Vitamins

Biochemistry

2nd year undergraduates, Biology

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Definition of vitamins

- Group of organic compounds that are essential for normal growth and nutrition and are required in small quantities in diet as they cannot be synthesized by the body.
- The term vitamin is derived from the words vital and amine, because vitamins are required for life and were originally thought to be amines

Properties of vitamins

- Vital to life; are essential
- Organic compounds
- Individual units; not linked in chains
- Do not provide energy
- Assist with release of energy (coenzymes)
- Needed in small amounts: micro/milli grams
- Fruits and vegetables are a primary source

Importance of vitamins

Vitamins	Functions
All B groups, c and K	Co enzymes
B_1-B_7	Metabolism of energy
B_6, B_9, B_{12}	Red blood cell synthesis and amino acid metabolism
B_3, B_5, B_7	Fatty acid synthesis
B_1, B_6, B_{12}	Nerve transmission
C and E	Antioxidants
A and D	Gene expression

Classifications of vitamins

Water Soluble

- Vitamin C
- B Vitamins
  - Thiamine (B_1)
  - Riboflavin (B_2)
  - Niacin
  - Pantothenic Acid
  - Biotin
  - Pyridoxine (B_6)
  - Folic Acid
  - Vitamin B_{12} (cyanocobalamin)

- Cannot be stored in the body,
- Provided by the dietary intake.

Lipid Soluble

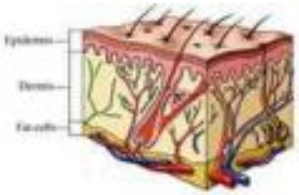
- Vitamin A
- Vitamin D
- Vitamin E
- Vitamin K

- Can be stored in the body,
- Excess is not secreted out of the body,
- Provided by the dietary intake, except Vit D (increased by exposure to the sun).

Fat Soluble Vitamins
A, D, E and K

Vitamin A

- Helps vision
- Keeps skin healthy



- Deficiency:
  - Night blindness
  - Xerophthalmia

The daily amount: 900 mcg/ day for adult males and 700 mcg/ day for adult females.

Vitamin D

cholecalciferol

- Needed for strong teeth and bones
- Regulates calcium and phosphorus metabolism

The body itself makes vitamin D when it is exposed to the sun

Cheese, butter, margarine, fortified milk, fish, and fortified cereals are food sources of vitamin D

The daily amount :800 International unit/day especially for adults over 50. Exposure to sunlight for 10-15 min without sunscreen, twice a week, is sufficient to absorb Vir D.

Deficiency:

-Rickets

- Bone deformity

Vitamin E Tocopherol

- Antioxidant role (prevents destruction of Vit. A & C)
- Protects cell membranes from damage
- Protects red blood cells (rbc)

- Deficiency:
  - Reduced # of RBC
  - Nerve tissue damage in infants

Vitamin E is found in corn, nuts, olives, green, leafy vegetables, vegetable oils and wheat germ, but food alone cannot provide a beneficial amount of vitamin E, and supplements may be helpful

The daily amount= 15 mcg of alpha-tocopherol/day

Vitamin K

- Helps in clotting blood

- Found in green leafy vegetables

Food sources of vitamin K include cabbage, cauliflower, spinach and other green, leafy vegetables, as well as cereals

Deficiency –

Bleeding caused by prolonged clotting time

The daily amount= for age 14 – 18 Y= 75 mcg/day;
age 19 and older= 90 mcg/day

Water Soluble Vitamins
C and B-groups

Vitamin C

- **Helps keep gums, teeth, bones healthy**

- **Needed for wound healing**

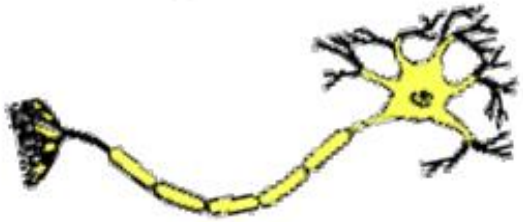
Deficiency: Scurvy –

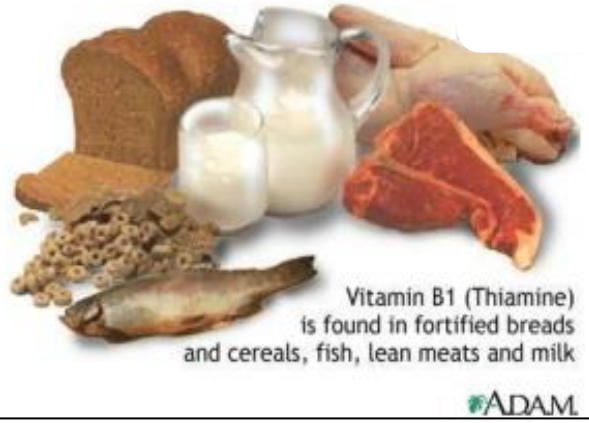
- **swollen and bleeding gums**
- **loose teeth**
- **slow-healing wounds**

The daily amount= 90 mg/day for males and 75 mg/day for females. For smokers= it should increases by 35 mg/day to reduce the effect of nicotine.

