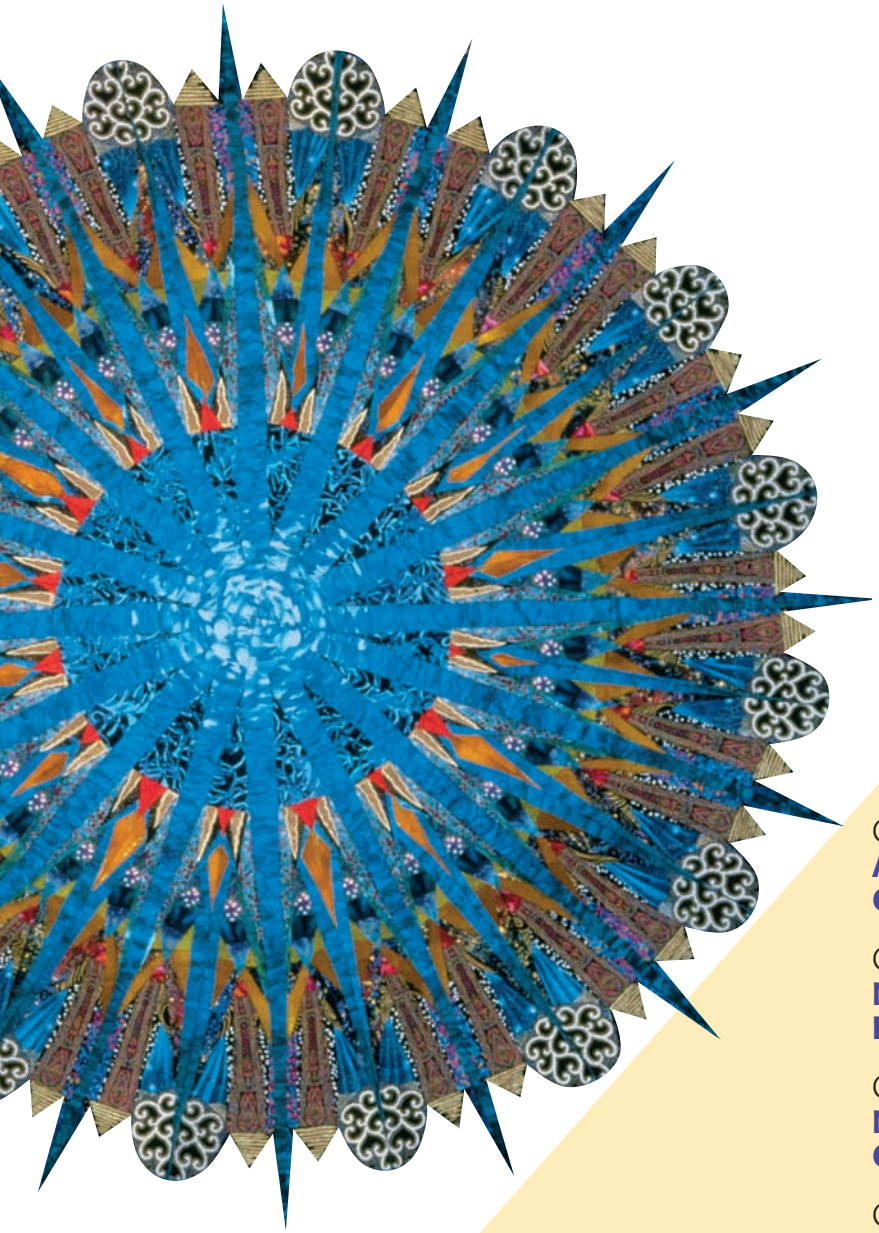
# Responses to Altered Nutrition

UNIT 6



# CHAPTER 21 Assessing Clients with Nutritional and Gastrointestinal Disorders

## LEARNING OUTCOMES

- Describe the sources of nutrients, and their functions in the human body.
- Describe the anatomy, physiology, and functions of the gastrointestinal system.
- Explain the processes of carbohydrate, fat, and protein metabolism.
- Identify specific topics to consider during a health history assessment interview of the client with nutritional and gastrointestinal disorders.
- Explain techniques used for assessing nutritional and gastrointestinal status.
- Describe normal variations in assessment findings for the older adult.
- Identify abnormal findings that may indicate alterations in gastrointestinal function.

## CLINICAL COMPETENCIES

- Conduct and document a health history for clients who have or are at risk for alterations in nutrition and gastrointestinal function.
- Conduct and document a physical assessment of nutritional status and the gastrointestinal system.
- Monitor the results of diagnostic tests and report abnormal findings.

## EQUIPMENT NEEDED

- Stethoscope
- Balance scale with height measuring attachment
- Tape measure
- Skin fold calipers

*MEDIALINK*

Resources for this chapter can be found on the Prentice Hall Nursing MediaLink DVD-ROM accompanying this textbook, and on the Companion Website at http://www.prenhall.com/lemone

KEY TERMS

**bile,** *612*
**borborygmus,** *624*
**bruit,** *624*
**cheilosis,** *622*
**gingivitis,** *623*
**glossitis,** *622*
**leukoplakia,** *623*
**metabolism,** *613*
**nutrition,** *605*
**peristalsis,** *610*
**striae,** *624*

**Nutrition** is the process by which the body ingests, absorbs, transports, uses, and eliminates nutrients in food. The digestive organs responsible for these processes are the gastrointestinal tract (also called the alimentary canal) and the accessory digestive organs. The gastrointestinal tract consists of the mouth, pharynx, esophagus, stomach, small intestine, and large intestine. The accessory digestive organs include the liver, gallbladder, and pancreas (Figure 21–1 ■). This chapter discusses the assessment of these organs except the large intestine. Assessment of the large intestine, which is primarily responsible for elimination, is discussed in Chapter 25 ∞.

## NUTRIENTS

Nutrients are substances found in food and are used by the body to promote growth, maintenance, and repair. The categories of nutrients are carbohydrates, proteins, fats, vitamins, minerals, and water. Dietary guidelines for Americans specific to nutrients are summarized in Table 21–1. (See Chapter 2 ∞ for the

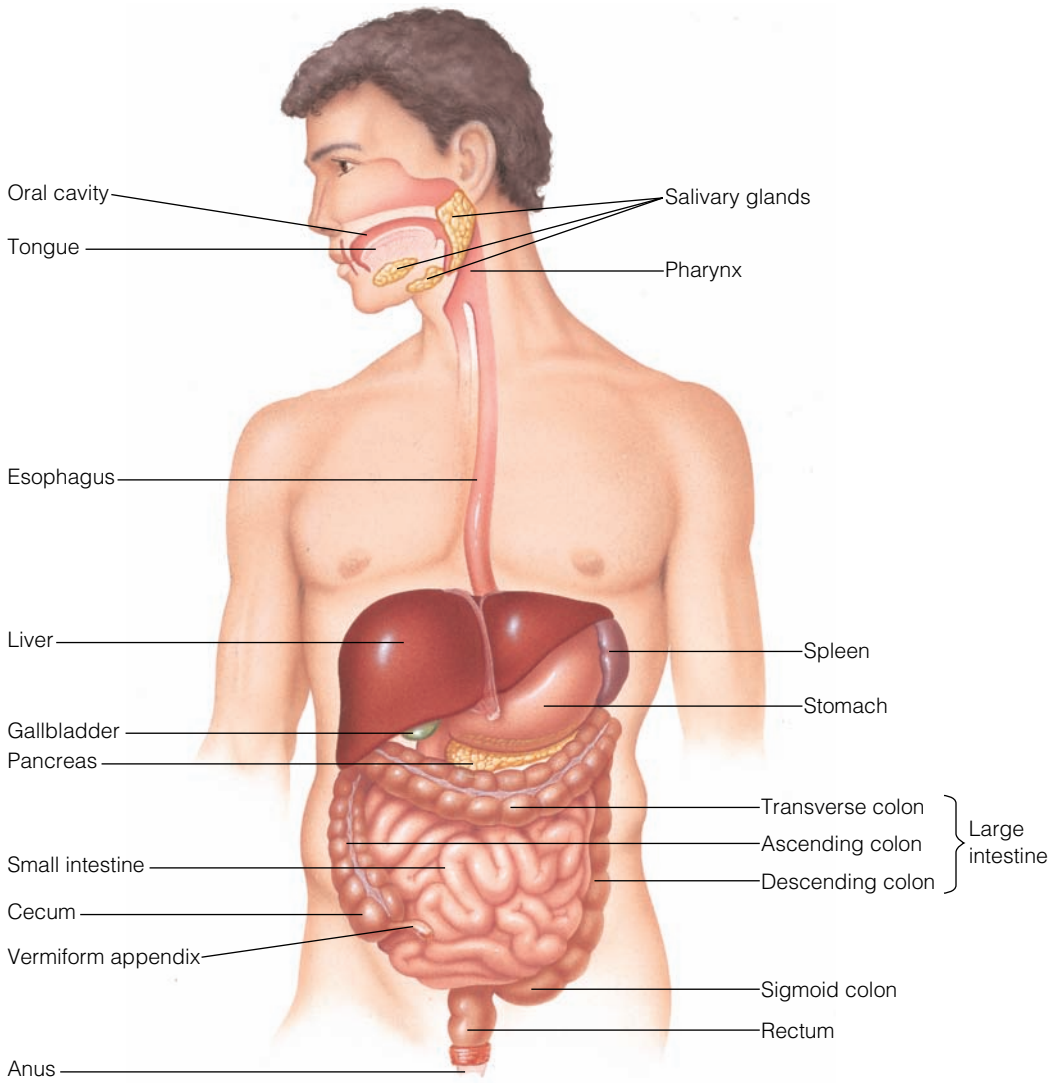



**Figure 21–1** ■ Organs of the gastrointestinal tract and accessory digestive organs.

**TABLE 21–1 Recommended Dietary Guidelines for Americans 2005**

| CATEGORY | RECOMMENDATION |
|---|---|
| General dietary guidelines | ■ Consume a variety of nutrient-dense foods and beverages within and among the basic food groups while choosing foods that limit the intake of saturated and *trans* fats, cholesterol, added sugars, salt, and alcohol.<br>■ Meet recommended intakes by adopting a balanced eating pattern, such as that provided by the USDA Food Guide Pyramid.<br>■ Balance calories from foods and beverages with calories expended to maintain body weight.<br>■ Over time, make small decreases in food and beverage calories and increase physical activity to prevent gradual weight gain. |
| Food groups | ■ For a 2000-calorie diet, consume 2 cups of fruit and 2 1/2 cups of vegetables per day (increase or decrease amounts depending on calorie level).<br>■ Select from all five vegetable subgroups (dark green, orange, legumes, starchy vegetables, other vegetables) several times a week.<br>■ Consume 3 or more ounce equivalents of whole-grain products each day, with the rest of recommended grains coming from enriched or whole-grain products. In general, at least half of the grains should be from whole grains.<br>■ Consume 3 cups per day of fat-free or low-fat milk or equivalent milk products. |
| Carbohydrates | ■ Choose fiber-rich foods, vegetables, and whole grains often.<br>■ Choose and prepare foods with little added sugars or caloric sweeteners. |
| Fats | ■ Consume less than 10% of calories from saturated fatty acids and less than 300 mg/day of cholesterol; keep *trans* fatty acid consumption as low as possible.<br>■ Keep total fat intake between 20% and 35% of calories, with most fats coming from sources of polyunsaturated and monounsaturated fatty acids, such as fish, nuts, and vegetable oil.<br>■ When selecting and preparing meats, poultry, dry beans, and milk or milk products, make choices that are lean, low fat, or fat free. |
| Sodium and potassium | ■ Consume less than 2300 mg (about 1 teaspoon of salt) of sodium each day.<br>■ Choose and prepare foods with little salt.<br>■ Consume potassium-rich foods, such as fruits and vegetables. |

Source: United States Department of Agriculture. (2005). *Dietary guidelines for Americans 2005. Key recommendations for the general population*. Available http://www.health.gov/dietaryguidelines/dga2005/recommendations.htm

new USDA Food Guide Pyramid, which is useful for planning and teaching about nutritional intake.)

## Carbohydrates

The primary sources of carbohydrates (which include sugars and starches) are plant foods. Monosaccharides and disaccharides come from milk, sugar cane, sugar beets, honey, and fruits. Polysaccharide starch is found in grains, legumes, and root vegetables. Following ingestion, digestion, and metabolism, carbohydrates are converted primarily to glucose, the molecule body cells use to make adenosine triphosphate (ATP). Excess glucose in the healthy person is converted to glycogen or fat. Glycogen is stored in the liver and muscles; fat is stored as adipose tissue. Carbohydrate use by the body is shown in Figure 21–2A ■.

