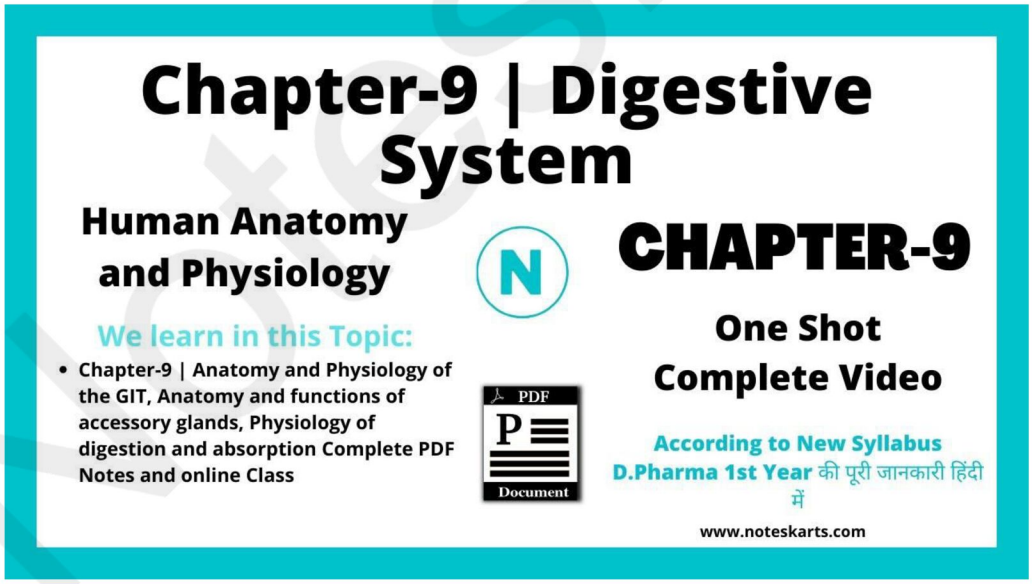
Chapter-9
Human Anatomy & Physiology

D.Pharma 1st Year Notes

Chapter- 9

Digestive system

- Anatomy and Physiology of GIT
- Anatomy and functions of accessory glands
- Physiology of digestion and absorption



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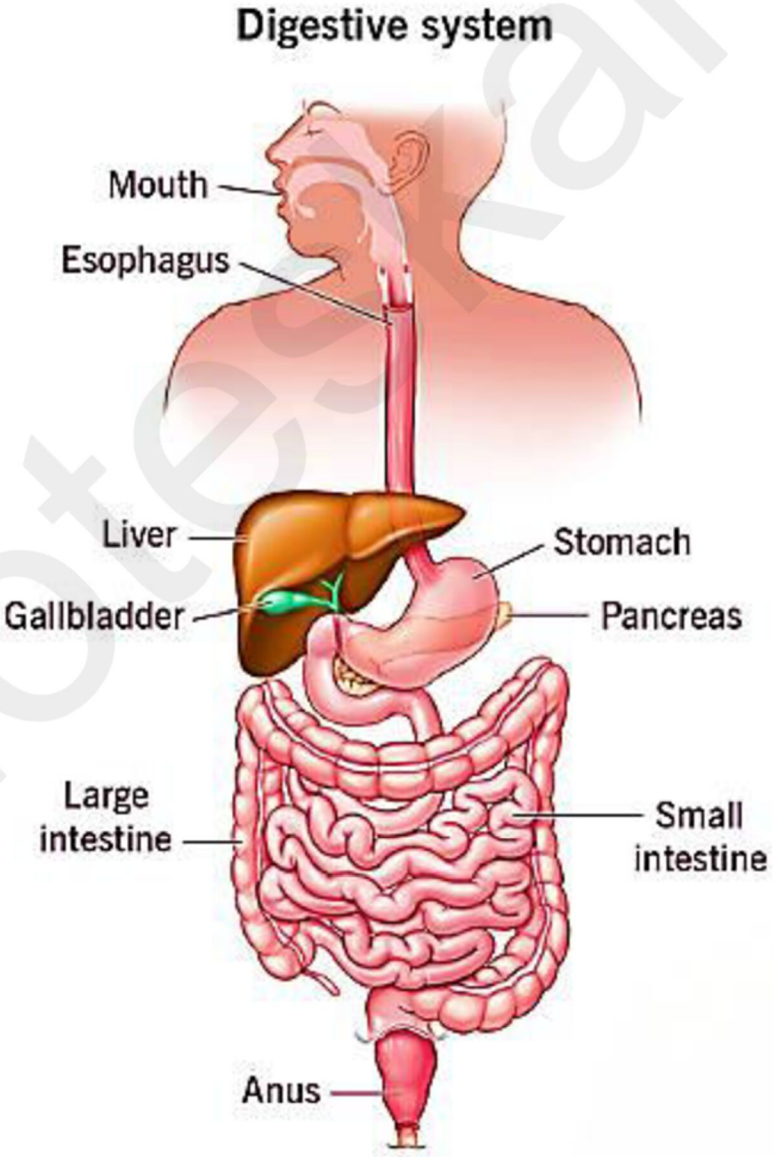
Digestive System:

- The digestive system transfer nutrients from the external environment (in the form of food) to the internal environment (via ingestion of food).
- The food provides nutrients are utilized by the cell for the production of energy.

Or

- The human digestive system consists of the gastrointestinal tract plus the accessory organs of digestion.
- Digestion involves the breakdown of food into smaller and smaller components, until they can be absorbed and assimilated into the body.



Anatomy and physiology of GIT

The gastrointestinal or digestive tract or alimentary canal begin at the mouth and terminates at the anus.

Different part of alimentary canal includes -

1. Oral cavity (mouth)
2. Esophagus
3. Pharynx
4. Stomach
5. Small intestine
6. Large intestine
7. Accessory organs

1. Oral cavity (Mouth):

- Oral cavity forms the first part of canal surrounded by various muscles and bones.
- The roof of oral cavity form by palate.

Teeth –

Food is taken in the mouth and chewed with the help of teeth to convert it in smaller particle.

The process is known as mastication.

Teeth can functionally divided in two parts -

a) **Deciduous teeth (baby or milk teeth, 20 in no.)**

b) **Permanent teeth (adult teeth, 32 in no.) Types and function of teeth**

Incisors - These teeth aid in biting off large pieces of food.

Cuspids/canines- These conical shaped teeth aid in grasping and tearing of food.

Bicuspids/premolars - These teeth help in grinding the food, they are absent in the children (after 9 year of age)

Molars - These are the largest teeth and are present at the back of the mouth.

Tongue - It is muscular organ situated on the floor of mouth, which help in chewing and swallowing the food (deglutition).

A test bud is a saclike oval shaped structure of about 50 micron meter in size.