B_1 Thiamin

- Needed for healthy nerves

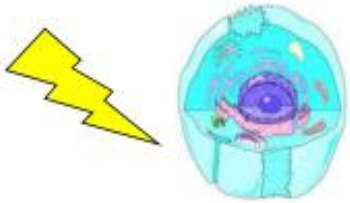


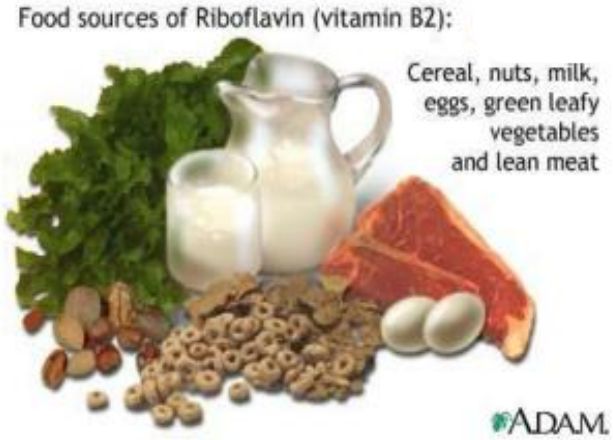


The amount of Thiamin/day = 1.1- 1.2 mg/da. Its presence in adequate amount helps to release energy from foods, promotes normal appetite, and is important in maintaining proper nervous system function

B_2 Riboflavin

- Helps cells use energy in foods





The daily amount : 1.3 mg/day and Females: 1.1 mg/day

B_3 Niacin

- Helps cells use energy in foods

Food sources of Niacin (vitamin B3) include dairy, poultry, fish, lean meat, nuts and eggs

A.D.A.M.

The daily amount of Vit B_3 is 16 mg/day for male and ; 14 mg/day for female.

B_6 Pyridoxine

- Needed for red blood cells
- Keeps nerves healthy

Food sources of vitamin B6 (pyridoxine) include beans, legumes, nuts, eggs, meats, fish breads and cereals

A.D.A.M.

The daily amount is 1.43 mg/day

Biotin: B7

Biotin is liver, kidney, egg yolk, milk, most fresh vegetables, yeast breads and cereals. Biotin is also made by intestinal bacteria.

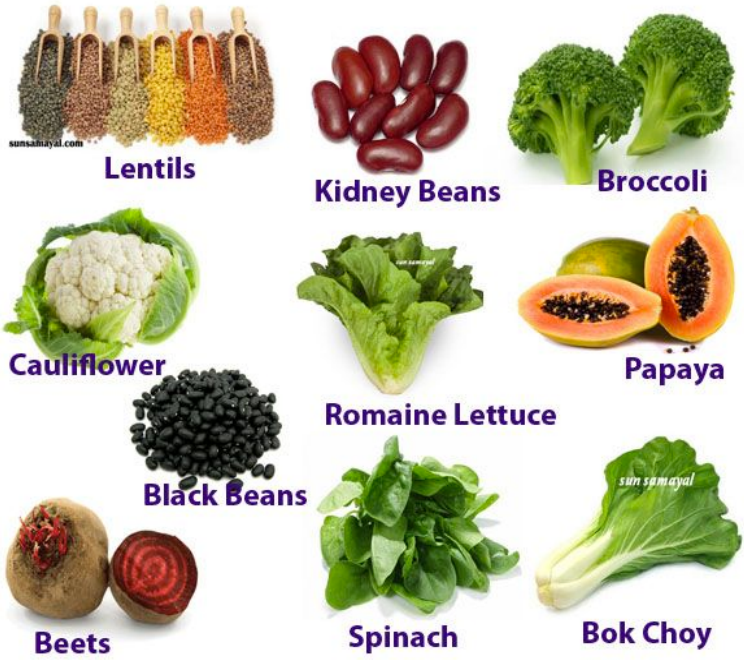
What does Biotin do ?
It helps release energy from carbohydrates and aids in the metabolism of fats, proteins and carbohydrates from food.

Biotin Deficiency
Biotin deficiency is uncommon under normal circumstances, but symptoms include fatigue, loss of appetite, nausea, vomiting, depression, muscle pains, heart abnormalities and anemia.

The daily amount: 30 mcg/day for adult males and females

Folic Acid, Folate : B9

Folic acid is found in liver, kidney, dark green leafy vegetables, meats, fish, whole grains, fortified grains and cereals, legumes, and citrus fruits



What does Folic acid do?

It aids in:

1. protein metabolism,
2. promoting red blood cell formation.
3. Folate may also play a role in reducing the risk for coronary heart disease.

Folate Deficiency

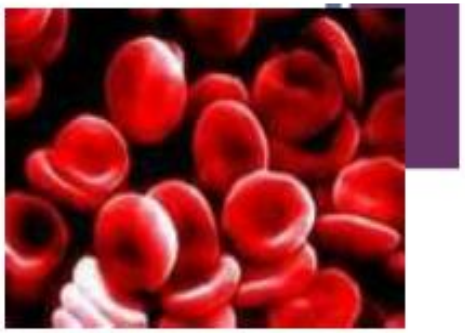
Folate deficiency affects:

1. cell growth and protein production, which can lead to overall impaired growth.
2. anemia and diarrhea.

The daily amount: is 400 mcg/day for adult males and females. For pregnancy =600 mcg/day.

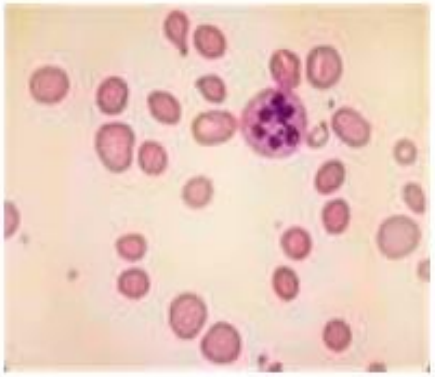
B_{12} Cobalamine

- Helps cells use energy in foods
- Needed for formation of RBC



Food sources of Niacin (vitamin B3) include dairy, poultry, fish, lean meat, nuts and eggs

Deficiency – pernicious anemia



The daily amount of B12 is 2.4 mcg/day for adult males and females.

Vitamin Algorithm