Regardless of the source, all carbohydrates supply 4 kcal per gram. The minimum necessary daily carbohydrate intake is unknown, but the recommended daily intake is 125 to 175 g, most of which should be complex carbohydrates (such as milk, potatoes, and whole grains). Excess intake of carbohydrates over time can result in obesity, dental caries, and elevated plasma triglycerides. Over extended periods of time, carbohydrate deficiencies lead to tissue wasting from protein breakdown and metabolic acidosis from an excess of ketones as a by-product of fat breakdown.

## Proteins

Proteins are classified as either complete or incomplete. Complete proteins are found in animal products such as eggs, milk, milk products, and meat. They contain the greatest amount of amino acids and meet the body's amino acid requirements for tissue growth and maintenance. Incomplete proteins are found in legumes, nuts, grains, cereals, and vegetables. These sources are low in or lack one or more of the amino acids essential for building complete proteins.

The body uses proteins to build many different structures, including skin keratin, the collagen and elastin in connective tissues, and muscles. They also are used to make enzymes, hemoglobin, plasma proteins, and some hormones. Protein use by the body is shown in Figure 21–2B.

Proteins provide 4 kcal per gram. The recommended daily intake of protein is 56 g for men and 45 g for women. Healthy people with adequate caloric intake have an equal rate of protein synthesis and protein breakdown and loss, reflected as nitrogen balance. If the breakdown and loss of proteins exceed intake, a negative nitrogen balance results. This may be due to starvation, altered physical states (e.g., from injury or illness), and altered emotional states (such as depression or anxiety). A positive nitrogen balance, which results when protein intake exceeds breakdown, is normal during growth, tissue repair, and pregnancy.

MEDIALINK Nutrition Assessment Resources

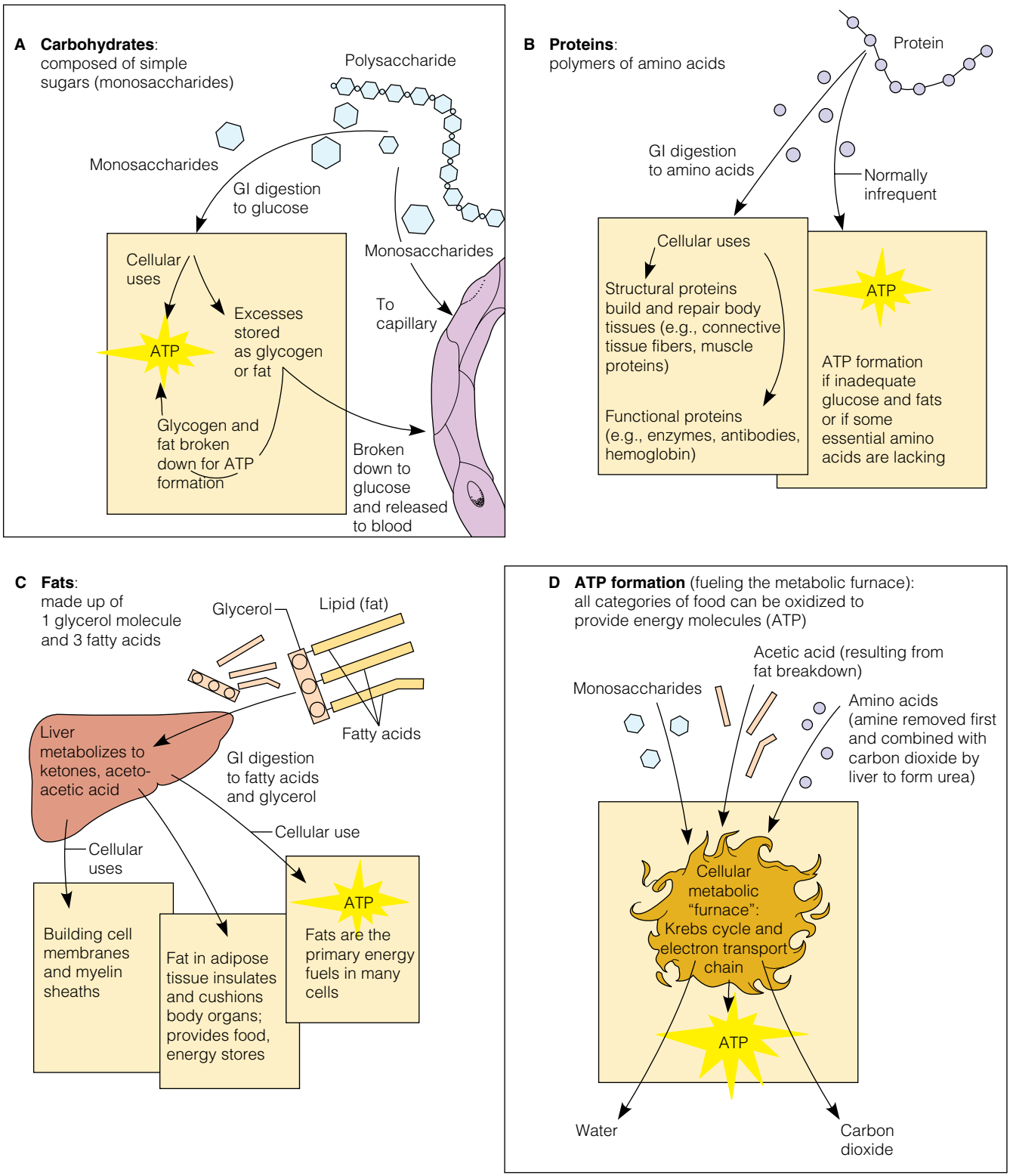



**Figure 21–2** ■ A schematic overview of nutrient use by body cells, including *A,* carbohydrates; *B*, proteins; *C*, fats; and *D*, ATP formation.

Anabolic steroids affect the rate of protein use; for example, the adrenal corticosteroids are released in times of stress to increase protein breakdown and conversion of amino acids to glucose. Excessive intake of proteins may lead to obesity, whereas deficits cause weight loss and tissue wasting, edema, and anemia.

## Fats (Lipids)

Fats, or lipids, include phospholipids; steroids, such as cholesterol; and neutral fats, more commonly known as triglycerides. Neutral fats are the most abundant fats in the diet. They may be

either saturated or unsaturated. Saturated fats are found in animal products (milk and meats) and in some plant products (such as coconut). Unsaturated fats are found in seeds, nuts, and most vegetable oils. Sources of cholesterol include meats, milk products, and egg yolks. Fat use by the body is shown in Figure 21–2C.

Fats supply 9 kcal per gram. When a person consumes more than the body requires, the excess is stored as adipose tissue, increasing the risk of obesity and heart disease. A deficit of fats may cause excessive weight loss and skin lesions.

Fats are a necessary part of the structure and function of the body. For example:

- Phospholipids are a part of all cell membranes.
- Triglycerides are the major energy source for hepatocytes and skeletal muscle cells.
- Dietary fats facilitate absorption of fat-soluble vitamins.
- Linoleic acid, an essential fatty acid, helps form prostaglandins, regulatory molecules that assist in smooth muscle contraction, maintenance of blood pressure, and control of inflammatory responses.
- Cholesterol is the essential component of bile salts, steroid hormones, and vitamin D.
- Adipose tissue serves as a protection around body organs, as a layer of insulation under the skin, and as a concentrated source of fuel for cellular energy.

## Vitamins

Vitamins are organic compounds that facilitate the body's use of carbohydrates, proteins, and fats. All of the vitamins except vitamins D and K must be ingested in foods or taken as supplements. Vitamin D is made by ultraviolet irradiation of cholesterol molecules in the skin, and vitamin K is synthesized by bacteria in the intestine.

Vitamins are categorized as either fat soluble or water soluble. The fat-soluble vitamins (A, D, E, and K) bind to ingested fats and are absorbed as the fats are absorbed. Water-soluble vitamins (the B complex and C) are absorbed with water in the GI tract (however, vitamin $B_{12}$ must become attached to intrinsic factor to be absorbed). Fat-soluble vitamins are stored in the body, and excesses may cause toxicity; water-soluble vitamins in excess of body requirements are excreted in the urine.

The recommended amounts of vitamins, previously labeled recommended daily allowances (RDAs), are now labeled by the National Academy of Sciences as dietary reference intakes (DRIs) per day. The source, function, and minimum daily recommended intake levels are provided for each vitamin in Tables 21–2 and Table 21–3.

## Minerals

Minerals work with other nutrients to maintain the structure and function of the body. An adequate supply of calcium, phosphorus, potassium, sulfur, sodium, chloride, and magnesium—as well as other trace elements such as iron, iodine, copper, and zinc—is necessary to health. Most minerals in the body are found in body fluids or are bound to organic compounds. The best sources of minerals are vegetables, legumes, milk, and some meats. Dietary sources for the major minerals are discussed in Chapter 10 ∞. The recommended daily intake for minerals is outlined in Table 21–4.

TABLE 21–2 **Recommended Daily Intake of Fat-Soluble Vitamins**

| NAME | SOURCE | FUNCTION | MINIMUM RECOMMENDED DAILY INTAKE (M = MEN, W = WOMEN) |
|---|---|---|---|
| Vitamin A (retinol) | ■ Fish liver oils<br>■ Egg yolk<br>■ Liver<br>■ Fortified milk<br>■ Margarine | Necessary for vision, integrity of skin and mucous membranes, cell membrane function, and reproductive function | M = 900 mcg<br>W = 700 mcg |
| Vitamin D | ■ The action of sunshine on cholesterol in the skin | Necessary for blood calcium homeostasis (in turn necessary for blood clotting), bone formation, and neuromuscular function | M and W = 5 mcg |
| Vitamin E | ■ Vegetable oils<br>■ Margarine<br>■ Whole grains<br>■ Dark green leafy vegetables | As an antioxidant, helps prevent the oxidation of vitamins A and C in the intestines and decreases the oxidation of unsaturated fatty acids to facilitate cell membrane integrity | M and W = 15 mcg |
| Vitamin K | ■ Synthesized by coliform bacteria in the large intestine<br>■ Green, leafy vegetables<br>■ Cabbage<br>■ Cauliflower<br>■ Pork | Essential for the formation of clotting proteins in the liver | M = 120 mcg<br>W = 90 mcg |

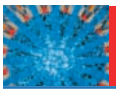
MEDIALINK Case Study: Counseling a College Student about Vitamins

TABLE 21–3 **Recommended Daily Intake of Water-Soluble Vitamins**

| NAME | SOURCE | FUNCTION | MINIMUM RECOMMENDED DAILY INTAKE (M = MEN, W = WOMEN) |
|---|---|---|---|
| Vitamin $B_1$ (thiamin) | ■ Lean meats<br>■ Liver<br>■ Eggs<br>■ Green leafy vegetables<br>■ Legumes<br>■ Whole grains | An essential coenzyme for carbohydrate metabolism and use; also for healthy function of nerves, muscles, and the heart | M = 1.2 mg<br>W = 1.1 mg |
| Vitamin $B_2$ (riboflavin) | ■ Liver<br>■ Egg white<br>■ Whole grains<br>■ Meat<br>■ Poultry<br>■ Fish<br>■ Milk | Involved in the catabolism and use of carbohydrates, fats, and proteins; the use of other B vitamins; and is important for the production of adrenal hormones | M = 1.3 mg<br>W = 1.1 mg |
| Vitamin $B_6$ (pyridoxine) | ■ Meat<br>■ Poultry<br>■ Fish<br>■ Potatoes<br>■ Tomatoes<br>■ Sweet potatoes<br>■ Spinach | Necessary for amino acid metabolism, formation of antibodies, and formation of hemoglobin | M and W < age 51 = 1.3<br>M > age 51 = 1.7 mg<br>W > age 51 = 1.5 mg |
| Vitamin $B_{12}$ (cyanocobalamin) | ■ Liver<br>■ Meat<br>■ Poultry<br>■ Dairy foods (except butter)<br>■ Eggs | Essential for the production of nucleic acids and red blood cells in the bone marrow; also plays an important role in the use of folic acid and carbohydrates, and in healthy function of the nervous system. | M and W = 2.4 mcg |
| Vitamin C (ascorbic acid) | ■ Citrus fruits<br>■ Potatoes<br>■ Tomatoes<br>■ Green leafy vegetables | Acts as an antioxidant and vasoconstrictor; also serves in the formation of connective tissue, conversion for cholesterol to bile salts, iron absorption and use, and conversion of folic acid to an active form | M = 90 mg<br>W = 75 mg |
| Vitamin $B_3$ niacin (nicotinamide) | ■ Meat<br>■ Poultry<br>■ Fish<br>■ Liver<br>■ Peanuts<br>■ Green leafy vegetables | Plays an important role in the metabolism of carbohydrates and fats; inhibits cholesterol synthesis; important for integumentary, nervous, and digestive system health; assists in the manufacture of reproductive hormones | M and W = 35 mg |
| Biotin | ■ Liver<br>■ Eggs<br>■ Nuts<br>■ Legumes | Essential for the catabolism of fatty acids and carbohydrates, and helps dispose of the waste products of protein catabolism | M and W = 30 mcg |
| Pantothenic acid | ■ Meats<br>■ Whole grains<br>■ Egg yolk<br>■ Liver<br>■ Yeast<br>■ Legumes | Assists in the synthesis of steroids and of the heme in hemoglobin; is essential for the metabolism of carbohydrates and fats, and for the manufacture of reproductive hormones | M and W = 5 mg |
| Folic acid (folate) | ■ Liver<br>■ Dark green vegetables<br>■ Lean beef<br>■ Eggs<br>■ Veal<br>■ Whole grains<br>■ Synthesized by bacteria in the intestine | The basis of a coenzyme necessary to the manufacture of nucleic acids and so is essential for the formation of red blood cells, growth and development, and nervous system health | M and W = 400 mcg |

