

# UNIT 10 - DIGESTIVE SYSTEM

## LECTURE NOTES

### 10.01 IDENTIFY THE GENERAL FUNCTIONS OF THE DIGESTIVE SYSTEM.

The digestive organs includes all organs involved with (1) digestion - the mechanical and chemical breakdown of food into a usable form, (2) absorption - the movement of molecules through the mucosal lining and into the blood, and (3) excretion - the removal of solid waste. Other associated processes include ingestion or the intake of nutrients and the movement through peristalsis.

### 10.02 CONTRAST CHEMICAL AND MECHANICAL DIGESTION

#### A. Chemical Digestion

Catabolic reactions which break down carbohydrates, proteins, and lipids into their building blocks of monosaccharides, amino acids, and fatty acids and glycerol. Requires enzymes to speed up the chemical reactions.

#### B. Mechanical Digestion

The breaking down of the bigger pieces of food to smaller pieces of food by chewing (mastication) or maceration.

### 10.03 DIFFERENTIATE BETWEEN THE ALIMENTARY CANAL AND ACCESSORY ORGANS

#### A. The Alimentary Canal

The alimentary canal is a continuous tube running through the middle of the body from the mouth to the anus. The food and/or waste products move through these organs. The organs include the mouth, pharynx, esophagus, stomach, small intestine, large intestine, and anus.

#### B. Accessory Organs

The accessory organs include those organs which provide enzymes, hormones, and fluids to break down food, and do not have direct contact with the food. These include the salivary glands, liver, gallbladder, and pancreas. The largest salivary glands, the parotid glands are located just anterior to the ear, under the masseter muscle.

### 10.04 DEFINE THE FUNCTIONS OF SALIVA AND SALIVARY AMYLASE IN DIGESTION.

#### A. Saliva

1. Saliva is the fluid secreted by the salivary glands. It flows from the salivary glands through ducts into the mouth.

2. Composition of Saliva.
  - a. Saliva is 99.5% water
  - b. 0.5% of the solutes include bicarbonate ions, mucin, and salivary amylase.
- B. Salivary amylase is the enzyme which chemically breakdown starch into maltose in the mouth.

#### 10.05 IDENTIFY THE PARTS OF A TYPICAL TOOTH.

- A. Crown  
The crown is the exposed portion of the tooth - found above the gums.
- B. Neck  
The neck is the constricted junction line of the tooth between the crown and the root.
- C. Root  
The root contains one to three projections of the tooth which embedded in the sockets of the alveolar processes of the mandible and the maxillae.
- D. Gingiva  
The gingiva is another name for the gums which surround the tooth.
- E. Periodontal Ligament  
The periodontal ligament is an area of dense fibrous connective tissue attached to the socket walls and the cemental surfaces of the roots of the tooth. It anchors the tooth in position and absorbs shock during chewing.
- F. Enamel  
The enamel is the portion of the tooth that protects the teeth from wear and tear. It is the hardest substance in the body. It is composed primarily of calcium phosphate and calcium carbonate and covers the crown.
- G. Dentin  
The dentin is calcified connective tissue, (bony part of the tooth) which gives the tooth its basic shape and rigidity
- H. Pulp  
The pulp cavity is a large cavity enclosed by the dentin and filled with fleshy material known as pulp. It contains the nerves and blood vessels.
- I. Root Canal  
Openings within the roots of the teeth which allow for the passage of nerves and blood vessels into and out of the pulp cavity.

## 10.06 DIGESTIVE PROCESSES

- A. Deglutition  
Deglutition or swallowing is the mechanism that moves food from the mouth, through the pharynx, and into the esophagus.
- B. Mastication  
Mastication or chewing breaks food down into smaller pieces by combining it with saliva. As the food and saliva mix, a ball of food called a bolus is formed.
- C. Maceration  
Maceration are mixing waves in the stomach which mix food with the gastric secretions to form a liquid paste called chyme.
- D. Segmentation  
Segmentation is a strictly localized contraction of the small intestine to mix food with digestive juices. It happens in areas of the small intestine containing food and brings chyme in contact with the mucosa for absorption.
- E. Peristalsis  
Peristalsis is the wave-like smooth muscle contractions of the muscularis layer which propel food and wastes along the alimentary canal.
- F. Haustral Churning  
Haustral churning is the way the large intestine moves food. A haustrum, or intestinal pouch, remains relaxed until it fills up, then it contracts moving food to the next haustrum.

## 10.07 IDENTIFY THE ANATOMICAL FEATURES OF THE STOMACH

The stomach is a J-shaped pouch located inferior to the diaphragm in the left upper quadrant. It is located between the esophagus and the small intestine and is part of the alimentary canal.

