

Vitamins

Vitamins: chemical substances that perform specific functions in the body; are *essential* nutrients

Two Classes of Vitamins:

- Fat-Soluble Vitamins
 - Vitamin A (Retinoids)
 - Vitamin D (Calciferol)
 - Vitamin E (Tocopherol)
 - Vitamin K (Quinones and Diones)
- Water-Soluble Vitamins
 - B Vitamins
 - Thiamin (B₁)
 - Riboflavin (B₂)
 - Niacin (B₃)
 - Folate/Folic Acid
 - Pyridoxine (B₆)
 - Cobalamide (B₁₂)
 - Biotin
 - Pantothenic Acid
 - Vitamin C (Ascorbic Acid)

Water-Soluble Vitamins

- Cooking and washing with water can leach these vitamins out of food
- The kidney removes excess from the body
- It is possible to reach toxic levels when consumed from supplements
- Needed in frequent doses (1-3 days)
- The B Vitamins (listed above)
 - Many serve as coenzymes to the enzymes that release energy from fuel energy sources
 - They do not “give” more energy but instead help the body extract more
 - Help cells such as blood cells multiply

Thiamin (B₁)

- Converted to TPP (a coenzyme) in energy metabolism

- TPP promotes the conversion of pyruvate to Acetyl-CoA (TCA cycle)
- Aids in nerve membrane integrity
- Rich sources
 - Pork
 - Whole grains
 - Enriched grains
 - Nuts
- Deficiency—Beriberi
 - Muscle weakness and wasting of lower extremities (dry beriberi)
 - Heart failure and edema—swelling due to excess fluids—(wet beriberi)
- People at highest risk
 - Alcoholics—decreased intake, liver damage
 - Elderly—impaired absorption

Riboflavin (B₂)

- Converted to FMN and FAD, coenzymes in numerous reactions of energy metabolism
- Can be destroyed by light (milk no longer served in glass bottles)
- Rich sources
 - Milk and milk products
 - Eggs, meat, and legumes
- Deficiency
 - Cracks at the corner of the mouth
 - Sensitivity to light

Niacin (B₃)

- Coenzyme form—NAD and NADP
- Roles in energy metabolism and the metabolism of glucose, fat, and alcohol
- Can be eaten as niacin or synthesized in the body from the amino acid tryptophan (found in meats)
- Rich sources
 - Protein foods
 - Enriched grains
- Deficiency—Pellagra
 - Symptoms: diarrhea, dermatitis, dementia, and even death
 - Seen in low-protein diets that center on corn
 - Early 1900s: >87,000 deaths due to pellagra in the southern U.S.

Folate (Folic Acid)

- Also known as Folacin or PGA
- Name varies based on source
- Coenzyme form = DHF and THF, which help synthesize DNA

- Requires Vitamin B₁₂ to function
- Folic Acid Fortification
 - As of January 1998, all enriched grain products (bread, rice, pasta, etc.) in the U.S. must be fortified with folic acid
 - Pregnant women and the elderly are of special benefit
- Rich sources
 - Legumes
 - Dark green vegetables
 - Enriched grains
 - Orange juice
 - Sunflower seeds
- Deficiency
 - Impaired cell division and synthesis
 - Anemia characterized by large, immature blood cells (megaloblastic)
 - Diarrhea
 - Poor growth
 - Depression
 - Neural tube defect
 - o The neural tube closes at 28 days of gestation
 - o Can lead to spina bifida
 - o Causes paralysis of lower limbs

Vitamin B₁₂

- Closely related to folate—coenzyme of folate metabolism
- Characterized by the presence of a cobalt atom
- Known as cyanocobalamin
- Maintains the sheath that surrounds and protects nerves (needed for nerve cell integrity)
- Needed for new cell synthesis
- Rich sources
 - Only from animal products
 - Not found in any plant foods
- Deficiency
 - Intrinsic Factor from stomach is needed for absorption
 - If there is low IF → pernicious anemia
 - Poor nerve function
- People who are at risk
 - Alcoholics
 - Gastroectomy patients
 - Elderly—B₁₂ deficiencies can look like senility (poor memory, depression, dementia)
 - A vegan diet can produce deficiencies

Vitamin B₅