

DIGESTIVE SYSTEM

OBJECTIVES/RATIONALE

To pursue a career in health care, proficiency in anatomy and physiology is vital. The student will describe biological and chemical processes that maintain homeostasis; analyze forces and the effects of movement, torque, tension, and elasticity on the human body; associate the disease process with changes in homeostasis; identify changes in structure and function due to trauma and disease; and identify normal and abnormal anatomy and physiology.

TEKS: 121.3 (c)(1)(F)(H),
121.4 (c)(1)(G)(H)(I),
121.5 (c)(1)(E)(F)(G)

TAAS: ELA 1, 3
Science 1, 2, 3, 4

KEY POINTS

Powerpoint

- I. Introduction
 - A. General function: physical /chemical breakdown of foodstuffs so it can be absorbed into the bloodstream and used by the cells/ tissues and eliminate non-digestible substances produced during metabolism
 - B. Digestion: process of changing foodstuffs into usable substances
 - C. Absorption: transfer of nutrients into the blood stream
 - D. Digestive processes
 - 1. Ingestion: process of taking food into the digestive tract
 - 2. Propulsion: process of moving food through the alimentary canal (swallowing, peristalsis)
 - 3. Mechanical digestion: physical preparation of food for chemical digestion; mastication, mixing of food with saliva by tongue, churning and mixing of food in stomach, segmentation in intestine (rhythmic local constrictions of the intestine)
 - 4. Chemical digestion: catabolic process in which large food molecules are broken down into smaller molecules by enzymatic hydrolysis (simple sugars=monosaccharides, glycogen, starch, amino acids, polypeptides, peptides, fatty acids, glycerol)
 - 5. Absorption: transport of digested end products from the GI tract into the capillaries and lymph vessels
 - 6. Defecation: elimination of indigestible materials and waste from the body

- II. Alimentary Canal: long muscular tube approximately 30 feet long
 - A. Oral cavity

1. Mouth: root stoma = mouth
 - a. Receives and tastes food
 - b. Physical breakdown of food
 - c. Partial digestion by saliva
 - d. Lubrication of food
 - e. Stomatitis: inflammation of the mouth (viral, bacterial, trauma, irritants)
 - f. Buccal: pertaining to the cheek
 - g. Deglutition: the act of swallowing (root phag/o- = to eat)
 - h. Dysphagia: difficulty swallowing
 2. Hard palate: bony structure, roof of mouth, separates mouth from nasal cavity
- B. Pharynx and Esophagus
1. Passageways 10 inches long; food only here 4-8 seconds; no chemical changes take place
 2. Pharynx: throat, tube that carries food and air
 3. Epiglottis: flap that covers the trachea (windpipe) when food or water is swallowed
 4. Esophagus: muscular tube dorsal (behind) to the trachea; carries food to the stomach by rhythmic wavelike motion (peristalsis=involuntary motion throughout digestive system)
 5. Peristalsis: progressive wave-like smooth muscle contraction, distention
 6. Stricture: narrowing due to trauma, infection, spasms, tumors
 7. Regurgitation: backward flow of foodstuffs from stomach into esophagus
 8. Reflux esophagitis: inflammation due to regurgitation
 9. Esophageal varices: dilation/rupture of veins
 10. Hiatal hernia: protrusion of stomach upward into mediastinal area
- C. Stomach: food stays 3-4 hours for physical and chemical breakdown
1. Abdomen: stomach is located in the Left Upper Quadrant (LUQ)
 - a. Peritoneum: membranes that line abdomen, decreases friction of organs (peritonitis)
 - b. Mesentery: greater and lesser omentum forms protective covering that insulates organs and holds them in place
 2. Stomach
 - a. Greater and lesser curvatures
 - b. Fundus, body, antrum
 - c. Rugae: folds in stomach to increase surface area
 - d. Sphincters: cardiac (ring of muscle where esophagus and stomach join; keeps stomach contents from moving up into the esophagus) and pyloric (ring like muscle between the stomach and small intestine; keeps food in stomach 30 minutes to 4 hours so that digestion can occur); prevents reflux

