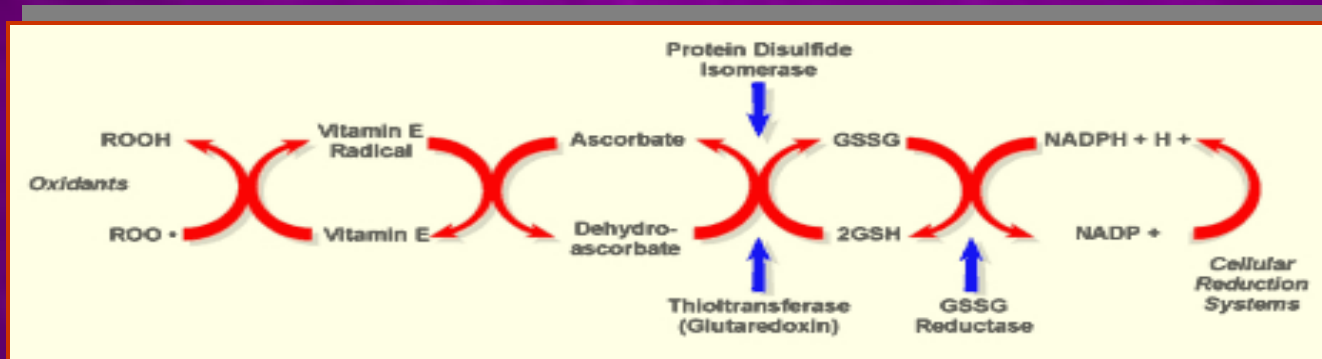
7-it is needed for synthesis of adrenal steroid hormones.

8-L-ascorbic acid decreases capillary fragility.

9-Ascorbic acid appears to be a biologically important antioxidant, reducing the risk of cancer when present in adequate amounts in the diet.

- **Mechanism:**

Can react with many reactive oxygen species (ROS) and reactive nitrogen species (RNS)



# Vitamin C

Structures of the immune system



Vitamin C promotes a healthy immune system, helps wounds heal, maintains connective tissue and aids in the absorption of iron

RDA: 60 mg

Water-soluble

ADAM.

## Deficiency

- *Symptoms of mild vitamin C deficiency include bruises and petechiae formation (spots of hemorrhage under the skin's surface) due to increased capillary fragility.*
- *Extreme deficiency results in a disease termed scurvy which is characterized by:*
  - *1-looseness of teeth, inflammation of gums (gingivitis) and bleeding from gums.*
  - *2-Delayed wound healing.*
  - *3-osteoporosis and easy fractunbility of bones.*
  - *4-Hemorrhage (multiple subcutaneous hemorrhage).*
  - *5-Anemia (iorn deficiency anemia results from hemorrhage coupled wiyh defects in both iron absorption and folate metabolism).*
  - *6-Increased susceptibility to infections.*



- Requirements:

- Children: 30mg/day. Adults 75mg/day.
- Pregnant female 100mg/day.
- Lactating female 150mg/day.

- Effect of excess vitamin C:

- No effect in man.
- In rat: dehydroascorbic acid in excess doses 1.5g/kg produces permanent diabetes mellitus identical with that produced by alloxan (destruction of  $\beta$ -cells).

# *Vitamin B complex*

- *This is a group of vitamin having common properties and sources.*
- *The following are considered as member of the B complex group of vitamins:*
  - *Vitamin B1 (thiamine)*
  - *Vitamin B2 (riboflavin)*
  - *Vitamin B3 (niacin or niacinamide)*
  - *Vitamin B5 (pantothenic acid)*
  - *Vitamin B6 (pyridoxine, pyridoxal, or pyridoxamine, or pyridoxine hydrochloride)*
  - *Vitamin B7 (biotin)*
  - *Vitamin B9 (folic acid)*
  - *Vitamin B12 (various cobalamins; commonly cyanocobalamin in vitamin supplements).*
  - *Lipoic acid.*
  - *Inositol.*
  - *Para amino benzoic acid.*
  - *Choline.*

- *Properties:*
  1. *These are water soluble.*
  2. *Heat stable except B1.*
  3. *Destroyed by light except niacin.*
  4. *Stable in acid medium.*
  5. *Unstable in alkaline medium.*



# Vitamin B1



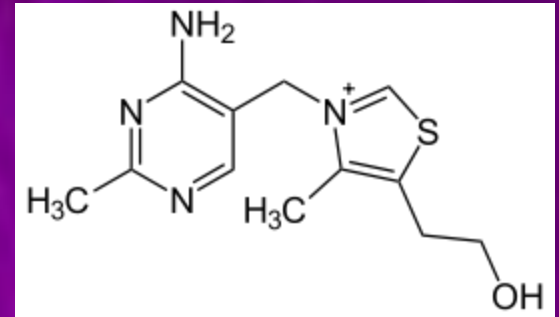
Vitamin B1 (Thiamine)