- A. Fundus  
The fundus is the rounded superior area of the stomach that acts as a temporary storage for food
- B. Body  
The body is the large, central portion of the stomach below the fundus.
- C. Pylorus  
The pylorus is the narrow, inferior region of the stomach.

- D. Rugae  
Rugae are folds of the mucosa which stretch to increase the size of the stomach.
- E. Cardiac Sphincter  
The cardiac sphincter or the cardiac opening is where the stomach and the esophagus join.
- F. Pyloric Sphincter  
The pyloric sphincter is the opening from the pylorus of the stomach into the duodenum of the small intestine.

#### 10.08 THE BASIC COMPONENTS OF GASTRIC JUICE

- A. Pepsin  
Pepsin is an enzyme secreted in its inactive form pepsinogen. It is activated by the presence of hydrochloric acid. It facilitates the chemical digestion of proteins into dipeptides.
- B. Hydrochloric Acid  
Hydrochloric acid provides the acidic environment needed for the enzyme action in the stomach.
- C. Mucus  
Mucus is a thick, sticky substance which helps protect the inner lining of the stomach.

#### 10.09 THE LOCATION AND DIGESTIVE FUNCTIONS OF THE PANCREAS

- A. Anatomical Description
  1. The pancreas is located in the left upper quadrant, posterior to the stomach.
  2. The pancreas is an endocrine gland since its specialized islet cells produce the hormones insulin and glucagon.
  3. The pancreas is an exocrine gland since its specialized acinar cells produce digestive enzymes which are released through ducts into the duodenum of the small intestine.
- B. Digestive Physiology
  1. Pancreatic juice includes secretions which are made by the pancreas including digestive enzymes and bicarbonate ions to increase the pH of the acidic chyme. It is necessary to increase the pH as the chyme flows into the duodenum.
  2. Pancreatic juice flows through the pancreatic duct, through the hepatopancreatic sphincter and into the duodenum.

3. It helps to chemically digest organic compounds including carbohydrates, lipids, and proteins.

#### 10.10 DESCRIBE THE FUNCTION OF BILE (EMULSIFICATION)

- A. Bile is a greenish-colored fluid which is produced in the liver. The principle pigment in bile is bilirubin.
- B. Bile is typically stored and concentrated in the gallbladder and flows to the duodenum when stimulated by the presence of fat.
- C. Bile functions to emulsify fat to aid in lipid digestion by assisting in mechanical digestion or breaking the fat into smaller pieces to increase the surface area available for digestive enzymes to work.
- D. Bile is excreted in the feces through the intestines.

#### 10.11 THE SMALL INTESTINE

##### A. Description of the Small Intestine

The small intestine is located between the stomach and the large intestine and is part of the alimentary canal. It is important in completing the chemical digestion of nutrients as well as the absorption of nutrients. The mucosa is modified with finger-like projections called villi and a brush border called microvilli which increase the surface area for absorption.

##### B. Sections of the Small Intestine

###### 1. Duodenum

The duodenum is the first portion of the small intestine where the small intestine joins the stomach, about 14 inches long. This is where the majority of chemical digestion occurs. Secretions from the pancreas and the gallbladder flow into the duodenum to aid in digestion.

###### 2. Jejunum

The jejunum is the portion of the small intestine immediately after the duodenum, about eight feet long. This is where most of the absorption of nutrients occurs.

###### 3. Ileum

The ileum is the final portion of the small intestine (about 12 feet long) that joins the large intestine. This is where absorption of nutrients also occurs.

## 10.12 IDENTIFY THE STRUCTURES AND SECTIONS OF THE LARGE INTESTINE

### A. Functions

1. Absorption of water, vitamins, and electrolytes.
2. Production of vitamins (Vitamin K).
3. Formation of feces.
4. Removal of feces from the body.

### B. Anatomy of the Large Intestine

1. Cecum  
The cecum is the beginning of the large intestine and is connected to the small intestine by the ileocecal valve. The vermiform appendix is attached to it.
2. Ascending Colon  
The ascending colon is portion of the large intestine that is found on the right side of the body between the cecum and the transverse colon. It transports fecal contents upward.
3. Transverse Colon  
The transverse colon is the horizontal portion of the large intestine found inferior to the diaphragm. It is located between the ascending colon and the descending colon. It transports fecal contents from the right side of the body to the left side.
4. Descending Colon  
The descending colon is the portion of the colon on the left side of the body located between the transverse colon and the sigmoid colon. It transports fecal contents downward.
5. Sigmoid Colon  
The sigmoid colon is portion of the colon that turns inward from the end of the descending colon to the rectum.
6. Rectum  
The rectum is the last eight inches of the colon. It functions as a temporary storage of solid wastes before excretion.
7. Anal Canal  
The anal canal: the last portion of the rectum that terminates with the anus.