- e. Pyloric stenosis
 - f. Gastric enzymes: pepsin (protein), rennin, lipase (fats), HCl (kills bacteria, helps in absorption of Fe, activates pepsin)
 - g. Chyme: gastric juices plus digested food (paste, creamy semi-fluid)
3. Disorders
- a. Eructation: belching gas from the stomach
 - b. Vagotomy: incision of vagus nerve
 - c. Emesis: vomiting
 - d. Hematemesis: bright red or coffee ground vomit
 - e. Botulism: food poisoning; bacterial (infant botulism related to SIDS)
 - f. Gastric lavage: emptying stomach contents
 - g. Pyrosis: heartburn
 - h. Gastritis: epigastric pain, indigestion, burning in stomach area
 - i. Gastric ulcer: open sore in stomach; pain and internal bleeding
- D. Small Intestine: Approximately 21 feet long/1 inch in diameter; 80% of absorption occurs here; 3 sections
1. Duodenum
 - a. 1st 10-12 inches
 - b. Ducts from pancreas and gallbladder (sphincter of Oddi) enter here
 - c. Receives chyme
 - d. Pancreatic juices: amylase (sugars), trypsin (proteins), lipase (fats)
 - e. Gallbladder: bile (emulsifies and breaks down fats)
 - f. Intestinal juices: maltase/sucrase/lactase (breakdown sugars)
 2. Jejunum: 8 feet
 3. Ileum
 - a. Final 12 feet
 - b. Connects to large intestine at cecum
 - c. Process of digestion completed
 - d. Most absorption occurs here
 - e. Villi, fingerlike projections containing blood capillary loop and lacteals (lymphatic vessels) for absorption
 4. Enzymes stimulate intestinal secretions
 5. Hormones inhibit intestinal secretions
 6. Peyer's patches: lymph nodes in intestine to aid in defense/protection
- E. Disorders
1. Duodenal ulcers: peptic ulcers (gnawing pain 1-3 hours after eating)
 2. Diverticulum: outpocketing of intestinal mucosa

3. Enteritis: abdominal cramping, diarrhea
 4. Gastroenteritis: vomiting, abdominal cramps, diarrhea
 5. Crohn's disease: regional enteritis
 6. Dyspepsia: painful digestion, indigestion
 7. Ileostomy: surgical opening in abdomen into ileum
 8. Ileus: intestinal obstruction with colic
 9. Intussusception: telescoping of intestines (often found in infants, children)
- F. Large Intestine: 5 feet/2 inches in diameter
1. Ileocecal valve: circular, sphincter muscle; prevents food from returning to ileum
 2. Cecum: blind pouch at first portion of the large intestines; lower end is the vermiform appendix (RLQ)
 3. Colon: absorbs water, remaining nutrients, electrolytes; storage of indigestible materials until elimination; transport waste out of the body
 - a. Ascending (right side)
 - b. Transverse
 - c. Descending (left side)
 - d. Sigmoid
 - e. Rectum (final 6-8 inches): storage of feces
 4. Anal canal: anus; outlet of rectum; 2 sphincters
 5. Fecal matter: non-digestible waste products and bacteria
 6. Defecation: emptying of fecal matter from rectum
 7. Disorders
 - a. Intestinal bleeding: black, tarry stools
 - b. Stools without bile: clay-colored
 - c. Reduced digestion of foods: green
 - d. Flatus: gas
 - e. Constipation: infrequent defecation
 - f. Diarrhea: frequent, watery stools
 - g. Appendicitis: inflammation of the appendix
 - h. Tenesmus: spasmodic contraction of anal sphincter (involuntary straining)
 - i. Hemorrhoids: dilated veins in rectum
 - j. Fissure: linear ulcer
 - k. Fistula: abnormal tube-like passageway from one cavity/organ to another
 - l. Ulcerative colitis: chronic disorder; inflammatory disease of colon
 - m. Colostomy: opening of colon through the abdomen
 - n. Intestinal obstruction: a true emergency
 - o. Paralytic ileus: paralysis of intestines, occurs after some abdominal surgeries
 - p. Dysentery: inflammation of intestines, can be bacterial or viral