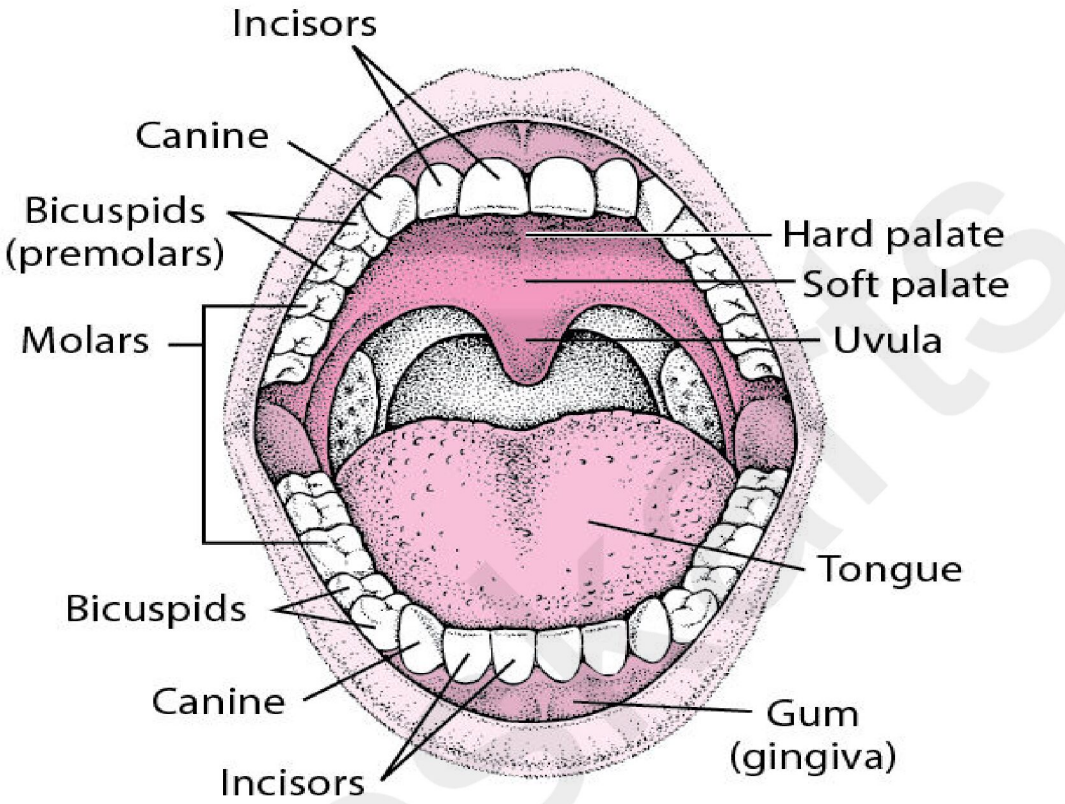


Diagram of teeth and tongue

2. Esophagus

- Food pipe is cv a long muscular tube which forms a passage for the food to pass from the pharynx to the stomach.
- The esophagus joins the stomach at the gastro-esophageal junction

Function-

A wave of peristalsis is stimulated when the bolus is present in the pharynx thus; it is propelled to the stomach via esophagus.

3. Pharynx

Pharynx (throat) is a funnel shaped tube extending from the internal nares to the posterior parts of esophagus and anterior of larynx.

Function -

- Passageway for the air and food.
- Taste sensation.
- Warming and humidifying.
- Hearing.

4. Stomach

- Stomach is a hollow, muscular, bag like structure.
- Stomach lies between the esophagus and the small intestine.
- The second phase of digestion (after mastication) takes place in the stomach.

Function –

- It provides highly acidic environment due to gastric acid production and secretion, which is able to breakdown large molecules in to smaller molecules.

5. Small intestine

- Small intestine is a portion between the stomach and the large intestine.
- In adult it measure about 7 cm in length and 2-3 cm in diameter.
- It is a long, highly convoluted tubes in the digestive system that absorbs about 90% of the nutrients from the ingested food.
- It is the main site of absorption.
- The presence of villi and microvilli increase the surface area available for nutrients absorption.

Structurally the small intestine can be divided into 3 parts-

1. Duodenum
2. Jejunum
3. Ileum

Function -

- It provide site for absorption for the process of chemical digestion of carbohydrates.
- It secrets the significant hormones, cholecystokinin and secretin.

6. Large intestine

- Large intestine forms the last part of alimentary canal. It extent caecum to the anus while including the ascending colon, transverse colon, descending colon sigmoid colon and the rectum.
- It is about 1.5 m in length and 6-7 in diameter.

Comprises of following parts

- **Rectum -** It act to store the faeces temporarily
- **Anus -** It is the external opening of rectum. It surrounded by spincter muscles, which control its opening and closing.

Function -

- It forms the site for absorption of water, glucose and salt.
- Its walls form the site for excretion of excess amount of calcium, iron and drugs of heavy metals.

Anatomy and function of accessory glands

- Accessory organ of digestion are organ that secrets substances needed for the chemical digestion of food but through which food does not actually pass as it is digested.
- The accessory glands of digestive system consist of salivary glands, pancreas, liver and gall bladder.

Salivary glands

- Salivary glands present in the form of 3 large multicellular pairs-

a) **Parotid glands -** It is largest salivary gland located anterior to the ear on either side and responsible to produces serous secretion. secretion is occur through the parotid duct.

b) **Submandibular glands -** These are second largest glands and are also paired, located below mandible. secretion of these gland is mix type both serous and mucous secretion.

c) **Sublingual glands** - It is smallest and also paired. these glands secrets mucous. These are ductless glands, each gland opens into the flow of the oral cavity.

Function of salivary glands -

- Cleaning effect of washing away food debris.
- Make swallowing food easier.
- Antibacterial effect of fighting off bacteria entering the mouth.
- pH buffering effect that prevents caries effect of promoting remineralization of teeth.

7. Pancreas

- Pancreas is an organ and a gland that produce and release substance in the body.
- It is an elongated digestive gland .its size 6-10 inch and its weight is 65 gm.
- It is located behind the stomach in the upper left abdomen and close to the duodenum.
- It is largest gland of digestive system.
- It is the mixed gland producing both endocrine (Insulin, glucagon) and exocrine (pancreatic juice containing digestive enzymes) secretion.

Structure -

Pancreas has a head the part lying with in duodenal curvature, a body and a tail connecting the pancreas to the spleen.