TABLE 21–4 **Recommended Daily Intake of Minerals**

| NAME | MINIMUM RECOMMENDED DAILY INTAKE (M = MEN, W = WOMEN) |
|---|---|
| Calcium | M and W = 1000 mg<br>W > menopause = 1200 mg |
| Phosphorus | M and W = 1000 mg |
| Iron | M and W = 18 mg |
| Zinc | M and W = 15 mg |
| Manganese | M = 2.3 mg<br>W = 1.8 mg |
| Molybdenum | M and W = 75 mcg |
| Chromium | M and W = 120 mcg |
| Iodine | M and W = 150 mcg |
| Selenium | M and W = 70 mcg |
| Magnesium | M and W = 400 mg |
| Copper | M and W = 2.0 mg |
| Chloride | M and W = 3400 mg |



# ANATOMY, PHYSIOLOGY, AND FUNCTIONS OF THE GASTROINTESTINAL SYSTEM

The gastrointestinal tract is a continuous hollow tube, extending from the mouth to the anus. Once foods are placed in the mouth, they are subjected to a variety of processes that move them and break them down into end products that can be absorbed from the lumen of the small intestine into the blood or lymph. These digestive processes are as follows:

- Ingestion of food
- Movement of food and wastes
- Secretion of mucus, water, and enzymes
- Mechanical digestion of food
- Chemical digestion of food
- Absorption of digested food.

## The Mouth

The mouth, also called the oral or buccal cavity, is lined with mucous membranes and is enclosed by the lips, cheeks, palate, and tongue (Figure 21–3 ■).

The lips and cheeks are skeletal muscle covered externally by skin. Their function is to keep food in the mouth during chewing. The palate consists of two regions: the hard palate and the soft palate. The hard palate covers bone in the roof of the mouth and provides a hard surface against which the tongue forces food. The soft palate, extending from the hard palate and ending at the back of the mouth as a fold called the uvula, is primarily muscle. When food is swallowed, the soft palate rises as a reflex to close off the oropharynx.

The tongue, composed of skeletal muscle and connective tissue, is located in the floor of the mouth. It contains mucous and serous glands, taste buds, and papillae. The tongue mixes food with saliva during chewing, forms the food into a mass (called a *bolus*), and initiates swallowing. Some papillae provide surface roughness to facilitate licking and moving food; other papillae house the taste buds.

Saliva moistens food so it can be made into a bolus, dissolves food chemicals so they can be tasted, and provides enzymes (such as amylase) that begin the chemical breakdown of starches. Saliva is produced by salivary glands, most of which lie superior or inferior to the mouth and drain into it. The salivary glands include the parotid, the submaxillary, and the sublingual glands.

The teeth chew (masticate) and grind food to break it down into smaller parts. As the food is masticated, it is mixed with saliva. Adults have 32 permanent teeth. The teeth are embedded in the gingiva (gums), with the crown of each tooth visible above the gingiva.

## The Pharynx

The pharynx consists of the oropharynx and the laryngopharynx (see Figure 21–3). Both structures provide passageways for food, fluids, and air. The pharynx is made of skeletal muscles and is lined with mucous membranes. The skeletal muscles move food to the esophagus via the pharynx through **peristalsis** (alternating waves of contraction and relaxation of involuntary muscle). The mucosa of the pharynx contains mucous-producing glands that provide fluid to facilitate the passage of the bolus of food as it is swallowed.

## The Esophagus

The esophagus, a muscular tube about 10 inches (25 cm) long, serves as a passageway for food from the pharynx to the stomach (see Figures 21–1 and 21–3). The epiglottis, a flap of cartilage over the top of the larynx, keeps food out of the larynx

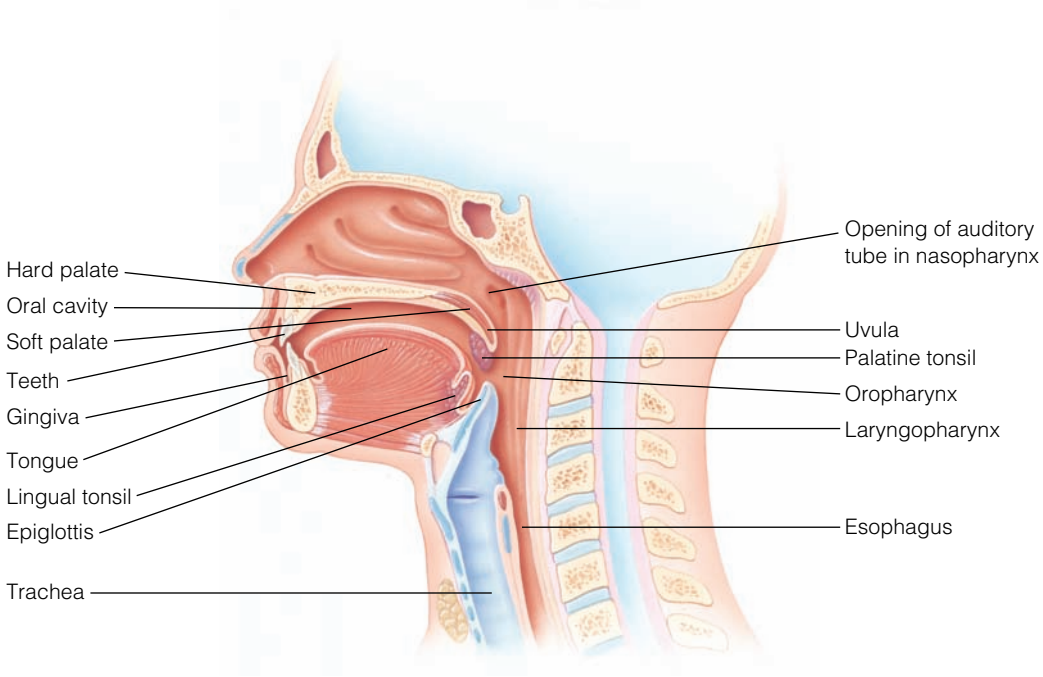



**Figure 21–3** ■ Structures of the mouth, the pharynx, and the esophagus.

during swallowing. The esophagus descends through the thorax and diaphragm, entering the stomach at the cardiac orifice. The gastroesophageal sphincter surrounds this opening. This sphincter, along with the diaphragm, keeps the orifice closed when food is not being swallowed.

For most of its length, the esophagus is lined with stratified squamous epithelium; simple columnar epithelium lines the esophagus where it joins the stomach. The mucosa and submucosa of the esophagus lie in longitudinal folds when the esophagus is empty.

## The Stomach

The stomach, located high on the left side of the abdominal cavity, is connected to the esophagus at the upper end and to the small intestine at the lower end (Figure 21–4 ■). Normally about 10 inches (25 cm) long, the stomach is a distensible organ that can expand to hold up to 4 L of food and fluid. The concave surface of the stomach is called the lesser curvature; the convex surface is called the greater curvature. The stomach may be divided into regions extending from the distal end of the esophagus to the opening into the small intestine. These regions are the cardiac region, fundus, body, and pylorus (see Figure 21–4). The pyloric sphincter controls emptying of the stomach into the duodenal portion of the small intestine. The stomach is a storage reservoir for food, continues the mechanical breakdown of food, begins the process of protein digestion, and mixes the food with gastric juices into a thick fluid called chyme.

The stomach is lined with columnar epithelial, mucous-producing cells. Millions of openings in the lining lead to gastric glands that can produce 4 to 5 L of gastric juice each day. The gastric glands contain a variety of secretory cells, including the following:

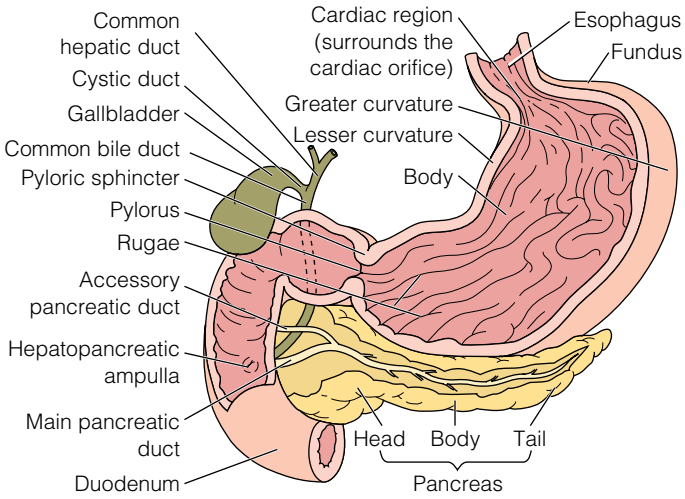



**Figure 21–4** ■ The internal anatomic structures of the stomach, including the pancreatic, cystic, and hepatic ducts; the pancreas; and the gallbladder.

- Mucous cells produce alkaline mucus that clings to the lining of the stomach and protects it from being digested by gastric juice.
- Zymogenic cells produce pepsinogen (an inactive form of pepsin, a protein-digesting enzyme).
- Parietal cells secrete hydrochloric acid and intrinsic factor. Hydrochloric acid activates and increases the activity of protein-digesting cells and also is bactericidal. Intrinsic factor is necessary for the absorption of vitamin $B_{12}$ in the small intestine.
- Enteroendocrine cells secrete gastrin, histamine, endorphins, serotonin, and somatostatin. These hormones or hormone-like

substances diffuse into the blood. Gastrin is important in regulating secretion and motility of the stomach.

The secretion of gastric juice is under both neural and endocrine control. Stimulation of the parasympathetic vagus nerve increases secretory activity; in contrast, stimulation of sympathetic nerves decreases secretions. The three phases of secretory activity are the cephalic phase, the gastric phase, and the intestinal phase.

- The cephalic phase prepares for digestion and is triggered by the sight, odor, taste, or thought of food. During this initial phase, motor impulses are transmitted via the vagus nerve to the stomach.
- The gastric phase begins when food enters the stomach. Stomach distention (stimulating stretch receptors) and chemical stimuli from partially digested proteins initiate this phase. Gastrin-secreting cells produce gastrin, which in turn stimulates the gastric glands (especially the parietal cells) to produce more gastric juice. Histamine also stimulates hydrochloric acid secretion.
- The intestinal phase is initiated when partially digested food begins to enter the small intestine, stimulating mucous cells of the intestine to release a hormone that promotes continued gastric secretion.

Mechanical digestion in the stomach is accomplished by peristaltic movements that churn and mix the food with the gastric juices to form chyme. Gastric motility is enhanced or retarded by the same factors that affect secretion, namely, distention and the effect of gastrin. After a person eats a well-balanced meal, the stomach empties completely in approximately 4 to 6 hours. Gastric emptying depends on the volume, chemical composition, and osmotic pressure of the gastric contents. The stomach empties large volumes of liquid content more rapidly, while gastric emptying is slowed by solids and fats.

## The Small Intestine

The small intestine begins at the pyloric sphincter and ends at the ileocecal junction at the entrance of the large intestine (see Figure 21–1). The small intestine is about 20 ft (6 m) long but only about 1 inch (2.5 cm) in diameter. This long tube hangs in coils in the abdominal cavity, suspended by the mesentery and surrounded by the large intestine. The small intestine has three regions: the duodenum, the jejunum, and the ileum. The duodenum begins at the pyloric sphincter and extends around the head of the pancreas for about 10 inches (25 cm). Both pancreatic enzymes and bile from the liver enter the small intestine at the duodenum. The jejunum, the middle region of the small intestine, extends for about 8 ft (2.4 m). The ileum, the terminal end of the small intestine, is approximately 12 ft (3.6 m) long and meets the large intestine at the ileocecal valve.

Food is chemically digested, and most of it absorbed, as it moves through the small intestine. Circular folds (deep folds of the mucosa and submucosa layers), villi (finger-like projections of the mucosa cells), and microvilli (tiny projections of the mucosa cells) increase the surface area of the small intestine to enhance absorption of food. Although up to 10 L of food, liquids, and secretions enter the GI tract each day, less than 1 L reaches the large intestine.