## 10.13 DISEASES AND DISORDERS OF THE DIGESTIVE SYSTEM

### A. **Appendicitis**

Appendicitis, the inflammation of the appendix, is the most common surgical disease. It results from the obstruction of the opening to the appendix by a mass, stricture or infection. This sets off an inflammatory process that can lead to infection and necrosis. Symptoms of appendicitis include generalized abdominal pain, rebound tenderness, with the pain localizing in the lower right abdomen, nausea, vomiting, possibly fever, and an elevated white blood cell count. Treatment involves the removal of the structure and possibly antibiotic therapy.

### B. **Cirrhosis**

Cirrhosis of the liver is a chronic liver disease characterized by the destruction of the liver cells followed by scarring. Mortality is high with most patients dying within five years of the onset. One of the major causes of cirrhosis is alcoholism. Signs and symptoms of cirrhosis include anorexia, indigestion, nausea, vomiting, abdominal pain, later including ascites, jaundice, and hepatomegaly. Treatment is designed to prevent further liver damage and to prevent and/or treat liver complications.

### C. **Colorectal Cancer**

Colorectal cancer is the second most common form of cancer in the United States and Europe. Colorectal cancer has a slow progression and remains localized for long periods of time. If it is detected early, it has a 90% cure rate. The problem is many people are embarrassed to talk with their health care providers about changes in bowel habits and do not seek professional help until the cancer has spread and is more difficult to treat. The exact cause is unknown, but studies suggest a relationship to a high fat diet, aging, and a family history of colorectal cancer. The signs and symptoms of colorectal cancer include mild abdominal discomfort and a change in bowel habits. Treatment varies but may include surgery and chemotherapy.

### D. **Gallstones**

Gallstones or cholelithiasis is the presence of stones in the gallbladder, resulting from changes in the bile component. The stones are made of cholesterol, calcium bilirubinate, and the bilirubin pigment. They arise during periods of sluggishness in the gallbladder due to pregnancy, obesity, and diabetes mellitus. It is the fifth leading cause of hospitalization among adults. Symptoms include a classic gallbladder attack that follows a meal rich in fats. It begins with abdominal pain in the right upper quadrant and may radiate to the back. Other features include fat intolerance, nausea, vomiting, and chills. A person may have clay-colored stools. Diagnosis is usually made with an ultrasound. Treatment involves the removal of the gallbladder and a low-fat diet.

## **E. Hepatitis**

### **1. Hepatitis A**

This is a highly contagious form of hepatitis and is usually transmitted by the fecal-oral route, commonly within institutions and families. The usual cause is the ingestion of contaminated food, milk, or water. The disease is marked by liver cells destruction, anorexia, jaundice, headache, nausea and vomiting. Also seen is a dark colored urine and clay colored stools. There is no specific treatment. The person should rest. Liver failure is a complication. Vaccines are available to reduce the incidence of this disease.

### **2. Hepatitis B**

This is a highly contagious form of hepatitis that is transmitted by the direct exchange of contaminated blood. The disease is marked by liver cell destruction, anorexia, jaundice, headache, nausea, and vomiting. Also seen is dark colored urine and clay colored stools. There is no specific treatment. The person should rest. Liver failure is a complication. Vaccines are available to reduce the incidence of this disease. They are strongly recommended for all health care workers.

## **F. Obesity**

Obesity is the presence of excess body fat, generally over 20% for men and over 30% for women. There are many precipitating causes, but the bottom line is that too many calories are consumed in comparison to the number of calories being used for energy. Precipitating factors include genetics, gender, and inactivity. Treatment includes a reduction of calories and an increase in exercise. Treatment may also include surgery, such as a gastric bypass or gastric banding to reduce the size of the stomach. Complications of obesity include joint pain, gallstones, hypertension, hyperlipidemia, atherosclerosis, heart attacks, strokes, and a predisposition to certain cancers.

## **G. Ulcers**

Ulcers are lesions found in the mucosal membrane in the alimentary canal. They can develop in the esophagus, stomach, duodenum, or jejunum. The most common cause is a bacterial infection, followed by chronic use of non-steroidal anti-inflammatory drugs, like aspirin and ibuprofen. Other predisposing factors include genetics, exposure to alcohol and tobacco, and stress. Symptoms of ulcers include heartburn, indigestion, and pain. Other side effects include weight loss and GI bleeding. Treatment includes removing the cause, the use of antibiotics to treat the infection, watching for signs of bleeding and possible surgery.