

Chapter 7 The Vitamins

- Organic molecules in food
 - Required in small amounts
 - Classified based on solubility
- See Table 7.1
- There are 9 essential water-soluble vitamins
 - 8 B vitamins and Vitamin C
 - Each vitamin is chemically unique
 - Characteristics of water soluble vitamins
 - Dissolve in water, but not oils
 - Absorbed mostly in the small intestine and the stomach
 - Many are bound to proteins in foods
 - Many vitamins are heat sensitive
 - Factors affecting bioavailability
 - Nutritional status
 - Other nutrients and substances in foods (Ex: Vitamin C should not be taken with milk)
 - Medications
 - Age (Ex: Vitamin B12; intrinsic factor)
 - Illness
 - Alcoholism
 - Most are circulated to the liver by the blood
 - Not actively stored in the body
 - Nontoxic in large amounts; will be excreted if consumed in excess
- See Table 7.2 (also handed out in class on 10/7)
- Diverse Functions
 - Most water-soluble vitamins serve as coenzymes in energy metabolism
 - Folate (growth of red blood cells) and Vitamin C (collagen) are involved in many other activities
 - Water soluble vitamins are lost by exposure to water, air, heat, and light
 - Protection:
 - Don't overcook foods
 - Reduce exposure to light
 - The work of Vitamin C
 - Functions
 - Assist enzymes in formation and maintenance of collagen
 - First vitamin discovered (by the British; experiment; lemon juice)
 - Acts as an antioxidant, especially protecting the immune system cells from free radicals generated during their assault on invaders
 - This is why Vitamin C helps with colds
 - REMEMBER: antioxidants get rid of free radicals
 - Collagen production
 - Collagen is structural protein found in connective tissue, including skin, bones, teeth, cartilage, and tendons

- Vitamin C reduces (or recharges) the enzyme needed for collagen production
 - Vitamin C deficiency: Scurvy
 - Symptoms: bleeding gums, skin irritations, bruising, poor wound healing
 - ➔ See Snapshot 7.5
 - Vitamin C Needs:
 - 10mg- Prevents scurvy
 - 30mg- Supports metabolism
 - 60mg- Daily Value on food and supplement labels
 - 75mg- DRI recommended intake for women
 - 90mg- DRI recommended intake for men
 - 100mg- Maintains full body pool
 - 110mg- DRI recommended intake for smokers (women)
 - 125mg- DRI recommended intake for smokers (men)
 - NOTE: smokers need higher levels of vitamins because they have more free radicals
 - 2,000mg- Tolerable Upper Intake Level
 - 4,000mg- Nutraceutical recommendation
- The B Vitamins in Unison
 - B vitamins function as part of coenzymes
 - Coenzymes help enzymes do their jobs
 - ➔ See Table 7.4
 - ➔ See Figure 7.9
 - ➔ See Figure 7.10
- Role in Metabolism
 - Thiamin, riboflavin, niacin, pantothenic acid, and biotin participate in the release of energy from the energy nutrients
 - Folate and B12 help cells multiply (grow)
 - B6 helps the body use amino acids to synthesize proteins
 - "enriched" means added folate, thiamin, riboflavin, and niacin
- Thiamin (B1)
 - Coenzyme in energy metabolism pathways
 - Essential water soluble vitamin involved in energy metabolism, nerve function, and synthesis of DNA, RNA, and NADPH, and H⁺
 - Deficiency: Beriberi
 - First observed in East Asia where rice provided 80-90% of the total calories most people consumed
 - Polished rice became widespread, and beriberi became an epidemic
 - ➔ See Snapshot 7.6
- Riboflavin
 - Very sensitive to light
 - ➔ See Snapshot 7.7
- Niacin
 - Deficiency: Pellagra
 - Discovered in populations where the basic food was corn
 - In the early 1900s in the US, pellagra was affecting hundreds of thousands in the south and Midwest
 - Seen in low protein diets which center on corn

- Niacin in corn is mostly unavailable because corn is high in the amino acid leucine, which may contribute to the development of the disease
 - Symptoms: "4Ds"
 - Diarrhea
 - Dermatitis (skin peels off)
 - Dementia
 - Death

➔ See Snapshot 7.8
- Folate
 - Helps synthesize DNA and is important for making new cells (growth)
 - One of the last vitamins added to the list of vitamins in cereal, bread, etc.
 - Very important during pregnancy
 - Deficiency causes anemia, diminished immunity, and abnormal digestive function
 - Deficiency during pregnancy causes neural tube defect
 - Neural tissue (spinal cord, brain) does not form properly during fetal development
 - Spina bifida
 - A form of neural tube defect in which closure of the neural tube is incomplete
 - Causes paralysis in lower limbs
 - Affects about 20 out of every 1000 babies
 - Closes at 28 days; most women don't even know they are pregnant

➔ Snapshot 7.9
- Vitamin B12 (Cobalamin)
 - Made only by microorganisms
 - Contains trace amounts of cobalt and nitrogen
 - Shellfish are an excellent source
 - Deficiency: anemia
 - Helps in the formation of red blood cells
 - B12 and Folate are closely related; each depends on the other for activation
 - Main roles:
 - Helps maintain nerves
 - Coenzyme needed in red blood cell synthesis
 - Intrinsic factor is a compound made by the stomach that is needed for the absorption of B12
 - A few people have an inherited defect in the gene for intrinsic factor, causing poor B12 absorption
 - Problem for vegans
 - Must be injected to avoid defective absorption
 - This anemia of B12 deficiency is called pernicious anemia

➔ See Snapshot 7.10
- Vitamin B6
 - Participates in more than 100 reactions in body tissues
 - Good for nausea treatment
 - Needed to convert amino acids to other lacking amino acids
 - Plays an important role in the synthesis of hemoglobin and neurotransmitters
 - Assists in releasing glucose from glycogen