PART III: MAINTENANCE OF THE HUMAN BODY
CHAPTER 14: DIGESTIVE SYSTEM AND NUTRITION

LEARNING OUTCOMES

14.1 The Digestive Tract
1. Describe all the major components of the human digestive tract from the mouth to the anus.
2. Compare mechanical and chemical digestion with regard to where and how they occur.

14.2 Accessory Organs of Digestion
1. Summarize the major functions of the pancreas, the liver, and the gallbladder.
2. Summarize the structure and function of the hepatic portal.

14.3 Digestive Enzymes
1. Describe the overall function of digestive enzymes.
2. Compare the specific types of chemical digestion that take place in the mouth, stomach, and small intestine.

14.4 Nutrition
1. Describe the overall function of digestive enzymes.
2. Compare the specific types of chemical digestion that take place in the mouth, stomach, and small intestine.

14.5 Disorders of the Digestive System
1. Describe a common disorder that affects each part of the digestive system.
2. Classify the digestive disorders by the type of cause (i.e., infectious, cancer, inflammatory, etc.).

LECTURE OUTLINE

14.1 The Digestive Tract
Digestion takes place within a tube called the digestive tract, which begins with the mouth and ends with the anus. Digestion involves mechanical and chemical digestion.

The Mouth
The mouth receives food and contains the sensory receptors that make eating food an enjoyable experience. Due to enzymes in saliva, chemical digestion begins in the mouth.

The Teeth
The teeth begin the process of mechanical digestion.

The Pharynx
The pharynx is a region that receives air from the nasal cavities and food from the mouth. Swallowing occurs in the pharynx. The epiglottis covers the opening to the larynx.

The Esophagus
The esophagus is a muscular tube that passes from the pharynx to the stomach. Peristalsis pushes the food along the digestive tract.

The Wall of the Digestive Tract
The wall of the esophagus has four layers: mucosa, submucosa, muscularis, and serosa.

The Stomach
The stomach receives food from the esophagus, stores food, starts the digestion of proteins, and moves food into the small intestine.

The Small Intestine
The wall of the small intestine contains fingerlike projections called villi that aid in the absorption of nutrients.

Regulation of Digestive Secretions
The secretion of digestive juices is promoted by the nervous system and by hormones.
The Large Intestine
The large intestine absorbs water, salts, and some vitamins. It stores indigestible material until it is eliminated at the anus.

14.2 Accessory Organs of Digestion
The pancreas, liver, and gallbladder are accessory digestive organs.

The Pancreas
The pancreas is an endocrine gland that secretes insulin and glucagon to keep blood glucose levels within normal limits. For the purposes of digestion, it is an exocrine gland. It produces pancreatic juice, pancreatic amylase, trypsin, and lipase to aid in digestion.

The Liver
The liver acts as the gatekeeper to the blood. It maintains the blood glucose level and produces bile.

The Gallbladder
The gallbladder stores bile.

14.3 Digestive Enzymes
The various digestive enzymes present in the digestive juices help break down carbohydrates, proteins, nucleic acids, and fats. The enzymes required for digestion work at particular pH optimum.

14.4 Nutrition
A nutrient is a component of food that performs a physiological function in the body. The six major classes of nutrients are carbohydrates, fats, proteins, vitamins, minerals, and water.

Carbohydrates
The quickest, most readily available source of energy for the body is glucose. Complex sources of carbohydrates, such as whole-grain foods, are recommended because they are digested to sugars gradually and contain fiber.

Proteins
Foods rich in proteins include red meat, fish, poultry, dairy products, legumes, nuts, and cereals. Following digestion of protein, amino acids are used to build proteins that make up the body.

Lipids
Fats, oils, and cholesterol are lipids. Polyunsaturated oils are nutritionally essential because they contain two fatty acids the body cannot make.

Fats That Cause Disease
Cardiovascular disease is often due to arteries blocked by plaque, which contains saturated fats and cholesterol. Saturated fats tend to raise LDL, or the “bad” kind of cholesterol levels. Trans fatty acids and saturated fats should be avoided.

Vitamins
Vitamins are organic compounds that the body uses for metabolic purposes. Many vitamins are portions of coenzymes.

Antioxidants
Vitamins C, E, and A are believed to defend the body against free radicals. These vitamins are especially abundant in fruits and vegetables.

Vitamin D
The lack of vitamin D results in defective mineralization of the skeleton.

Dietary Supplements
Dietary supplements are nutrients and plant products that are used to enhance health. The U.S. government does not require dietary supplements to undergo the same safety and effectiveness testing that new prescription drugs must complete before they are approved. Therefore, many of these products have not been tested scientifically to determine their benefits. Dietary supplements may provide a potential safeguard against
cancer and cardiovascular disease, but they should not replace the intake of fruits and vegetables.

**Minerals**

Minerals are divided into major minerals and trace minerals. Major minerals are constituents of cells and body fluids and are structural components of tissues. The trace minerals are parts of larger molecules.

- **Calcium**
  Many people take calcium supplements to counteract osteoporosis, a degenerative bone disease. Vitamin D is an essential companion to calcium.

- **Sodium**
  The average American takes in too much sodium. High sodium intake has been linked to hypertension.

**Eating Disorders**

People with eating disorders have attitudes and behaviors toward food that are outside the norm.

- **Obesity**
  Obesity is most often defined as a body weight 20% or more above the ideal weight for a person’s height.

- **Bulimia Nervosa**
  People with this condition have the habit of eating to excess and then purging themselves by some artificial means.

- **Anorexia Nervosa**
  In anorexia nervosa, a morbid fear of gaining weight causes the person to be on a very restrictive diet.

**14.5 Disorders of the Digestive System**

Disorders of the digestive tract can be grouped into disorders of the tract itself, and disorders of the accessory organs.

- **Disorders of the Digestive Tract**
  - **Stomach Ulcers**
    An ulcer is an open sore in the wall caused by a gradual disintegration of the tissue. Most stomach ulcers are initiated by infection of the stomach by a bacterium.
  - **Intestinal Disorders**
    The major causes of diarrhea are infections of the lower intestinal tract and nervous stimulation. Increasing the amount of water and fiber in the diet can help prevent constipation.
  - **Polyps and Colon Cancer**
    Polyps are small growths arising from the epithelial lining. Dietary fats are thought to increase the likelihood of colon cancer.

- **Disorders of the Accessory Organs**
  - **Disorders of the Pancreas**
    Pancreatitis is an inflammation of the pancreas.
  - **Disorders of the Liver and Gallbladder**
    A person who has a liver ailment may develop jaundice, a yellowish coloring in the whites of the eyes, as well as in the skin. Jaundice can result from hepatitis, or inflammation of the liver. Cirrhosis is another chronic disease of the liver, often seen in alcoholics. In some individuals, the cholesterol present in bile forms crystals that may grow to become gallstones.