CHAPTER 26

PHYSIOLOGY OF THE DIGESTIVE SYSTEM

Digestion is the process of breaking down complex nutrients into simpler units suitable for absorption. It involves two major processes: mechanical and chemical. Mechanical digestion occurs during mastication and the churning and propelling mechanisms that occur along the alimentary canal. Chemical digestion occurs with the help of the many digestive enzymes and various substances that are added to the nutrients as they progress the length of the digestive tube. These substances include saliva and gastric, pancreatic, and intestinal enzymes. Delicate nervous and hormonal reflex mechanisms control the flow of these juices so that the proper amount is released at the appropriate time.

Absorption is the passage of substances (digested foods, water, salts, and vitamins) through the intestinal mucosa and into the blood or lymph. After the body has determined the nutrients necessary for absorption, it sends the residue of digestion to the final segment of the GI tract to be eliminated as feces.

Your review of this system will help you understand the mechanical and chemical processes necessary to convert food into energy sources and compounds necessary for survival.

I DIGESTION

Multiple Choice—select the best answer.

1. Which of the following describes the pharyngeal stage of deglutition?
   a. mouth to oropharynx
   b. oropharynx to esophagus
   c. esophagus to stomach
   d. none of the above

2. Which step of deglutition is under voluntary control?
   a. oral
   b. pharyngeal
   c. esophageal
   d. all of the above

3. The final product of carbohydrate digestion is
   a. disaccharide.
   b. monosaccharide.
   c. polysaccharide.
   d. fatty acid.

Enzymes that catalyze the hydrolysis of proteins are:
   a. proteases.
   b. amylases.
   c. lactases.
   d. lipases.

A micelle is:
   a. a disaccharide attached to the brush border of the small intestine.
   b. a tiny sphere of lipid and water.
   c. a thick, milky material comprised of food and digestive enzymes.
   d. synonymous with bolus.

Which of the following is NOT true concerning the gastric emptying of water?
   a. Large volumes of water leave the stomach more rapidly than small volumes.
   b. Warm fluids empty more quickly than cool fluids.
   c. High-solute concentration fluids empty slower than dilute concentrations.
   d. All of the above are true.
7. The process of fat emulsification consists of:
   a. chemically breaking down fat molecules.
   b. absorption of fats.
   c. breaking down fats into small droplets.
   d. the secretion of digestive juices for fat digestion.

True or false

8. ____________ Peristalsis can be described as a mixing movement.

9. ____________ The volumes of the stomach and the duodenum are approximately equal.

10. ____________ Enzymes are organic catalysts.

11. ____________ Digestive enzymes catalyze chemical reactions with great efficiency within a wide range of pH.

12. ____________ Cellulose resists digestion and is eliminated in feces.

13. ____________ Water is readily absorbed in the stomach.

14. ____________ Amino acids are the end product of protein digestion.

*****If you had difficulty with this section, review pages 771-781

II SECRETION AND CONTROL OF DIGESTIVE GLAND SECRETION

Multiple Choice—select the best answer.

15. The principle enzyme of saliva is:
   a. protease.  c. lipase.
   b. amylase.  d. salivase.

16. Which of the following is true?
   a. Saliva contains large amounts of lipase.
   b. Pepsinogen is converted into pepsin by hydrochloric acid.
   c. Chief cells secrete pepsin.
   d. Zymogenic cells produce intrinsic factor.

17. Which of the following is present in bile?
   a. lecithin  c. bile salts
   b. gastrin  d. both a and c

18. The hormone that stimulates the gallbladder to release bile is:
   a. enterogastrone.
   b. insulin.
   c. gastrin.
   d. cholecystokinin-pancreozymin.

True or false

19. ____________ Pancreatic juice is secreted by exocrine acinar cells of the pancreas.

20. ____________ Olfactory and visual stimuli are factors concerning the control of digestive gland secretion.

21. ____________ The cephalic phase is initiated by the presence of food in the stomach.

22. ____________ Chyme is liquefied food found in the stomach.

*****If you had difficulty with this section, review pages 778-784
III  ABSORPTION AND ELIMINATION

Multiple Choice—select the best answer.

23. Fats are absorbed primarily into which of the following structures?
   a. blood in intestinal capillaries
   b. lymph in intestinal lacteals
   c. none of the above

24. Movement of lower colon and rectum contents at a rate slower than normal can cause:
   a. defecation.
   b. constipation.
   c. diarrhea.
   d. both b and c.