Enzymes in the small intestine break down carbohydrates, proteins, lipids, and nucleic acids. Pancreatic amylase acts on starches, converting them to maltose, dextrins, and oligosaccharides; the intestinal enzymes dextrinase, glucoamylase, maltase, sucrase, and lactase further break down these products into monosaccharides. Pancreatic enzymes (trypsin and chymotrypsin) and intestinal enzymes continue to break down proteins into peptides. Pancreatic lipases digest lipids in the small intestine. Triglycerides enter as fat globules and are coated by bile salts and emulsified. Nucleic acids are hydrolyzed by pancreatic enzymes and then broken apart by intestinal enzymes. Both pancreatic enzymes and bile are excreted into the duodenum in response to the secretion of secretin and cholecystokinin, hormones produced by the intestinal mucosa cells when chyme enters the small intestine.

Nutrients are absorbed through the mucosa of the intestinal villi into the blood or lymph by active transport, facilitated transport, and passive diffusion. Almost all food products and water, as well as vitamins and most electrolytes, are absorbed in the small intestine, leaving only indigestible fibers, some water, and bacteria to enter the large intestine. (The large intestine is discussed in Chapter 25 ∞.)

## The Accessory Digestive Organs

The liver, gallbladder, and exocrine pancreas secrete substances necessary for the digestion of chyme. The liver produces bile, necessary for fat digestion and absorption, and stores it in the gallbladder. The liver also receives nutrients absorbed by the small intestine and metabolizes or synthesizes these nutrients so they are in a form that can be used by the cells of the body. The exocrine pancreas produces enzymes necessary for digestion of fats, proteins, and carbohydrates.

### The Liver and Gallbladder

The liver weighs about 3 lb (1.4 kg) in the average-size adult. It is located in the right side of the abdomen, inferior to the diaphragm and anterior to the stomach (see Figure 21–1). The liver has four lobes: right, left, caudate, and quadrate. A mesenteric ligament separates the right and left lobes and suspends the liver from the diaphragm and anterior abdominal wall. The liver is encased in a fibroelastic capsule, called the Glisson capsule. This capsule contains blood vessels, lymphatics, and nerves. When the liver is diseased or swollen, distention causes pain and the lymphatics may ooze fluid into the peritoneal cavity.

Liver tissue consists of units called lobules, which are composed of plates of hepatocytes (liver cells). A branch of the hepatic artery, a branch of the hepatic portal vein, and a bile duct communicate with each lobule. Sinusoids, blood-filled spaces within the lobules, are lined with Kupffer cells. These phagocytic cells remove debris from the blood.

Bile production is the liver's primary digestive function. **Bile** is a greenish, watery solution containing bile salts, cholesterol, bilirubin, electrolytes, water, and phospholipids. These substances are necessary to emulsify and promote the absorption of fats. Liver cells make from 700 to 1200 mL of bile daily. When bile is not needed for digestion, the sphincter of Oddi (located at the point at which bile enters the duodenum) is closed, and the bile backs up the cystic duct into the gallbladder for storage.

Bile is concentrated and stored in the gallbladder, a small sac cupped in the inferior surface of the liver. When food containing fats enters the duodenum, hormones stimulate the gallbladder to secrete bile into the cystic duct. The cystic duct joins the hepatic duct to form the common bile duct, from which bile enters into the duodenum (see Figure 21–4).

The major digestive and metabolic functions of the liver are outlined in Box 21–1. These functions require a large amount of blood, with the liver receiving blood from both venous and arterial blood vessels. The hepatic artery, branching from the abdominal aorta, provides oxygenated blood at the rate of 400 to 500 mL/min. The hepatic portal vein delivers about 1000 to 1200 mL/min of deoxygenated blood to the liver from the inferior and superior mesenteric veins and the splenic vein.

### The Exocrine Pancreas

The pancreas, a gland located between the stomach and small intestine, is the primary enzyme-producing organ of the digestive system. It is a triangular gland extending across the abdomen, with its tail next to the spleen and its head next to the duodenum (see Figure 21–4). The body and tail of the pancreas are retroperitoneal, lying behind the greater curvature of the stomach. The pancreas is actually two organs in one, having both exocrine and endocrine structures and functions. The exocrine portion of the pancreas, through secretory units called acini, secretes alkaline pancreatic juice containing many different enzymes. The acini, clusters of secretory cells surrounding ducts, drain into the pancreatic duct. The pancreatic duct joins with the common bile duct just before it enters the duodenum (so that pancreatic juice and bile from the liver enter the small intestine together). The pancreas also has endocrine functions, discussed in Chapter 18 ∞.

The pancreas produces from 1 to 1.5 L of pancreatic juice daily. Pancreatic juice is clear and has high bicarbonate content. This alkaline fluid neutralizes the acidic chyme as it enters the duodenum, optimizing the pH for intestinal and pancreatic enzyme activity. The secretion of pancreatic juice is controlled by the vagus nerve and the intestinal hormones secretin and cholecystokinin. Pancreatic juice contains enzymes that aid in the digestion of all categories of foods: lipase promotes fat breakdown and absorption; amylase completes starch digestion; and trypsin, chymotrypsin, and carboxypeptidase are responsible for half of all protein digestion. Nucleases break down nucleic acids.

## METABOLISM

After nutrients (carbohydrates, fats, and proteins) are ingested, digested, absorbed, and transported across cell membranes, they must be metabolized to produce and provide energy to maintain life. **Metabolism** is the process of biochemical reactions occurring in the body's cells. Metabolic processes are either catabolic or anabolic. Catabolism involves the breakdown of complex structures into simpler forms, for example, the breakdown of carbohydrates to produce ATP, an energy molecule that fuels cellular activity. In the process of anabolism, simpler molecules combine to build more complex structures, for example, amino acids bond to form proteins.

The biochemical reactions of metabolism produce water, carbon dioxide, and ATP (see Figure 21–2D on page 607). The energy value of foods is measured in kilocalories (kcal). A kilocalorie is defined as the amount of heat energy needed to raise the temperature of 1 kilogram (kg) of water 1 degree centigrade.

## ASSESSING NUTRITIONAL STATUS AND GASTROINTESTINAL FUNCTION

Nutritional status and the function of the gastrointestinal system are assessed by findings from diagnostic tests, a health assessment interview to collect subjective data, and a physical assessment to collect objective data. See the box below for sample documentation of a nutritional status assessment.

SAMPLE DOCUMENTATION

**Assessment of Nutritional Status**

*22-year-old female visiting health clinic for regular check-up. Height 5 feet, 5 inches (165 cm); Weight 128 pounds (58 kg). BMI: 24. MAC: 28 cm. Waist-to-hip ratio: 0.6. Skin is warm, moist and smooth without lesions other than well-healed scar on RLQ of abdomen from appendectomy, age 15. Oral mucosa and tongue pink and moist. No breath odor. All teeth present with evidence of dental care. Abdomen slightly concave when lying on back, bowel sounds present in all four quadrants, liver nonpalpable, tympany over lower abdomen on percussion.*

### BOX 21–1 Major Metabolic and Digestive Functions of the Liver

- Secretes bile.
- Stores fat-soluble vitamins (A, D, E, and K).
- Metabolizes bilirubin.
- Stores blood and releases blood into the general circulation during hemorrhage.
- Synthesizes plasma proteins to maintain plasma oncotic pressure.
- Synthesizes prothrombin, fibrinogen, and factors I, II, VII, IX, and X, which are necessary for blood clotting.
- Synthesizes fats from carbohydrates and proteins to be either used for energy or stored as adipose tissue.
- Synthesizes phospholipids and cholesterol necessary for the production of bile salts, steroid hormones, and plasma membranes.
- Converts amino acids to carbohydrates through deamination.
- Releases glucose during times of hypoglycemia.
- Takes up glucose during times of hyperglycemia and stores it as glycogen or converts it to fat.
- Alters chemicals, foreign molecules, and hormones to make them less toxic.
- Stores iron as ferritin, which is released as needed for the production of red blood cells.

## Diagnostic Tests

The results of diagnostic tests of nutritional status and gastrointestinal function are used to support the diagnosis of a specific disease, to provide information to identify or modify the appropriate medication or therapy used to treat the disease, and to help nurses monitor the client's responses to treatment and nursing care interventions. Diagnostic tests to assess nutritional status and function of the gastrointestinal tract and the accessory organs are described on pages 615–617 and summarized in the list that follows. More information, including specific laboratory tests, is included in the discussion of disorders in Chapters 22, 23, and 24 ∞.

- Diagnostic tests of the esophagus and stomach include tests of esophageal pressure and acidity, x-rays of the esophagus and stomach using barium (Figure 21–5 ■), direct visualization with an endoscope, CT, MRI, and analysis of gastric secretions and emptying. These tests are used to evaluate chronic acid reflux, esophageal varices, inflammation, ulceration, hernia, foreign bodies, polyps, diverticula, tumors, and GI bleeding.
- Gallbladder and pancreatic tissue and duct structure and function are evaluated with ultrasound, x-ray series with a contrast medium, fluoroscopy, MRI, CT, and direct visualization. In addition to evaluating structure and function, the tests are used to identify tumors, cysts, ascites, gallstones, and obstructions; and to retrieve gallstones, dilate structures, and biopsy tumors. Blood serum lipase and amylase tests assess pancreatic function, with alterations in serum amylase being highly diagnostic of acute pancreatitis.
- Liver biopsy is used to rule out metastatic cancer, or to detect a liver cyst or cirrhosis. Other laboratory tests used to diagnose and monitor liver disorders are included in Chapter 24 ∞ with discussions of interdisciplinary care.

Regardless of the type of diagnostic test, the nurse is responsible for explaining the procedure and any special preparation needed, for supporting the client during the examination as necessary, for documenting the procedure as appropriate, and for monitoring the results of the test.

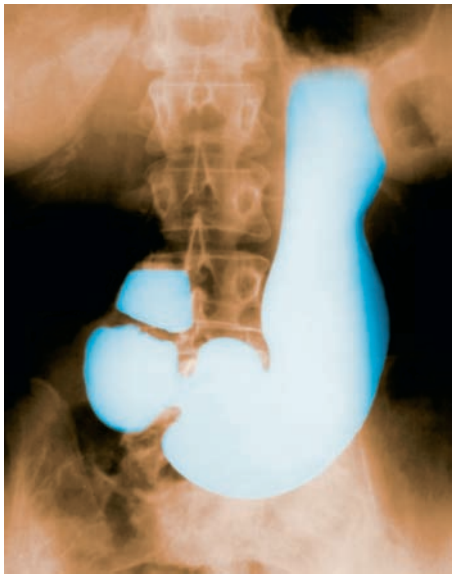


**Figure 21–5** ■ A barium x-ray of a healthy stomach.
*Source:* Biophoto Associates/Photo Researchers, Inc.

## Genetic Considerations

When conducting a health assessment interview and physical assessment, it is important for the nurse to consider genetic influences on health of the adult. During the health assessment interview, ask about family members with known abnormalities of copper accumulation in the body, hypercholesteremia, abnormal cholesterol or fat metabolism, obesity, or cancer of the pancreas. During the physical assessment, assess for any manifestations that might indicate a genetic disorder (see the Genetic Considerations box below). If data are found to indicate genetic risk factors or alterations, ask about genetic testing and refer for appropriate genetic counseling and evaluation. Chapter 8 ∞ provides further information about genetics in medical-surgical nursing.

## Health Assessment Interview

A health assessment interview to determine problems with nutrition and digestion may be conducted during a health screening, may focus on a chief complaint (such as nausea or unexplained weight loss), or may be part of a total health assessment. If the client has a health problem involving nutrition and digestion, analyze its onset, characteristics and course, severity, precipitating and relieving factors, and any associated symptoms, noting the timing and circumstances. For example, the nurse may ask the client:

- Have you had any episodes of indigestion, nausea, vomiting, diarrhea, or constipation? If so, describe the appearance of what was vomited or the stools and anything that makes these problems better or worse. How long have you had these problems?
- What is your usual dietary intake pattern during a 24-hour period?
- Describe what you believe to be a "healthy" diet.

