Vitamin

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- Non-caloric organic nutrients
- Needed in very small amounts
- Facilitators – help body processes proceed; digestion, absorption, metabolism, growth etc.
- Calassification: water & fat soluble

Fat soluble vitamins

- Found in the fats and oils of food.
- Absorbed into the lymph and carried in blood with protein transporters = chylomicrons.
- Stored in liver and body fat and can become toxic if large amounts are consumed.

Vitamine A

- Vitamin A (precursor – beta carotene)
  - 3 forms: retinol (stored in liver), retinal, retinoic acid
  - Roles in body:
    - Regulation of gene expression
    - Part of the visual pigment rhodopsin, maintains clarity of cornea (yes eating carrots is good for your eyesight)
    - Required for cell growth and division - epithelial cells, bones and teeth
    - Promotes development of immune cells, especially “Natural Killer Cells”
    - Antioxidant

- Vitamin A
  - Deficiencies cause:
    - Night blindness, xerophthalmia (keratin deposits in cornea), macular degeneration.
    - Skin and mucous membrane dryness and infection, keratin deposits.
    - Anemia
    - Developmental defects – bones, teeth, immune system, vision

Vitamin A

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Anemia

Developmental defects – bones, teeth, immune system, vision

Vitamin D

- Vitamin D – precursor is cholesterol, converted by UV from sunlight exposure, therefore is a “non-essential” vitamin.
  - Roles:
    - Increases calcium absorption in bone, intestines, kidney. Promotes bone growth and maintenance.
    - Stimulates maturation of cells – heart, brain, immune system, etc.

Vitamin E

- Vitamin E – tocopherol, *alpha-, beta -, gamma-, and delta-
  - Roles:
    - Antioxidant (protects polyunsaturated fats)
    - Prevention of damage to lungs, RBCs, WBCs (immunity), heart
    - Necessary for normal nerve development

Vitamin K

- Vitamin K – produced by bacteria in large intestine
  - Roles
    - Promotes synthesis of blood clotting proteins
    - Bone formation
  - Deficiencies are rare but seen in infants, after prolonged antibiotic therapy, and in patients with decreased bile production.
  - Toxicities (>1000 mg/day): rupture of RBCs and jaundice

Water soluble vitamins

- Found in vegetables, fruit and grains, meat.
- Absorbed directly into the blood stream
- Not stored in the body and toxicity is rare. Alcohol can increase elimination, smoking, etc. cause decreased absorption.

Vitamin B

- (Thiamin, Riboflavin, Niacin, Folate, B_6, B_{12}, Biotin, and Pantothenic acid)
  - Aid in metabolism of and energy release from carbohydrates, lipids, amino acids.
  - Mode of action – coenzymes or parts of coenzymes that are necessary for the proper activity of enzymes, fig 7.9

Thiamin and Riboflavin

Roles – energy metabolism in cells, part of nerve cell membranes.

Deficiencies

- Beri beri, edema &/or muscle weakness
- Alcohol abuse – Wernicke-Korsakoff syndrome

DRI thiamin:1.1(women) – 1.2(men) mg/day; riboflavin 1.1(women) – 1.3(men) mg/day

Sources: All food groups except fats and oils

Niacin – can be produced from the amino acid tryptophan.

Roles: energy metabolism

Deficiencies: Pellagra – dermatitis, diarrhea, dementia, death

Toxicities (2 - 3X DRI): prevents blood clotting, causes liver damage, enhances action of Coumadin

Folate

Role: required for synthesis of DNA - ***pregnancy

Deficiencies (drug interactions, smoking)

- Anemia
- Decreased immunity
- Decreased digestive and cardiovascular function
- Colon and cervical cancers
- *Neural tube defects, ?other birth defects

Vitamin B_{12} (requires intrinsic factor for absorption)

- Roles: works with folate, part of insulating sheath around nerves.
- Deficiencies:
  - Pernicious anemia
  - Paralysis
  - Nerve damage in fetus

Vitamin B_6

Roles:

- Conversion of amino acids to other amino acids
  - Ex.: Tryptophan to niacin
- Synthesis of hemoglobin and neurotransmitters
- Release of glucose from glycogen
- Immune function
- Promotes steroid hormone activity
- Development of nervous system

Biotin and Pantothenic acid

Roles:

Metabolism of carbohydrates, fats and proteins

Synthesis of lipids, neurotransmitters, steroid hormones, hemoglobin.

"Non-B vitamins": choline, carnitine, inositol, lipoic acid, etc. No beneficial effects proven!!

Vitamin C, <u>ascorbic acid</u> – history of controversy

- Roles:
  - Connective tissue development, collagen
  - Antioxidant
  - Promotes iron absorption, immunity?
  - Protects vitamin E