**Vitamins**

 Are chemically unrelated organic compounds that cannot synthesize by human and therefore must be supplied by the diet.

**Vitamins**

** Water soluble fat soluble A, K , E ,D**

**Non B complex B complex B1, B2, B3 , B5, B6 ,B7, B9, B12 vit C**

**Functions**: required to perform specific cellular functions, water soluble vitamins and only vit K are precursors of coenzyme (enzyme’s helper) in metabolism.

These vitamins are released, absorbed, transported with the fat of the diet, they are not excreted in urine, but stored in liver and adipose tissues.

**Excess consumption** of vitamins A and D can lead to accumulation of toxic quantities of these compounds .

1. **Thiamine vit B1:**

**Function**: coenzyme need for energy of metabolism .

**Deficiency:**

 1.Beriberi eat polished rice lead to death .

2. Wernicke\_korsakoff syndrome : chronic alcoholism impaired intestinal absorption of the vitamins .

2. **Riboflavin vit B2 :**

**Function**: coenzyme of oxidation –reduction reaction in body.

**FMN, FMNH2, FAD, FADH2.**

**Deficiency**:

 1. Not associated with major human disease

2. Dermatitis.

3. Effect on upper part of digestive system.

 3. **Niacin vitamin B3**:

**Function:** coenzyme in oxidation –reduction reaction in body, **NAD, NADH, NADP, NADPH.**

**Deficiency**: Pellagra: a disease involving the skin , gastrointestinal tract , central nervous system and finally death.

4. **Pantothenic vit B5:**

**Function:**

 1. Component of coenzyme A which transfer acyl group.

2. Component of fatty acid synthesis.

**Deficiency**: not well characterized until now (rare) .

5. **Pyridoxin vit B6:**

**Function:** coenzyme for large number of enzyme, pyridoxyl phosphate

**Deficiency:** rare but have been observed in new born infants.

6 . **Biotin vit B7:**

**Function**: Coenzyme in carboxylation reaction, carrier of CO2 .

**Deficiency**: rare.

 7. **Folic acid**  **vit B9**:

**Function:** Essential in synthesis of amino acid , purine , thymidine in DNA .

**Deficiency**:

1. megaloblastic anemia: cells inability to synthesis of DNA therefore they cannot divide.

2. Neural tube defect in the fetus, birth defect.

8. **Cobalamin vit B12**:

Function: synthesis of amino acid methionine.

2. degradation of amino acid and fatty acid .

3. coenzyme.

**Deficiency**:

1. Megaloblastic anemia.

2. Pernicious anemia: neural damage.

9. **Ascorbi acid**  **vit C**:

**Function:**

1. Antioxidant.

2. coenzyme .

3. Reducing agent .

4. maintenance of normal connective tissue .

5. wound healing.

6. Facilitate the absorption of iron .

**Deficiency:**

1. Scurvy: lose teeth , spongy gum ,swollen joint .

2. Anemia.

10 . **Retinol vit A**:

**Function:**

 1. vision .

2. reproduction.

3. growth.

4. Gene expression.

**Deficiency**:

1. Night blindness increased visual threshold.

2. xerophthalmia (blindness) .

11. **Pylloquinone vit K**:

**Function**: Coenzyme in blood clotting mechanism.

**Deficiency:** bleeding in newborn.

12. **Tocopherol** **vit E** :

**Function:** antioxidant especially protection of lipid.

**Deficiency**: abnormal cell membrane.

13 .**Cholecalciferol vit D:**

**Function:** regulate Ca , P levels in the body .

**Deficiency**:

1. Rickets: demineralization of bone lead to osteoporosis.

2. Renal failure.