When collecting information about the client's current health status, ask about any changes in weight, appetite, and the ability to taste, chew, or swallow. What is the client's perception of the role of nutrition in maintaining health? Who buys and prepares the food? What medications (prescribed, over-the-counter, or

**GENETIC CONSIDERATIONS**
**Nutritional and Gastrointestinal System**

- Cleft lip and/or palate are influenced by genetic factors.
- An autosomal recessive disorder, Wilson's disease is an abnormality of copper transport, resulting in copper accumulation and toxicity to the liver and grain. Neurologic disease results in adults.
- Tangier disease is a disease of cholesterol transport, leading to characteristic orange tonsils, very low levels of high-density lipoprotein, and an enlarged liver and spleen.
- Hypercholesterolemia has a familial tendency.
- About 90% of human pancreatic cancers show a chromosome defect.
- Obesity is believed to result from a variety of factors, including genetics.
- Gaucher disease, more common in descendants of Jewish people from Eastern Europe, results in lack of an enzyme to break down fats. Fats accumulate in the liver, spleen, and bone marrow, causing pain, fatigue, jaundice, bone damage, anemia, and even death.

## DIAGNOSTIC TESTS of Gastrointestinal Disorders

### ESOPHAGEAL AND STOMACH TESTS

**NAME OF TEST** Esophageal Acidity, Esophageal Manometry, Acid Perfusion (Bernstein Test)

**PURPOSE AND DESCRIPTION** Esophageal acidity is measured to diagnose problems of the lower esophageal sphincter and chronic reflux esophagitis. A catheter with a pH electrode is inserted into the esophagus through the mouth. The measurement may be one time, or over a 24-hour period.

Esophageal manometry is done to measure esophageal sphincter pressure and peristaltic contractions for diagnosis of esophageal motility problems, such as achalasia. A manometric catheter with a pressure transducer is inserted into the esophagus through the mouth and esophageal pressure is measured before and after swallowing.

Acid perfusion (Bernstein test) tests are done to distinguish between gastric acid reflux and cardiac involvement. A catheter is inserted through the nose into the esophagus. A saline solution, followed by a HCL solution, is dripped into the catheter and the client is asked to indicate when pain occurs. Normal esophageal pH is 5 to 6.

**RELATED NURSING CARE** Advise the client to be NPO and to avoid alcohol intake for 8 to 12 hours prior to the exam. Assess medications: Results of the tests may be affected by antacids, anticholinergics, and cimetidine-like drugs, which increase the pH, reducing acidity and causing false test results.

---

**NAME OF TEST** Barium Swallow or Upper GI Series

**PURPOSE AND DESCRIPTION** To diagnose esophageal varices, inflammation, ulcerations, hiatal hernia, foreign bodies, polyps, diverticula, and tumors of the esophagus, stomach, and duodenal bulb. These radiologic studies are done by observing the movement of a contrast medium with a fluoroscope.

**RELATED NURSING CARE** Advise the client to be NPO and avoid smoking for 8–12 hours before the exam; client will drink 16–20 ounces of a chalky liquid (barium sulfate or meglumine diatrizoate [Gastrografin]) before the exam. Withhold medications for 8 hours before the exam. Following the exam, ensure the client eliminates the barium by giving laxatives and forcing fluids as appropriate.

---

**NAME OF TEST** Upper GI Endoscopy (Esophagogastroduodenoscopy [EGD])

**PURPOSE AND DESCRIPTION** To directly visualize mucous membrane lining of the esophagus, stomach, and duodenum. A flexible fiber-optic endoscope is used to visualize inflammations, ulcerations, tumors, or varices; and video imaging may illustrate gastric motility. May also be combined with an ultrasound examination by attaching an ultrasound transducer to the endoscope.

**CLIENT PREPARATION**

- Schedule at least 2 days after barium swallow or upper gastrointestinal series.
- Ensure the informed consent is signed prior to premedication.
- Encourage questions, and provide answers and support.
- Withhold food and fluids for 6 to 8 hours before the procedure.
- Remove dentures and eyewear.

**HEALTH EDUCATION FOR THE CLIENT AND FAMILY**

- Do not eat or drink anything for 6 to 8 hours before the procedure.
- The procedure is somewhat uncomfortable but requires only 20 to 30 minutes to complete.
- A local anesthetic will be used in your throat and you will be given a sedative during the procedure.
- After the procedure, you will be allowed to eat and drink as soon as your gag reflex returns and you are able to swallow.
- You may experience mild bloating, belching, or flatulence following the procedure.
- Contact your physician immediately if you develop any of the following: difficulty swallowing; epigastric, substernal or shoulder pain; vomiting blood or black tarry stools; or fever.

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**NAME OF TEST** Magnetic Resonance Imaging (MRI)

**PURPOSE AND DESCRIPTION** To identify source of gastric bleeding.

**RELATED NURSING CARE** Assess for metal implants or pregnancy (will not do the exam if present). Explain need to be NPO for at least 6 hours prior to the exam.

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**NAME OF TEST** Gastroscopy

**PURPOSE AND DESCRIPTION** See Upper GI Endoscopy.

**RELATED NURSING CARE** See Upper GI Endoscopy.

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**NAME OF TEST** Gastric Analysis

**PURPOSE AND DESCRIPTION** To evaluate gastric secretions and detect an increase or decrease of free hydrochloric acid. To conduct the gastric analysis, a nasogastric tube is inserted into the stomach and specimens are aspirated to evaluate gastric acidity. A stimulation gastric analysis may follow, with a gastric stimulant (such as Histalog or pentagastrin) administered and several gastric samples aspirated.

Normal values:
Fasting: 1.0–5.0 mEq/L/per hour
Stimulation: 10–25 mEq/L/per hour

**RELATED NURSING CARE** Advise client to remain NPO with no smoking for 8 to 12 hours prior to the exam. Assess medications and fluid intake: Anticholinergics, cholinergics, adrenergic blockers, antacids, steroids, alcohol, and coffee can alter results. Remove loose dentures. Insert nasogastric tube. Aspirate gastric contents at 15- to 20-minute intervals as ordered.

*(continued)*

## DIAGNOSTIC TESTS of Gastrointestinal Disorders (continued)

**NAME OF TEST** Gastric Emptying Studies

**PURPOSE AND DESCRIPTION** To evaluate the ability of the stomach to empty liquids or solids. In this nuclear imaging study, the client is asked to eat a cooked egg containing Tc-$^{99m}$ (solids) or to drink orange juice with Tc$^{99m}$ (liquids). Sequential images are recorded with a gamma camera every 2 minutes for up to an hour.

**RELATED NURSING CARE** Explain to client that the substances contain only very small amounts of radioactivity and are not hazardous.

### GALLBLADDER AND PANCREAS TESTS

**NAME OF TEST** Abdominal Ultrasound, Hepatobiliary Ultrasound, Gallbladder Ultrasound

**PURPOSE AND DESCRIPTION** Abdominal ultrasound is used to detect abdominal tumors, cysts, and ascites.

Hepatobiliary ultrasound is used to visualize the biliary ducts, and to detect subphrenic abscesses, cysts, tumors, and cirrhosis of the liver.

Gallbladder ultrasound is used to detect gallstones.

These noninvasive procedures record ultrasound waves as they are reflected off body structures. A conductive gel is applied to the skin and a transducer placed on the area.

**RELATED NURSING CARE** Advise the client to remain NPO for 8 to 12 hours prior to the test.

**NAME OF TEST** Cholecystography (Oral) (GB Series)

If the GB cannot be visualized with an oral contrast substance, an IV cholangiography may be ordered. *If the client is also having GI x-rays with barium, the GB tests should be done first, because barium would interfere with the test.*

**PURPOSE AND DESCRIPTION** To detect gallbladder stones, inflammation or tumors, and obstruction of the cystic duct. Evening before the test, radiopaque tablets (for example, iopanoic acid [Telepaque], sodium ipodate [Oragrafin], iodoalphionic acid [Priodax], or iodipamide meglumine [Cholografin]) are given, the following morning x-rays are taken. A high-fat meal may be given after the fasting x-rays are completed and further x-rays taken to determine how fast the GB expels the dye.

**RELATED NURSING CARE** Advise client to eat a fat-free diet 24 hours prior to test. No food or fluids except sips of water should be taken 12 hours before the test. Assess client for allergy to iodine, seafood, or x-ray dye (many contain iodine).

**NAME OF TEST** Cholangiography

- Percutaneous Transhepatic Cholangiogram (PTC)
- Surgical Cholangiogram

**PURPOSE AND DESCRIPTION** A PTC is done to evaluate filling of the hepatic and biliary ducts. Using local anesthesia, the liver and bile duct is entered with a long needle (using fluoroscopy), bile is withdrawn, and a contrast medium is injected into the bile duct.

During a surgical cholangiogram with general anesthesia, contrast medium is injected into the common bile duct to evaluate filling of the common bile duct.

**RELATED NURSING CARE** Assess client for allergy to iodine, seafood, or x-ray dye (many contain iodine). Monitor for bile leakage or hemorrhage following the tests.

**NAME OF TEST** Magnetic Resonance Cholangiopancreatography (MRCP)

**PURPOSE AND DESCRIPTION** This noninvasive MRI study is done to evaluate the biliary and pancreatic ducts

**RELATED NURSING CARE** Assess for metal implants or pregnancy (will not do the exam if present).

**NAME OF TEST** Computed Tomography (CT)

**PURPOSE AND DESCRIPTION** A noninvasive procedure, using radio-frequency waves and a magnetic field; used to evaluate disorders of the GB, pancreas, biliary tract, and liver.

**RELATED NURSING CARE** No special preparation is needed.

**NAME OF TEST** Endoscopic Retrograde Cholangiopancreatography (ERCP)

**PURPOSE AND DESCRIPTION** To directly visualize gastrointestinal structures, and to retrieve gallstones from the distal common bile duct, dilate structures, and biopsy tumors. A fiberoptic endoscope is inserted (under fluoroscopy) through the mouth through the esophagus, stomach, and descending duodenum, and the common bile ducts and pancreatic ducts are cannulated. Contrast medium is injected into the ducts and structures are visualized.

**RELATED NURSING CARE** Advise the client to be NPO for 8 hours before the test. Following the test, assess vital signs and gag reflex, and monitor for complications (pancreatitis is the most common).

**NAME OF TEST** Serum Lipase

**PURPOSE AND DESCRIPTION** This blood test is used to measure the secretion of lipase by the pancreas.

**Normal value:** 0–160 Unit/L

**RELATED NURSING CARE** No special preparation is needed.

## DIAGNOSTIC TESTS of Gastrointestinal Disorders (continued)

**NAME OF TEST** Serum Amylase

**PURPOSE AND DESCRIPTION** This blood test is used to measure the secretion of amylase by the pancreas. It is used to diagnose acute pancreatitis, when amylase level peaks in 24 h and then drops to normal in 48 to 72 h.

**Normal value:** 0–130 Unit/L

**RELATED NURSING CARE** No special preparation is needed.

### LIVER TESTS

**NAME OF TEST** Liver Biopsy

**PURPOSE AND DESCRIPTION** To rule out metastatic cancer or to detect a cyst or cirrhosis of the liver. Using ultrasound, a biopsy needle is inserted into the liver and guided to the pathologic site. See Figure 21–6 ■.

**RELATED NURSING CARE** Related nursing care of the client having a liver biopsy is described below.

#### PREPARATION OF CLIENT

- Review chart for signed consent form.
- Withhold food and fluids per policy, usually 4 to 6 hours preprocedure.
- Assess and record baseline vital signs.
- Review prothrombin time (PT) and platelet count; administer vitamin K as ordered.
- Instruct to empty bladder immediately before the biopsy.
- Place in supine position on far right side of bed; turn head to left and extend right arm above head to improve access to the biopsy site.

#### HEALTH EDUCATION FOR THE CLIENT AND FAMILY

- Discuss preparation for the biopsy and expected sensations during the procedure.
- Hold your breath following expiration during needle insertion to keep diaphragm and liver high and stabilized in the abdominal cavity.
- Obtaining the tissue sample usually requires only 10 to 15 seconds; there may be some pain or discomfort during this time.
- Direct pressure is applied to the site immediately after the needle is removed; you will be placed on your right side to maintain site pressure.
- You may develop pain in the right shoulder as the anesthetic loses effect.

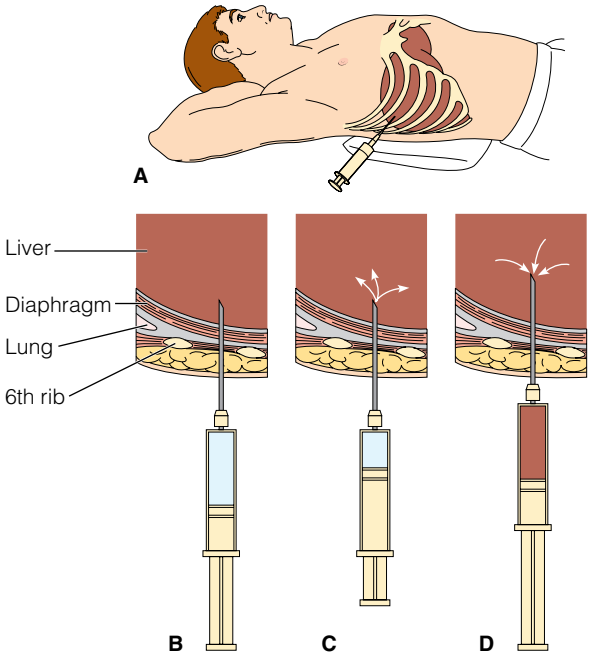



**Figure 21–6** ■ Liver biopsy. *A*. The client exhales completely, then holds his or her breath. This brings the liver and diaphragm to their highest position. *B*. The biopsy needle is inserted into the liver. *C*. Approximately 1 mL of saline is injected to clear the needle of blood and tissue. *D*. The needle is advanced, and a tissue sample is aspirated. Pressure is applied to the site immediately after the needle is withdrawn. The specimen is sent to the laboratory for analysis.