# Vitamin B1 (Thiamine= antiberi beri)

- Chemistry:

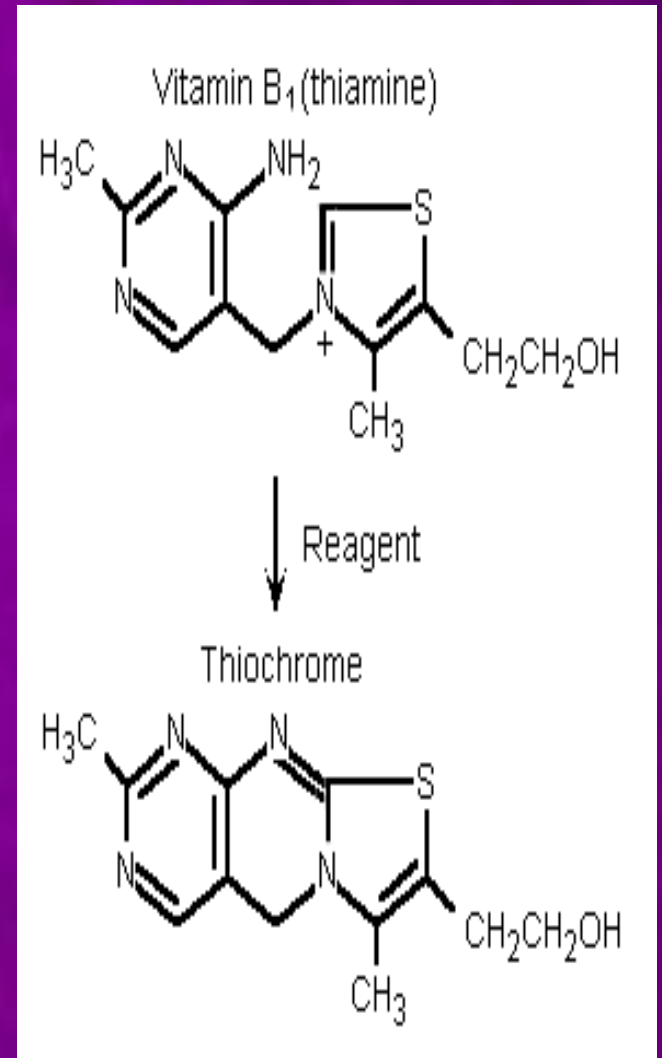
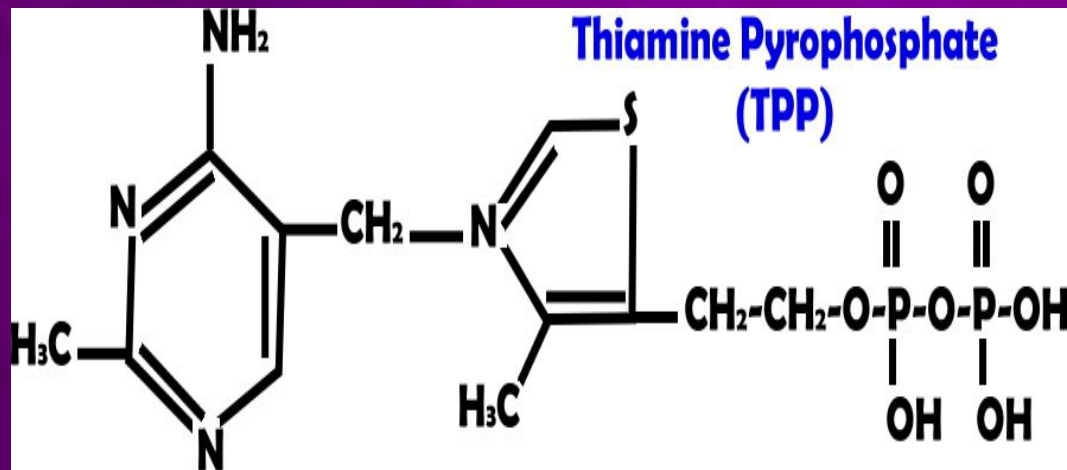
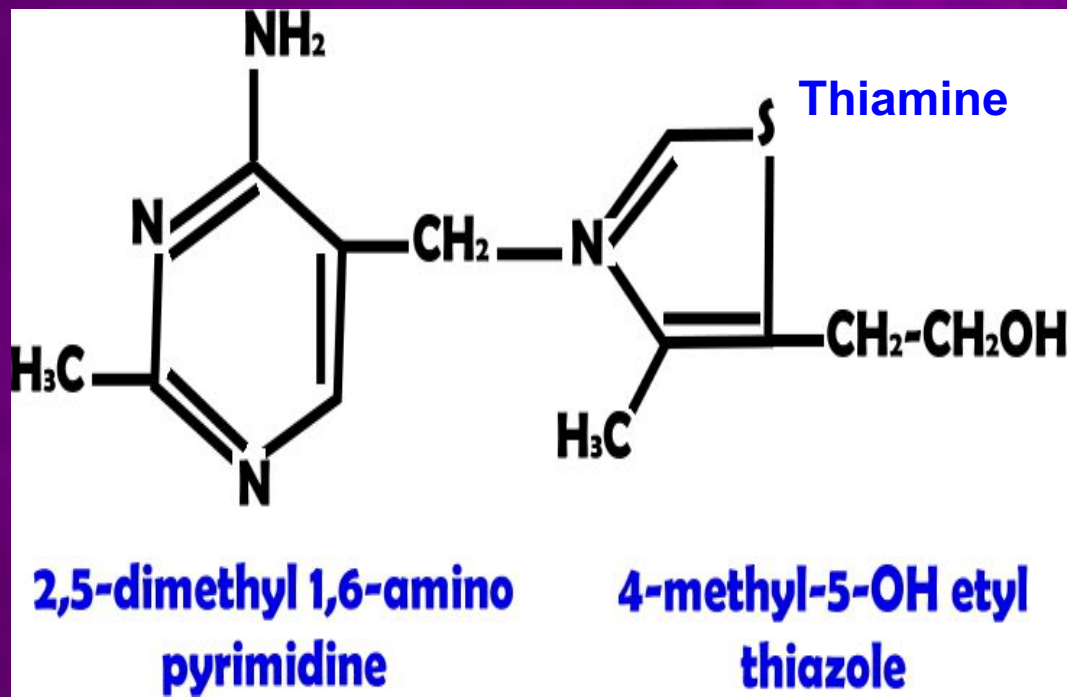
- It is a basic substance formed of:

- A pyrimidin ring.
    - A thiazole ring connected together through a methylene group.



- Properties:

1. It is a sulfur containing vitamin.
2. it is destroyed by alkalies and light.
3. Stable in acid solution.
4. It is soluble in water and ethyl alcohol but not fat solvents.
5. It is white crystalline substance. it is alcoholic in nature, the alcohol group on thiazole ring reacts with phosphoric acid to form ester called thiamine pyrophosphate (TPP) acting as a coenzyme.
6. Thiamine or its pyrophosphate is oxidized by mild oxidising agents e.g. potassium fericyanide and results in the formation of thiochrome.



- Sources:

- *Animals:* liver, spleen, egg, milk, fish, kidney and yeast.
- *Plants:* Seeds as peas, beans, whole cereal grains bran.  
Unrefined cereal grains e.g. rice, bray vegetables.

- Absorption:

- Free thiamine is absorbed easily from the small intestine.  
In the liver free thiamine is actively phosphorylated to codecarboxylase.

- Excretion:

- 10% of thiamine taken is excreted in urine.
- It is also excreted in milk as a thiamine-protein complex.
- Thiamine of stools is of bacterial origin.

- **Function:**

*1-Thiamine pyrophosphate (TPP) is the most active form and act as a coenzyme necessary for:*

- *Decarboxylation of  $\alpha$ -keto acids which includes:*
- *A-Simple decarboxylation which needs TPP only as a coenzyme e.g.*



- *This reaction occurs in yeast.*

- *B-Oxidative decarboxylation which needs TPP and other factors e.g.*



- *It acts also as a coenzyme in transference of a ketol group (transketolase reaction) which is very important for pentose metabolism in RBCs.*

*2-B1 is necessary for optimal growth of infants and children.*

*3-B1 increases the activity of acetylcholine at nerve endings by inhibiting acetylcholine esterase enzyme.*

- *It is necessary for pentose metabolism in RBCs. being necessary for the action of transketolase enzyme.*

## Deficiency

- *Deficiency of vitamin B1 results in deficiency of TPP which leads to:*
  - 1-*Accumulation of pyruvic acid in blood due to decrease activity of oxidative decarboxylation.*
  - 2-*Increase of lactic acid in blood.*
  - 3-*Appearance of methyle glyoxal in urine due to decreased activity of glyoxal enzyme catalyzing the conversion of methyle glyoxal to lactic acid in the liver.*
  - 4-*Accumulation of pentose sugars in RBCs as a result of retardation of transketolase reaction.*
- *Sever thiamine deficiency result in disease called Beri beri .*
  - *Beriberi is a neurological and cardiovascular disease. The three major forms of the disorder are dry beriberi, wet beriberi, and infantile beriberi.*