- q. IBS: irritable bowel syndrome
- r. Cancer of colon or rectum: 15% of population
- s. Borborygmsu: gurgling, rumbling sound in bowels caused by gas passing thru

G. Accessory Organs

1. Liver: accessory organ;
 - a. largest gland/solid organ of body;
 - b. RUQ under diaphragm
 - c. Secretes 1 liter of bile /24 hours
 - d. Biliary tree: composed of hepatic duct, cystic duct, and common bile duct
 - e. Functions
 - a. Manufactures blood proteins (i.e. antibodies), blood clotting factors (i.e. heparin)
 - b. Stores iron, copper, vitamin A/D/B12, glycogen
 - c. Produces bile for fat digestion
 - d. Detoxifies blood (poisons absorbed in small intestine)
 - f. Disorders
 - a. Hepatomegaly
 - b. Hepatitis: viral (A=oral transmission, B=blood transmission, C, D)
 - c. Obstructive jaundice: usually from stones or tumors
 - d. Ascites: accumulation of fluid in abdomen usually due to inflamed liver
 - e. Paracentesis: puncture to remove fluid from the abdominal cavity
 - f. Cirrhosis: chronic liver disease with death of cells due to nutritional deficiencies, toxins (alcohol, drugs), viral/bacterial infections; cells damaged, scarring limits function
2. Gallbladder: accessory organ
 - a. Pear-shaped muscular sac under the liver
 - b. Stores bile (500-600 ml. stored)
 - c. Fatty foods enter duodenum → stimulates CCK hormone → contracts GB to release bile → emulsifies fats and stimulates peristalsis
 - d. Bile pigments: bilirubin
 - e. Bile + water forms foaming antiseptic and purgative (laxative)
 - f. Obstruction → icterus and jaundice
 - g. Chole/o = gallbladder
 - h. Cholelithiasis: gallstones = cholesterol and bile salts
 - i. Cholecystectomy: removal of GB
 - j. Choledocho = root for common bile duct

3. Pancreas: accessory organ; behind the stomach; head attached to duodenum, tail reaching to spleen
 - a. Exocrine functions: acini cells secrete digestive juices and bicarbonate ions (to adjust pH and)
 - b. Endocrine functions: for CHO (carbohydrate) metabolism
 - a. Insulin and Glucagon: secreted from the islets of Langerhans for CHO metabolism
 - b. Diabetes mellitus: decreased secretion of insulin, therefore glucose is increased in blood
 - c. Pancreatitis: inflammation caused by overproduction of pancreatic juices
4. Salivary glands: accessory organ
 - a. Parotid: at ear/upper jaw
 - b. Submandibular
 - c. Sublingual
 - d. Saliva: (root sialo = Latin for spit) lubricates food for swallowing; body produces 1500 ml in 24 hours
 - e. Lubricates mouth during speech and chewing
 - f. Moistens food for swallowing
 - g. Contains enzyme (salivary amylase) which begins chemical breakdown of carbohydrates and starches into sugars
5. Tongue: accessory organ; muscular organ with taste buds (sweet, salt, sour, bitter) on sides of papillae; for maintaining placement of food for chewing and swallowing and speech
6. Teeth: accessory organ
 - a. 20 deciduous form 6 months to 2 years
 - b. 32 permanent: incisors, canines, premolars/molars, cuspids/bicuspid
 - c. Enamel, dentin, pulp cavity, cementum
 - d. Mastication: chewing
 - e. Bolus: mass of chewed food
 - f. Dento/donto = teeth; gingivo = gums

ACTIVITIES

- I. Build a 3-dimensional model of the Digestive System.
- II. Analyze Ingredients of Favorite Foods

MATERIALS NEEDED

Digestive System Terminology
Various Foods

ASSESSMENT

Project Rubric

ACCOMMODATIONS

For reinforcement, the student will label a diagram of digestive system.

For enrichment, the students research and report on the major enzymes involved in digestion, their source, and action. Explain what might happen if enzymes were not present.

REFLECTIONS