- You will be monitored for bleeding after the procedure.
- Food and fluids are withheld for 2 hours after the biopsy; you then can resume your usual diet.
- Avoid coughing, lifting, or straining for 1 to 2 weeks.

*Note*: A wide variety of blood tests are used to diagnose and monitor liver disease. These are discussed in appropriate interdisciplinary care sections in Chapter 24 ∞.

vitamins) is the client currently taking? Does the client take any vitamins, herbal supplements, or other "health food" items? Does the client consume alcohol (how much and type)? If the client has experienced nausea or vomiting, ask whether the vomitus contains bright red blood, dark (old) blood, bile, or fecal material. If the client is very thin or verbalizes concerns about body size incongruent with the ratio of height to weight, ask whether the client induces vomiting or uses laxatives to control weight. Ask whether the client has appliances such as braces, bridges, or dentures, and what self-care measures are used for such appliances, as well as oral hygiene practices and frequency of dental visits.

Ask the client to describe any heartburn, indigestion, abdominal discomfort, or pain. Explore the location of the pain, the type of pain, the time it occurs, foods that aggravate or relieve it, and how it is relieved. Abdominal pain is often referred to other sites (see Chapter 9 ∞ ). For example, a client with a liver disorder may experience pain over the right shoulder (Kehr's sign). Epigastric (middle upper abdominal) pain is experienced in cases of acute gastritis, obstruction of the small intestine, and acute pancreatitis. Pain in the right upper quadrant is associated with cholecystitis. Pain in the left upper quadrant may be related to a gastric ulcer.

The health history should include questions about any prior surgeries or trauma of the GI tract. Explore the past history of any medical condition that may affect the client's ingestion, digestion, and/or metabolism (for example, Crohn's disease, diabetes mellitus, irritable bowel syndrome, peptic ulcers, or pancreatitis). Other areas significant to assessment of nutritional status and the gastrointestinal system are food allergies (especially to milk, which is evidenced as lactose intolerance with abdominal cramping, excessive flatus, and loose stools) and a family history that may provide clues to increased risk for health problems.

## FUNCTIONAL HEALTH PATTERN INTERVIEW **Nutritional Status and Gastrointestinal System**

| Functional Health Pattern | Interview Questions and Leading Statements |
|---|---|
| Health Perception-Health Management | ■ Have you had any illness or surgery that affects your nutrition and digestion? If so, how were these treated?<br>■ Describe your current problem; how long has it lasted; what have you done to treat it?<br>■ What medications do you take? Do you take antacids? If so, what do you use them for and how often do you take them?<br>■ Do you have allergies to foods? What are they and how do you react?<br>■ Do you have tooth or gum pain that interferes with your ability to eat?<br>■ When was your last dental examination?<br>■ Describe what you do each day to take care of your teeth. |
| Nutritional-Metabolic | ■ Describe what you eat and how much (and type) of fluids you drink in a 24-hour period.<br>■ Describe herbs, vitamins, and dietary supplements you currently are taking.<br>■ Have you noticed any change in your appetite? Explain.<br>■ What is your current weight? What do you feel your ideal weight would be? Have you had a recent gain or loss? Explain.<br>■ Describe your food likes and dislikes.<br>■ Do you have any of the following: indigestion, belching, nausea, vomiting, difficulty swallowing? If so, what causes this and how do you treat it?<br>■ Do you drink alcohol? If so, what type? Describe your average number of drinks each day.<br>■ Questions specific to the client's culture and ethnic group would be included in this functional health pattern area, such as what types of food are preferred or not eaten, what types of foods are never eaten together, and what types of foods are eaten to remain healthy. |
| Elimination | ■ Are your bowel movements affected by what you eat? Explain.<br>■ Have you noticed any change in the color of your urine or bowel movements? Explain.<br>■ Have you ever used laxatives or made yourself vomit to control your weight? Explain. |
| Activity-Exercise | ■ Describe your activities on a typical day.<br>■ What type of exercise do you get and how often?<br>■ Do you smoke? If so, what and how many cigarettes per day? |
| Sleep-Rest | ■ Do you wake up hungry during the night?<br>■ Does abdominal pain, cramping, nausea, or diarrhea ever interfere with your sleep? Explain. |
| Cognitive-Perceptual | ■ Describe the amount and type of foods you should eat each day.<br>■ Rate your ability to taste and smell foods on a scale of 1 to 10 (with 10 being excellent).<br>■ Describe any pain you have had in your mouth, stomach, or abdomen. What type of pain was it (dull, crampy, achy, burning)? What seems to cause it? What do you do to relieve it? |
| Self-Perception-Self-Concept | ■ Are you satisfied with your appearance in terms of weight? If no, why?<br>■ Have you been successful in the past in gaining or losing weight?<br>■ How does this condition make you feel about yourself? |
| Role-Relationships | ■ How does this condition affect your relationships with others?<br>■ Do you eat with others regularly? If so, who. |
| Sexuality-Reproductive | ■ Has this condition interfered with your usual sexual activities? |
| Coping-Stress-Tolerance | ■ Have you experienced any type of stress that may have worsened this condition?<br>■ Has having this condition created stress for you?<br>■ Describe what you do when you feel stressed. |
| Value-Belief | ■ Tell me how specific relationships or activities help you cope with this problem.<br>■ Describe specific cultural beliefs or practices that affect how you care for and feel about this condition.<br>■ Are there any specific treatments that you would not use to treat this condition? |

In addition to other factors assessed in the health history, culture and ethnicity are important components of nutritional status and gastrointestinal health. Nutritional diversity is common among cultural and ethnic groups and questions should be included to identify specific customs, food likes and dislikes, and how foods are prepared and served. In some ethnic groups, for example, dietary substances are used to protect health, such as eating raw garlic or onions (Spector, 2004). In other cultures, dietary balance is believed to be necessary to keep the body in balance or harmony. It is therefore necessary for nurses to be cognizant of specific culturally related nutritional values and practices, and ask questions to identify health-related concerns specific to individualized dietary intake.

Interview questions categorized by functional health patterns are listed in the box on the previous page.

## Physical Assessment

Physical assessment of gastrointestinal and nutritional status may be performed as part of a total health assessment, as a focused assessment of clients with known or suspected health problems, in combination with assessment of the urinary and reproductive systems (problems that may cause manifestations similar to those of the gastrointestinal system), or alone for clients with known or suspected health problems. The techniques of inspection, auscultation, percussion, and palpation are used. Palpation is the last method used in assessing the abdomen.

**PRACTICE ALERT**

When assessing the abdomen, use palpation last, because pressure on the abdominal wall and contents may interfere with bowel sounds and cause pain, ending the examination.

Collect objective data by obtaining anthropometric measurements (height, weight, triceps skin folds, and midarm circumference) and by examining the mouth and abdomen. Prior to the examination, collect all necessary equipment and explain techniques to the client to decrease anxiety. The client may be seated during assessment of the mouth, but is supine during the abdominal assessment.

Physical assessment of the integumentary system, nervous system, musculoskeletal system, cardiovascular system, and respiratory system may also reflect the client's nutritional status. Table 21–5 summarizes abnormal nutritional assessment findings related to these body systems. Normal age-related findings for the older adult are summarized in Table 21–6.

TABLE 21–5 **Assessment Findings Due to Malnutrition**

| BODY SYSTEM | ASSESSMENT FINDINGS |
|---|---|
| Nails | Soft and spoon shaped in iron deficiency. Splinter hemorrhages in vitamin C deficiency. |
| Hair | Dry, dull, and scarce in zinc, protein, and linoleic acid deficiencies. |
| Skin | Flaky and dry in vitamin A, vitamin B, and/or linoleic acid deficiency. Cracks and/or hyperpigmentation in niacin deficiency. Bruising in vitamin C or vitamin K deficiency. |
| Eyes | Eyes become dry and soft with decrease in vitamin A. Conjunctiva is pale with a decrease in iron, and red with a decrease in riboflavin. |
| Nervous system | Reflexes are decreased and client may have peripheral neuropathies with thiamine deficiency. Client may be irritable and/or disoriented with thiamine deficiency. |
| Musculoskeletal system | Muscle wasting is seen with deficits in protein, carbohydrate, and fat metabolism. Calf pain occurs with thiamine deficiency; joint pain may occur with vitamin C deficiency. |
| Cardiovascular system | Heart size and rate may increase with thiamine deficiency. Diastolic blood pressure may be increased with a high intake of fat. Lowered cardiac output and decreased blood pressure may occur with caloric deficiencies over a long time period. |
| Gastrointestinal system | Cheilosis (sores at corner of mouth) seen in vitamin B-complex deficiencies, especially riboflavin. Stomatitis and spongy, bleeding gums may also be seen in malnutrition. |

TABLE 21–6 **Age-Related Gastrointestinal Changes**

| AGE-RELATED CHANGE | SIGNIFICANCE |
|---|---|
| Teeth: ↑ number of root cavities and cavities around existing dental work; tooth enamel harder and more brittle; dentin is more fibrous; tooth cusps flatten; root pulp shrinks; ↑ loss of bone supporting teeth | Increase in periodontal disease and tooth loss<br>Increase in fractures of teeth<br>Increased incidence of dentures |
| Gums: Gingiva retracts | Increase in periodontal disease |
| Taste: Less acute as tongue atrophies, especially for sweet sensations | Excessive seasoning of foods |
| Saliva: ↓ amount is produced (1/3 of that produced in younger years) | Decreased ability to break down starches<br>Swallowing may take longer |
| Esophageal motility: ↓ intensity of propulsive waves and slower emptying time, weaker gag reflex | Discomfort when swallowing food<br>Increased risk of aspiration |
| Stomach: Mucosa atrophies, ↓ production of hydrochloric acid and pepsin leading to higher pH in stomach | Increase in incidence of gastric irritation |
| Liver: Less efficient handling of cholesterol | Increased incidence of gallstones |

# NUTRITIONAL AND GASTROINTESTINAL ASSESSMENTS

| Technique/Normal Findings | Abnormal Findings |
|---|---|

## Anthropometric Assessment with Abnormal Findings

**Weigh the client and measure the client's height. Compare the client's actual weight to ideal body weight (IBW) (Table 21–7).** *Weight should be appropriate to height as indicated on a standardized table.*

- A weight 10% to 20% less than ideal body weight indicates malnutrition.
- A weight 10% above ideal body weight is considered overweight.
- A weight 20% above ideal body weight is considered obese.