True or false

26. Both water and sodium are absorbed via simple diffusion.
27. The majority of substances are absorbed in the small intestine.
28. Cholera is an intestinal infection that kills more than 600,000 infants and children worldwide each year.
29. Micelles, formed from bile salts, carry fatty acids from emulsified droplets to the plasma membrane of absorptive cells.
30. Impaired fat absorption produces large, greasy, foul-smelling stools known as steatorrhea.

*****If you had difficulty with this section, review pages 784-789

IV  MECHANISMS OF DISEASE

Matching—select the best term in the left column for the description in the right column.

31. gastroenteritis  a. reduces the formation of HCl in the stomach
32. anorexia  b. outpouchings of the intestinal wall
33. emesis  c. inflammation of the liver
34. Zantac  d. chronic loss of appetite
35. Helicobacter pylori  e. degenerative liver condition
36. diverticulosis  f. cause of ulcers
37. colitis  g. vomiting
38. hepatitis  h. stomach inflammation
39. pancreatic cancer  i. inflammation of large intestine
40. cirrhosis  j. a form of adenocarcinoma

"If you had difficulty with this section, review pages 789-791"
Crossword Puzzle

Across
5. Process of taking food into the GI tract
6. Food leaving the stomach
7. Mixing movement
9. GI hormones
10. Chemical process in digestion

Down
1. Wavelike ripple of organ
2. Fat droplet
3. Expelling feces
4. Fat droplet surrounded by bile salts
8. Movement of nutrients into internal environment

APPLYING WHAT YOU KNOW
41. Mrs. Haygood was diagnosed with an ulcer of the digestive system. What kind of symptoms might she display? Where along her alimentary canal is this lesion most likely to reside? What are the two accepted mechanisms of this disease? How should her doctor treat her condition?

42. Cliff and Pete like to play soccer vigorously in the heat of the day. What kind of recommendations should they observe concerning the replacement of fluids? Be sure to consider parameters such as fluid temperature, volume, and solute concentration.
DID YOU KNOW

- There are 35 million digestive glands in the stomach.
- Even if the stomach, the spleen, 75% of the liver, 80% of the intestines, one kidney, one lung, and virtually every organ from the pelvic and groin area are removed, the human body can still survive!

ONE LAST QUICK CHECK

Multiple Choice—select the best answer.

43. During the process of digestion, stored bile is poured into the duodenum by which of the following?
   a. gallbladder    c. pancreas
   b. liver          d. spleen

44. The portion of the alimentary canal that mixes food with gastric juice and breaks it down into a mixture called chyme is the:
   a. gallbladder.    c. stomach.
   b. small intestine.  d. large intestine.

45. What is the middle portion of the small intestine called?
   a. jejunum        c. duodenum
   b. ileum          d. cecum

46. Duodenal ulcers appear in which of the following?
   a. stomach        c. large intestine
   b. small intestine d. esophagus

47. Protein digestion begins in the:
   a. esophagus.    c. stomach.
   b. small intestine.  d. large intestine.

48. The enzyme pepsin is concerned primarily with the digestion of which of the following?
   a. sugars.       c. proteins.
   b. starches.     d. fats.

49. The enzyme amylase converts which of the following?
   a. starches to sugars
   b. sugars to starches
   c. proteins to amino acids
   d. fatty acids and glycerols to fats

50. Which of the following substances does NOT contain any enzymes?
   a. saliva    c. gastric juice
   b. bile      d. intestinal juice

51. Which of the following is a simple sugar?
   a. maltose    c. lactose
   b. sucrose    d. glucose

52. Fats are broken down into:
   a. amino acids.    c. fatty acids.
   b. simple sugars.  d. disaccharides.

53. Which one is NOT part of the small intestine?
   a. jejunum        c. colon
   b. ileum          d. duodenum

54. The union of the cystic duct and hepatic duct form the:
   a. common bile duct.
   b. major duodenal papilla.
   c. minor duodenal papilla.
   d. pancreatic duct.

55. The process of swallowing is known as:
   a. mastication.    c. peristalsis.
   b. segmentation.   d. deglutition.

56. Peristalsis begins in the:
   a. mouth.        c. esophagus.
   b. pharynx.      d. stomach.
True or false

57. ________ The mechanical process that occurs in the rectum is churning.
58. ________ Enzymes are functional proteins that catalyze chemical reactions.
59. ________ The hormones secretin and CCK stimulate ejection of bile.
60. ________ Vitamins A, D, E, and K are known as the fat-soluble vitamins.
61. ________ Constipation occurs with increased motility of the small intestine.