

Digestive Systems and Human Nutrition

Digestion Inside and Outside Cells

- A. Physical Digestion
 - 1. Breakdown of large pieces of food into smaller ones
 - a. Grinding
 - b. Chewing
 - 2. Exposes more surface area to chemical digestion
- B. Chemical Digestion
 - 1. Enzymes break complex molecules into simpler ones
- C. Intracellular Digestion
 - 1. Digestion that occurs inside of a cell
 - a. Plant cells
 - b. Unicellular organisms
- D. Extracellular Digestion
 - 1. Digestion takes place outside of cells
 - 2. Cells secrete enzymes into a digestive cavity
- E. Endocytosis
 - 1. Pinocytosis
 - a. "Cell drinking" - Infolding of cell walls takes in large molecules
 - 2. Phagocytosis
 - a. "Cell eating" - Cells surrounds and absorbs food

An Overview of Human Digestion

- A. Oral Cavity
 - 1. Chewing
 - 2. Saliva moistens food
 - 3. Saliva contains enzymes
- B. Esophagus
 - 1. Moves food to the stomach by peristalsis
- C. Stomach
 - 1. Sphincters control movement of food into and out of the stomach
 - 2. Stomach glands release gastric juices
 - a. water, enzymes, mucus, acid
 - 3. Most food moves on to the small intestine within 4 hours
- D. Small Intestine
 - 1. Liver and pancreas secrete enzymes into the small intestine
 - 2. Digestion is completed
 - 3. Nutrients are absorbed through the intestinal walls
- E. Large Intestine
 - 1. Bacteria produce some vitamins
 - 2. Vitamins absorbed into bloodstream
 - 3. Water is reabsorbed
 - 4. Feces move on to the rectum

Carbohydrate Digestion

A. Mouth

1. Salivary amylase breaks starch into sugar



B. Stomach

1. pH is too low for amylase to work

C. Small Intestine

1. Pancreatic juices neutralize stomach acids
2. Intestinal and pancreatic enzymes complete carbohydrate digestion

Protein and Fat Digestion

A. Protein Digestion

1. Mouth

- a. Only mechanical digestion occurs

2. Stomach

- a. Hormone gastrin signals stomach to secrete acid
- b. Acid converts pepsinogen to protein digesting enzyme pepsin

3. Small Intestine

- a. Pancreas secretes trypsin into small intestine
- b. Trypsin and other enzymes secreted by sm. int. digest protein into amino acids

B. Fat Digestion

1. Mouth and Stomach

- a. Only mechanical digestion occurs here

2. Bile from liver (stored in gall bladder) emulsifies fat

3. Lipase from pancreas splits fat into fatty acids and glycerol

Absorption

A. End Products of Digestion

1. Proteins

- a. Amino acids

2. Starches

- a. Simple sugars

3. Fats

- a. Glycerol
- b. Fatty acids

B. Villi

1. Millions of fingerlike projections in sm. int. where absorption occurs

a. Capillary absorption

- a. sugars
- b. amino acids
- c. minerals and vitamins
- d. glycerol

b. Lymph absorption

- a. fatty acids

Carbohydrates

- A. Caloric value
 - 1. 4 kcal/gram (4 food calories)
- B. Sugars
 - 1. Types of sugar
 - a. Sucrose (table sugar)
 - b. Dextrose (glucose)
 - c. Honey (dextrose)
 - 2. Very few vitamins and minerals are found in sugars
- C. Starch
 - 1. Same calorie value as sugars
 - 2. Usually have more vitamins and minerals than sugar sources
 - 3. Only source of dietary fiber
 - a. Reduces risk of colon cancer
 - b. Possibly lower risk of heart disease

Fats and Energy

- A. Caloric Value
 - 1. 9 kcal/gram
- B. Triglycerides
 - 1. Saturated fats
 - meat fish poultry
 - coconut oil chocolate palm kernel oil
 - a. tend to be solids at room temperature
 - 2. Unsaturated fats
 - vegetable oil olive oil peanut oil
 - almonds walnuts mayonnaise
 - a. tend to be liquids at room temperature
- C. Cholesterol
 - 1. Found only in animal cells
- D. Cholesterol and Heart Disease
 - 1. Lipoproteins - Carriers of cholesterol in the blood
 - a. LDL - Low Density Lipoprotein
 - (1) Deposit cholesterol in blood vessels
 - b. HDL - High Density Lipoprotein
 - (1) Moves cholesterol into cells
 - c. Goal is high HDL and low LDL
 - 2. Recommended intake
 - a. 300 mg/day for men
 - b. 225 mg/day for women

Proteins and Amino Acids

- A. Caloric Value
 - 1. 4 kcal/gram
- B. Essential Amino Acids
 - 1. 9 amino acids that the body cannot synthesize
 - 2. Must be consumed in the diet
- C. Complete Proteins
 - 1. Proteins that contain all of the essential amino acids
 - a. Soybeans, meat, dairy products
- D. Incomplete Proteins
 - 1. Lack some of the essential amino acids
 - a. vegetable sources
 - 2. Mixing certain foods can supply complete protein from several incomplete sources
 - a. rice and beans
- E. Protein Requirement
 - 1. .5 g protein/kg of body mass each day

Vitamins, Minerals, and RDA's

- A. Water-Soluble Vitamins
 - 1. B-complex and C
 - 2. Not stored by the body
- B. Fat-Soluble Vitamins
 - 1. A, D, E, K
 - 2. Can be stored in fat tissue
 - 3. Overdose is possible
- C. RDA
 - 1. Recommended Daily Allowance
 - 2. No evidence that megadoses of vitamins are beneficial
 - a. May be harmful