**TABLE 21–7 Example of a Height and Weight Table**

| | HEIGHT | | WEIGHT* | | |
|---|---|---|---|---|---|
| | FEET | INCHES | SMALL FRAME | MEDIUM FRAME | LARGE FRAME |
| Men (ages 25–29) | 5 | 2 | 128–134 | 131–134 | 138–150 |
| | 5 | 3 | 130–136 | 133–143 | 140–153 |
| | 5 | 4 | 132–138 | 135–145 | 142–156 |
| | 5 | 5 | 134–140 | 137–148 | 144–160 |
| | 5 | 6 | 136–142 | 139–151 | 146–164 |
| | 5 | 7 | 138–145 | 142–154 | 149–168 |
| | 5 | 8 | 140–148 | 145–157 | 152–172 |
| | 5 | 9 | 142–151 | 148–160 | 155–176 |
| | 5 | 10 | 144–154 | 151–163 | 158–180 |
| | 5 | 11 | 146–157 | 154–166 | 161–184 |
| | 6 | 0 | 149–160 | 157–170 | 164–188 |
| | 6 | 1 | 152–164 | 160–174 | 168–192 |
| | 6 | 2 | 155–168 | 164–178 | 172–197 |
| | 6 | 3 | 158–172 | 167–182 | 176–202 |
| | 6 | 4 | 162–176 | 171–187 | 181–207 |
| Women (ages 25–29) | 4 | 10 | 102–111 | 109–121 | 118–131 |
| | 4 | 11 | 103–113 | 111–123 | 120–134 |
| | 5 | 0 | 104–115 | 113–126 | 122–137 |
| | 5 | 1 | 106–118 | 115–129 | 125–140 |
| | 5 | 2 | 108–121 | 118–132 | 128–143 |
| | 5 | 3 | 111–124 | 121–135 | 131–147 |
| | 5 | 4 | 114–127 | 124–138 | 134–151 |
| | 5 | 5 | 117–130 | 127–141 | 137–155 |
| | 5 | 6 | 120–133 | 130–144 | 140–159 |
| | 5 | 7 | 123–136 | 133–147 | 143–163 |
| | 5 | 8 | 126–139 | 136–150 | 146–167 |
| | 5 | 9 | 129–142 | 139–153 | 149–170 |
| | 5 | 10 | 132–145 | 142–156 | 152–173 |
| | 5 | 11 | 135–148 | 145–159 | 155–176 |
| | 6 | 0 | 138–151 | 148–162 | 158–179 |

**Calculate the client's percentage of ideal body weight (%IBW). Use the formula in Table 21–8 to determine the presence of obesity and/or malnutrition based on percentage of ideal body weight).** *Ideal body weight should be within normal range.*

**TABLE 21–8 Indications of Nutritional Status by Body Weight**

| %IBW | %UBW | NUTRITIONAL STATUS |
|---|---|---|
| >120 | — | Obese |
| 110–120 | — | Overweight |
| 80–90 | 85–95 | Mildly undernourished |
| 70–79 | 75–84 | Moderately undernourished |
| <70 | <75 | Severely undernourished |

UBW = usual body weight

| Technique/Normal Findings | Abnormal Findings |
|---|---|
| Calculate the client's percentage of usual body weight (% UBW) to determine weight change, using this formula:<br>$\frac{\text{Current weight}}{\text{Usual weight}} \times 100$<br>Refer to Table 21–8 to determine nutritional status based on %UBW. | ■ Using %IBW may result in overlooking malnutrition in a very obese client. |
| Measure body mass index (BMI). Determine BMI by using one of the following formulas. *BMI should be between 20 and 25.*<br>$\frac{\text{Weight in kilograms}}{\text{Height in meters}^2} = \text{BMI}$<br>$\frac{\text{Weight in pounds} \times 705}{\text{Height in inches}^2} = \text{BMI}$ | ■ A BMI of 25 to 29.9 kg/m$^2$ indicates overweight.<br>■ A BMI of 30 kg/m$^2$ indicates obesity. |
| Measure triceps skinfold thickness (TSF). Find the midpoint between the client's olecranon and acromion processes. Grasp the skin and fat, and pull it away from the muscle. Apply skinfold calipers for 3 seconds, and record reading (Figure 21–7 ■). Repeat three times, and average the three readings. Compare the client's reading to the standard values shown in Table 21–9. *TSF should be within normal range as compared to standard values.* | ■ Triceps readings are 10% or more below standards in malnutrition and 10% or more above standards in obesity or overnutrition. |

**Figure 21–7** ■ Measuring MAC with calipers.

**TABLE 21–9 Values for Anthropometric Measurements**

| | STANDARD VALUE | |
|---|---|---|
| **MEASUREMENT** | **MALE** | **FEMALE** |
| Triceps skinfold thickness | 12.5 mm | 16.5 mm |
| Midarm circumference | 29.3 cm | 28.5 cm |
| Midarm muscle circumference | 25.3 cm | 23.2 cm |

| | |
|---|---|
| Measure midarm circumference (MAC). Find the midpoint between the client's olecranon and acromion processes. Wind tape measure around arm (Figure 21–8 ■). Compare the client's reading to the standard values shown in Table 21–9. *MAC should be within normal range as compared to standard values.* | ■ MAC decreases with malnutrition and increases with obesity. |

**Figure 21–8** ■ Measuring MAC with a tape measure.

| Technique/Normal Findings | Abnormal Findings |
|---|---|
| Calculate midarm muscle circumference (MAMC). Use the client's triceps skinfold measurement and midarm circumference readings to calculate the client's MAMC:<br>Compare the result to the standard values shown in Table 21–9. *MAMC should be within normal range as compared to standard values.* | ■ In mild malnutrition, the MAMC is 90% of the standard; in moderate malnutrition, 60% to 90%. In severe malnutrition (muscle wasting), the MAMC is less than 60% of the standard.<br>$MAMC = MAC - (0.314 \times TSF)$ |
| Determine waist-to-hip ratio. With the client standing measure the waist, and then measure the hips midway between the iliac crest and the greater trochanter. Use the formula below to calculate the waist-to-hip ratio. *Normal findings: females, waist ratio less than or equal to 0.80; males, waist ratio less than or equal to 1.0.* | ■ Females with a ratio greater than 0.80 and males with a ratio greater than 1.0 have a three to five times greater risk for having a heart attack or stroke (Weber & Kelley, 2003).<br>$\frac{\text{Waist circumference}}{\text{Hip circumference}} = \text{waist-to-hip ratio}$ |

## Oral Assessment with Abnormal Findings

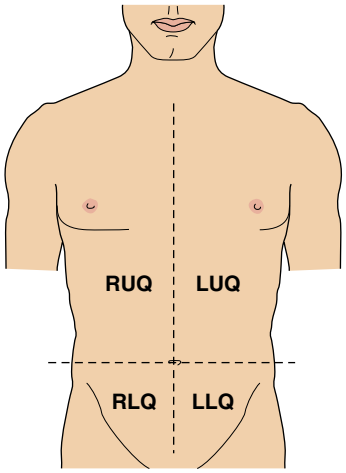
| | |
|---|---|
| Inspect and palpate the lips. *Lips should be of normal color for race without lesions.* | ■ **Cheilosis** (painful lesions at corners of mouth) is seen with riboflavin and/or niacin deficiency.<br>■ Cold sores or clear vesicles with a red base are seen in herpes simplex 1. |
| Inspect and palpate the tongue. *Tongue should be pink, smooth, and have good turgor.* | ■ Atrophic smooth **glossitis** is characterized by a bright red tongue. It is seen in $B_{12}$, folic acid, and iron deficiencies.<br>■ Vertical fissures are seen in dehydration.<br>■ A black, hairy tongue may be seen following antibiotic therapy. |
| Inspect and palpate the buccal mucosa. *Mucosa should be moist, without lesions and of appropriate color.* | ■ **Leukoplakia** (small white patches) may be a sign of a premalignant condition.<br>■ A reddened, dry, swollen mucosa may be seen in stomatitis.<br>■ Candidiases (white cheesy patches that bleed when scraped) may be seen in immune-suppressed clients receiving antibiotics or chemotherapy and in terminally ill clients. |
| Inspect and palpate the teeth. *Teeth should be in a state of good hygiene without caries.* | ■ Cavities and excessive plaque are seen with poor nutrition and/or poor oral hygiene. |
| Inspect and palpate the gums. *Gums should be of even color without swelling.* | ■ Swollen, red gums that bleed easily (**gingivitis**) are seen in periodontal disease, vitamin C deficiencies, or with hormonal changes. |
| Inspect the throat and tonsils. *Tonsils (if present) should be of appropriate color and size.* | ■ In acute infections, tonsils are red and swollen and may have white spots. |
| Note the client's breath. *Breath should not have unusual or foul odors.* | ■ Sweet, fruity breath is noted in diabetic ketoacidosis.<br>■ Acetone breath may be a sign of uremia.<br>■ Foul breath may result from liver disease, respiratory infections, and poor oral hygiene. |

**PRACTICE ALERT**
Always wear gloves when assessing the oral cavity.

**Technique/Normal Findings** **Abnormal Findings**

## Abdominal Assessment with Abnormal Findings

**The quadrants of the abdomen, with related internal structures, are illustrated in Figure 21–9 ■. Box 21–2 provides guidelines for abdominal assessment.**




**Right Upper Quadrant**
Liver and gallbladder
Pylorus
Duodenum
Head of pancreas
Right adrenal gland
Portion of right kidney
Hepatic flexure of colon
Portions of ascending and transverse colon

**Left Upper Quadrant**
Left lobe of liver
Spleen
Stomach
Body of pancreas
Left adrenal gland
Portion of left kidney
Splenic flexure of colon
Portions of transverse and descending colon

**Midline**
Aorta
Bladder
Uterus

◯ = Umbilicus

**Right Lower Quadrant**
Lower pole of right kidney
Cecum and appendix
Portion of ascending colon
Bladder (if distended)
Right ovary and salpinx
Right spermatic cord
Right ureter

**Left Lower Quadrant**
Lower pole of left kidney
Sigmoid colon
Portion of descending colon
Bladder (if distended)
Left ovary and salpinx
Uterus (if enlarged)
Left spermatic cord
Left ureter

**Figure 21–9** ■ The four quadrants of the abdomen, with anatomic location of organs within each quadrant.

### BOX 21–2 Guidelines for Assessing the Abdomen

Ask the client to empty the bladder before beginning the examination. Assist the client to the dorsal recumbent (supine) position, with a small pillow under the head, a pillow under the knees (if desired), and the arms at the sides of the body. Warm the stethoscope before applying it to the client's skin. Ask the client to point to areas that are painful, and explain that those areas will be examined last. Expose the abdomen from below the breasts to the pubic symphysis, and drape the client's thoracic and genital areas. When you document your findings, specify the location by abdominal quadrant.

General guidelines for abdominal assessment are as follows:

1. Inspect the abdomen under a good light source that is shining across the abdomen. Sit at the right side of the client, and note symmetry, distention, masses, visible peristalsis, and respiratory movements. If masses are detected, ask the client to take a deep breath, which decreases the size of the abdominal cavity and makes any abnormality more visible.
2. Auscultate each quadrant of the abdomen, using the diaphragm of the stethoscope Listen for bowel sounds, arterial bruits, venous hums, and friction rubs.
3. Percuss several areas within each quadrant of the abdomen, using a systematic path. (For example, always begin in the lower left quadrant, then proceed to the lower right quadrant, upper right quadrant, and upper left quadrant, respectively). The predominant percussion tones for the entire abdomen are tympany and dullness. Tympany is present over gas-filled intestines. Dullness is present over the liver, the spleen, an enlarged kidney, or a full stomach. Percuss for fluid, gaseous distention, and masses.
4. Palpate each quadrant of the abdomen for shape, position, mobility, size, consistency, and tenderness of the major abdominal organs. Begin this part of the assessment with light palpation, and increase the depth of palpation to elicit tenderness or better identify organ size and shape. Deep palpation should be conducted only by nurses with considerable experience. Remember to palpate areas of indicated tenderness last and to use gentle pressure. Palpation may be difficult or impossible if the client exhibits muscle guarding from pain or is ticklish. The gallbladder and the spleen are normally not palpable

**Inspect abdominal contour, skin integrity, venous pattern, and aortic pulsation.** *Abdomen should be slightly concave or rounded with intact skin. There should not be distended veins or obvious aortic pulsations.*

- Generalized abdominal distention may be seen in gas retention or obesity.
- Lower abdominal distention is seen in bladder distention, pregnancy, or ovarian mass.
- General distention and an everted umbilicus are seen with ascites and/or tumors.
- A scaphoid (sunken) abdomen is seen in malnutrition or when fat is replaced with muscle.
- **Striae** (whitish-silver stretch marks) are seen in obesity and during or after pregnancy.
- Spider angiomas may be seen in liver disease.
- Dilated veins are prominent in cirrhosis of the liver, ascites, portal hypertension, or venocaval obstruction.
- Pulsation is increased in aortic aneurysm.

| Technique/Normal Findings | Abnormal Findings |
|---|---|
| **Auscultate all four quadrants of the abdomen with the diaphragm of the stethoscope (Figure 21–10 ■). Begin in the lower right quadrant, where bowel sounds are almost always present.** *Normal bowel sounds (gurgling or clicking) occur every 5 to 15 seconds. Listen for at least 5 minutes in each of the four quadrants to confirm the absence of bowel sounds.* | ■ **Borborygmus** (hyperactive high-pitched, tinkling, rushing, or growling bowel sounds) is heard in diarrhea or at the onset of bowel obstruction.<br>■ Bowel sounds may be absent later in bowel obstruction, with an inflamed peritoneum, and/or following surgery of the abdomen. |

**Figure 21–10 ■** Auscultating the abdomen with the diaphragm of the stethoscope.

**Auscultate the abdomen for vascular sounds with the bell of the stethoscope (Figure 21–11 ■).** *No sounds (bruits, venous hum, or friction rub) other than bowel sounds should be auscultated.*

■ **Bruits** (blowing sound due to restriction of blood flow through vessels) may be heard over constricted arteries. A bruit over the liver may be heard in hepatic carcinoma.
■ A venous hum (continuous medium-pitched sound) may be heard over a cirrhotic liver.
■ Friction rubs (rough grating sounds) may be heard over an inflamed liver or spleen.