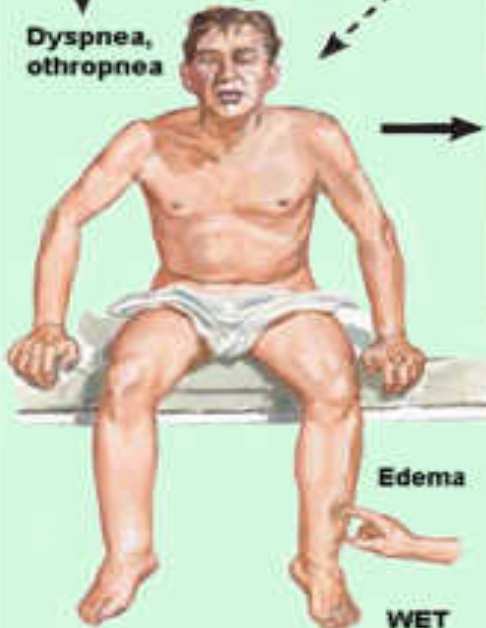
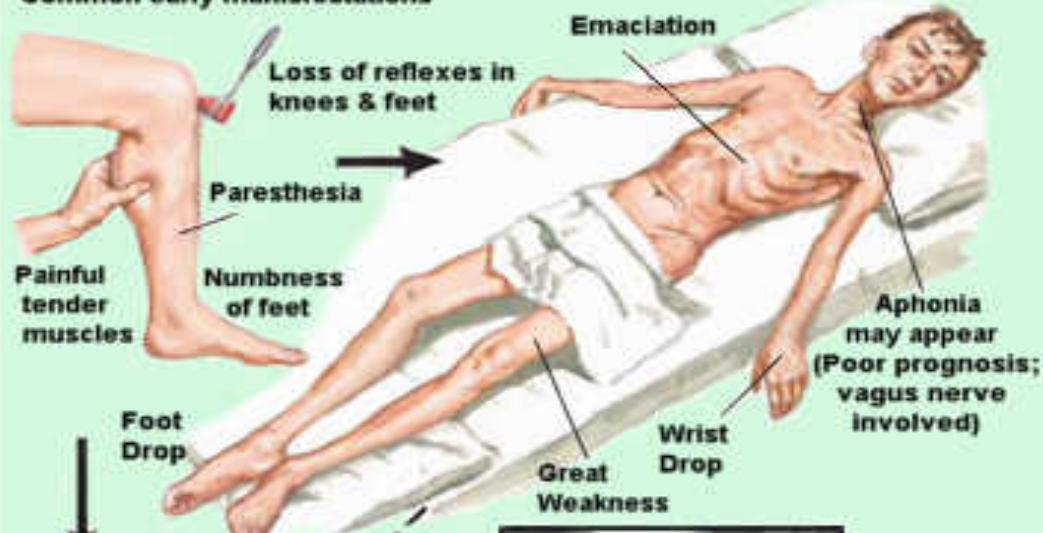
- Wet beri beri: is characterized congestive heart failure, edema and peripheral neuritis.
- Dry beri beri: is associated with atrophy of peripheral nerves, numbness, loss of sensation and paralysis.
- infantile beriberi: seen in infants under 6 months of age receiving inadequate thiamine in milk. In acute form, the infant develops dyspnea and cyanosis and dies of cardiac failure. Aphonia may be present and the infant may appear to be crying without emitting much sound. Diarrhea, wasting, vomiting and edema may be present.
- Wernicke-Korsakoff syndrome:
  - is the most common CNS-related neurological problem in alcoholics. Characteristic findings include weakness of eye movement, ataxia of gait and mental disturbance. The Wernicke syndrome responds dramatically to thiamine administration. Thiamine has also been successfully used to treat depression.



# THIAMINE DEFICIENCY (Beriberi)

## DRY BERIBERI

Common early manifestations



Wernicke's Syndrome

- Ophthalmoplegia
- > Confusion
- > Coma
- > Death



## WET BERIBERI



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Inability to follow a light source (ophthalmoplegia) due to thiamin deficiency and phosphorus deficiency.

- Requirements:

- 1-15mg/day for adults.

- 0.4 mg/day for children.

- 1.5-2 mg/day for pregnant and lactating female.



Thank You