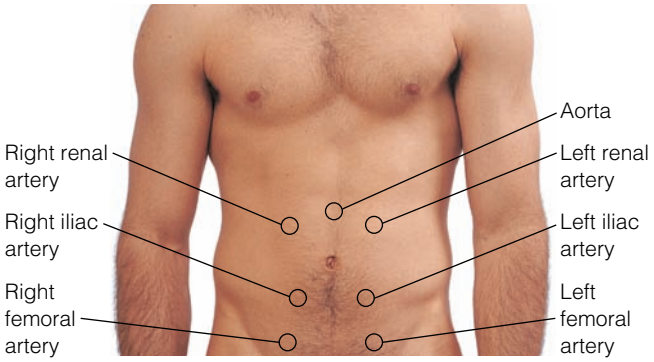



**Figure 21–11 ■** Location of placement of the stethoscope for auscultation of arteries of the abdomen.

**Percuss the abdomen in all four quadrants (Figure 21–12 ■).** *Normally, tympany is heard over the stomach and gas-filled bowels.*

■ Dullness is heard when the bowel is displaced with fluid or tumors or filled with a fecal mass.

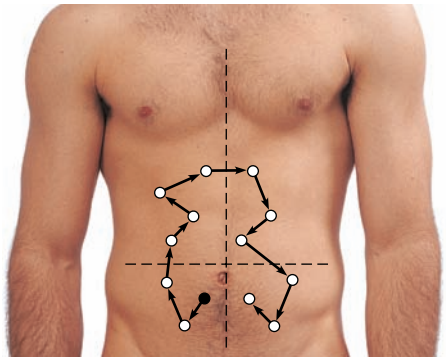


**Figure 21–12 ■** Location of sites for systematic percussion of all four quadrants.

| Technique/Normal Findings | Abnormal Findings |
|---|---|
| **Percuss the liver (see Box 21–3 for guidelines for liver percussion and palpation; see Figure 21–13 ■ for landmarks).** *The lower border of liver dullness is located at the costal margin to 1 to 2 cm below.* | ■ In cirrhosis and/or hepatitis, the liver is greater than 6 to 10 cm in the MCL and greater than 4 to 8 cm in the midsternal line (MSL). |

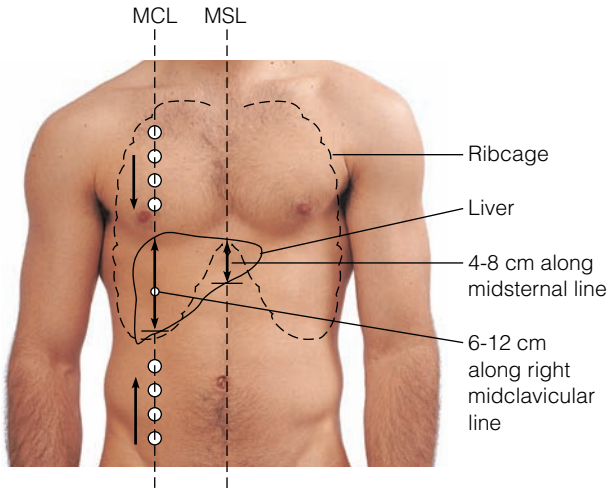



**Figure 21–13** ■ Anatomic location of the liver, with the midclavicular line (MCL) and midsternal line (MSL) superimposed. The normal liver span is 6 to 12 cm.

## BOX 21–3 Guidelines for Percussing and Palpating the Liver

The size of the liver may be determined by percussion and palpation, as follows:

1. Percuss, in the midclavicular line (MCL), beginning below the umbilicus (see Figure 21–13). Begin to percuss over a region of tympany, and move upward. The first dull percussion tone occurs at the lower border of the liver. Determine the upper liver border by beginning percussion over an area of lung resonance (in the MCL) and percussing downward to the first dull tone. Usually at the 5th to 7th interspace. Mark each of these locations, and measure the distance from one mark to the other to determine liver size. The normal liver size is 6 to 12 cm in the MCL; however, men have larger livers than women.
2. Conduct bimanual palpation of the liver by placing your left hand under the client at the level of the 11th to 12th ribs and applying upward pressure. Place your right hand below the costal margin, ask the client to take a deep breath, and palpate for the liver border. The liver is not normally palpable in a healthy adult, although it may be in very thin people.

| | |
|---|---|
| **Percuss the spleen for dullness posterior to the midaxillary line at the level of the 6th to 11th rib (Figure 21–14 ■).** *The spleen is percussed as an oval area of dullness approximately 7 cm wide near the left 10th rib and slightly posterior to the midaxillary line.* | ■ A large area of dullness that extends to the left anterior axillary line on inspiration is associated with an enlarged spleen and may be related to trauma, infection, or mononucleosis. |

**Figure 21–14** ■ Percussing the spleen.

| Technique/Normal Findings | Abnormal Findings |
|---|---|
| Percuss for shifting dullness (Figure 21–15 ■). *If ascites is not present, the borders between tympany and dullness remain relatively constant despite position changes.* | ■ In a client with ascites, the level of dullness increases when the client turns to the side. |

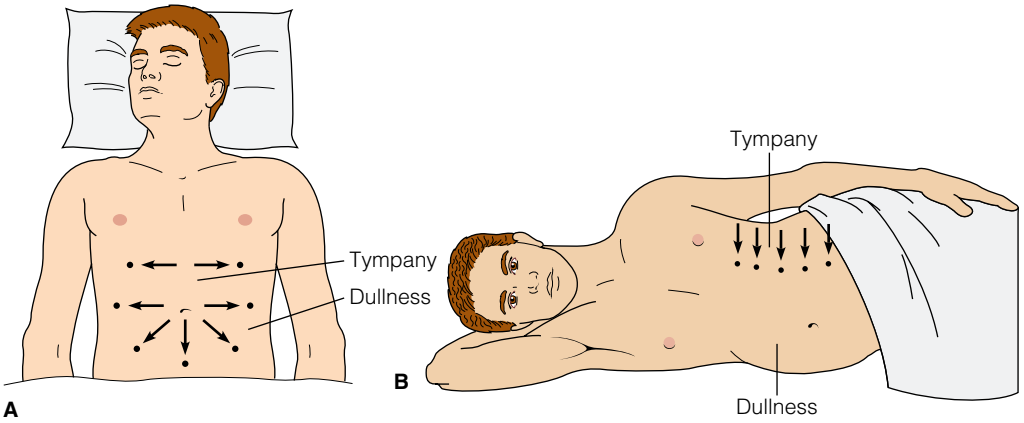



**Figure 21–15** ■ Percussing for shifting dullness in ascites. *A,* Common percussion tones when the client is lying supine; *B,* changes in percussion tones (shifting dullness) when the client turns to the side.

| | |
|---|---|
| Palpate the abdomen in all four quadrants. *There should be no abdominal masses or pain on palpation.* Use a circular motion to move the abdominal wall over underlying structures (Figure 21–16 ■). Feel for masses and note any tenderness or pain the client may have during this part of the exam. Palpate lightly at first (0.5 to 0.75 inch), then deeply (1.5 to 2 inches) with caution. If a mass is palpated, ask the client to raise head and shoulders. A mass in the abdomen may become more prominent with this maneuver, as will a ventral abdominal wall hernia. If the mass is no longer palpable, it is deeper in the abdomen. | ■ In cases of peritoneal inflammation, palpation causes abdominal pain and involuntary muscle spasms.<br>■ Abnormal masses include aortic aneurysms, neoplastic tumors of the colon or uterus, and a distended bladder or distended bowel due to obstruction.<br>■ A rigid, boardlike abdomen may be palpated when the client has a perforated duodenal ulcer. |

**PRACTICE ALERT**
Never use deep palpation in a client who has had a pulsatile abdominal mass, renal transplant, polycystic kidneys, or is at risk for hemorrhage.

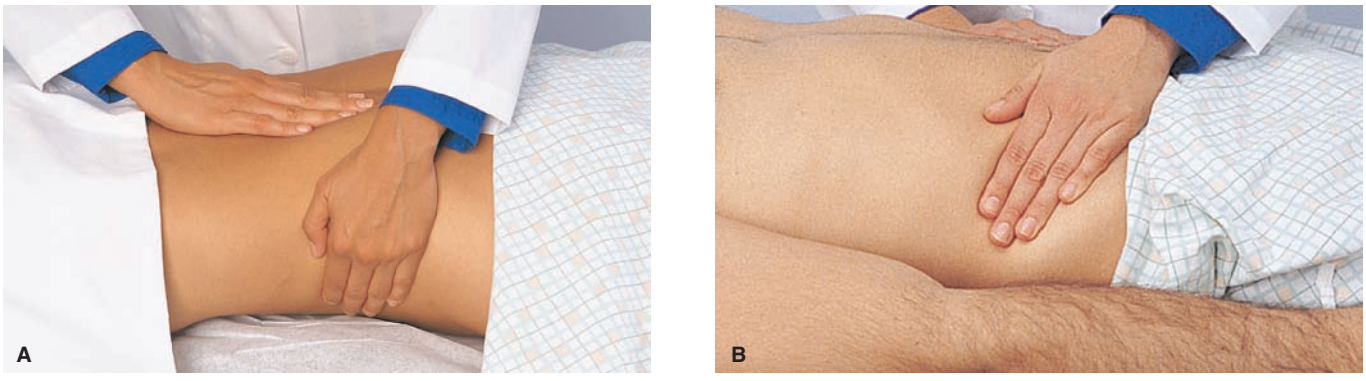



**Figure 21–16** ■ Light to moderate palpation of the abdomen. *A,* In light palpation, the examiner, keeping the fingers approximated, gently depresses the abdominal wall about 1 cm to assess for large masses, slight tenderness, and muscle guarding. *B,* The examiner performs moderate palpation by using the palm or the side of the hand to depress the abdominal wall to a slightly greater depth than in light palpation. This technique is useful for assessing abdominal organs that move with respiration (such as the liver and the spleen).

| Technique/Normal Findings | Abnormal Findings |
|---|---|
| Palpate for rebound tenderness. Press the fingers into the abdomen slowly and release the pressure quickly. *Releasing pressure should not cause or increase pain.* | ■ In peritoneal inflammation, pain occurs when the fingers are withdrawn.<br>■ Right upper quadrant pain occurs with acute cholecystitis.<br>■ Upper middle abdominal pain occurs with acute pancreatitis.<br>■ Right lower quadrant pain occurs with acute appendicitis.<br>■ Left lower quadrant pain is seen in acute diverticulitis. |
| Palpate the liver (Figure 21–17 ■). Note whether the client guards the abdomen or reports any sharp pain, especially on inspiration. *The abdomen should be nontender, and the liver is usually nonpalpable.* | ■ An enlarged liver with a smooth, tender edge may indicate hepatitis or venous congestion.<br>■ An enlarged, nontender liver may be felt in malignant condition.<br>■ The client with inflammation of the gallbladder feels sharp pain on inspiration and stops inspiring. This is called Murphy's sign. |

**Figure 21–17** ■ Palpating the liver with the bimanual method.

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## TEST YOURSELF NCLEX-RN® REVIEW

1 What is the digestive function of the liver?
**1.** to secrete bile
**2.** to release glucose
**3.** to synthesize plasma proteins
**4.** to store iron as ferritin

2 The breakdown of carbohydrates to produce ATP is an example of:
**1.** metabolism.
**2.** anabolism.
**3.** catabolism.
**4.** lipidism.

3 Your client asks you what type of foods are complete proteins. What would be your best response?
**1.** none
**2.** eggs and milk
**3.** fruits and vegetables
**4.** butter and oils

4 A client who is deficient in vitamin K may have what type of problem with minor surgery?
**1.** infection
**2.** blood clotting
**3.** keloid formation
**4.** slow peristalsis

5 During a health history for nutritional problems, it is important to ask the client to describe:
1. the type, amount, and character of pain experienced.
2. the odor and color of urine.
3. the ability to put joints through full range of motion.
4. the usual food and fluid intake for a 24-hour period.

6 On monitoring a client's lab results, you notice a greatly elevated serum amylase level. What disease does this indicate?
1. cheilosis
2. gastric reflux
3. gallstones
4. acute pancreatitis

7 While assessing an older adult, you notice her teeth have obvious caries and she has difficulty swallowing. She says, "My mouth is so dry." What health problem might result from these findings?
1. nutritional deficit
2. acute pain
3. altered elimination
4. risk for infection

8 Which quadrant of the abdomen would you palpate to assess the liver border?
1. right upper
2. right lower
3. left upper
4. left lower

9 Clients with ascites are assessed for changes in what type of percussion sounds?
1. inaudible bowel sounds
2. resonance
3. alternating amplitude
4. shifting dullness

10 When assessing the abdomen, what assessment technique is used last?
1. observation
2. auscultation
3. palpation
4. percussion

*See Test Yourself answers in Appendix C.*

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