Pancreatic islets , also known as islets of Langer Hans make up endocrine portion of the pancreas .

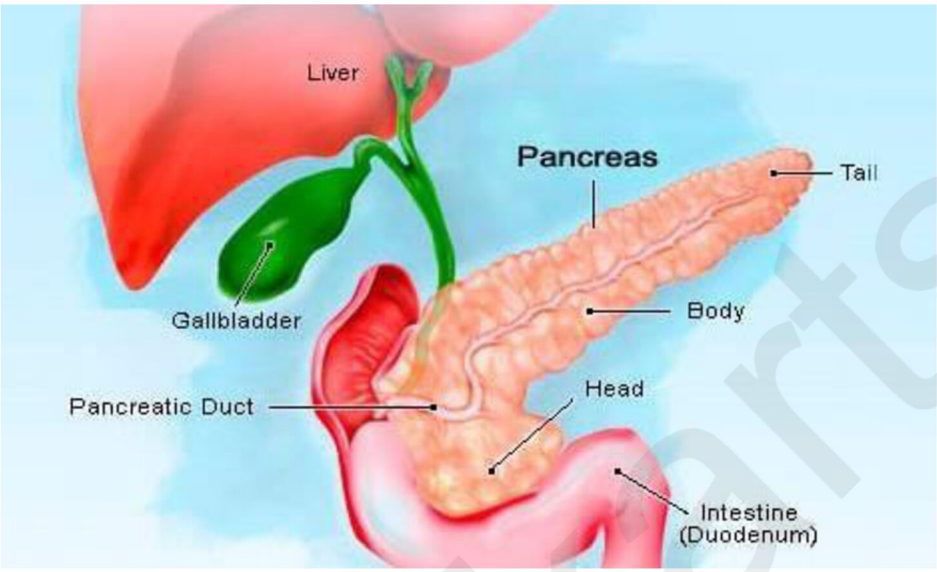


Diagram of Pancreas

Function -

- The enzyme secreted in the pancreas help in breakdown of carbohydrates, fats, proteins and acid in the duodenum.
- The pancreas also secrets a bicarbonate to neutralise stomach acid in the duodenum.
- The hormones secreted in the pancreas are insulin and glucagon (which regulate the level of glucose in the blood.

8. Liver

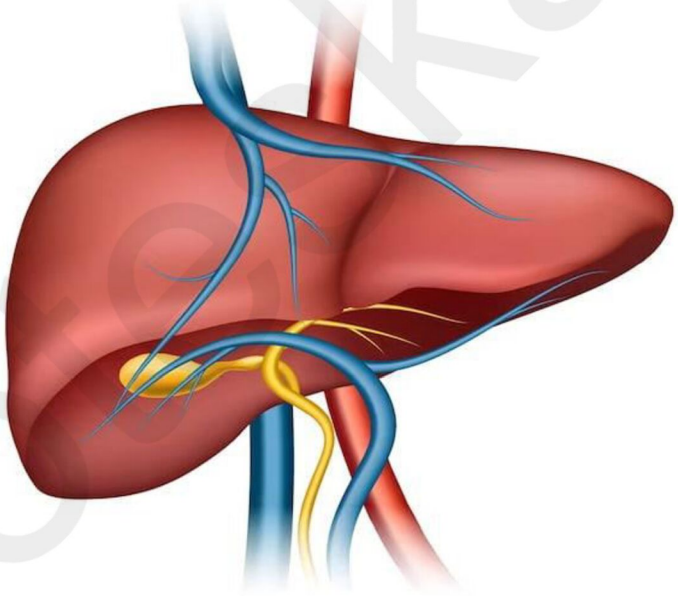
- Liver is the largest gland of the human body.
- It form the second largest organ which performs many essential biological function such as detoxification of organism, synthesis of protein, biochemical necessary for digestion and growth.
- It also filters the blood coming from the digestive tract, before passing it to the rest of the body.

Structure -

The liver is anatomically divided into four lobes: two larger lobes (right and left) and two smaller lobes (quadrate and caudate):

1. Right lobe: The largest lobe
2. Left lobe: The smaller, flattened lobe
3. Caudate lobe: Located on the upper part of the visceral surface of the liver, between the inferior vena cava and the ligamentum venosum
4. Quadrate lobe: Located between the gallbladder and the ligamentum teres hepatis

On the inferior surface of the liver, a porta is located which forms an entry and exit point for various vessels, ducts and nerves.



Function-

- The liver has a wide range of function processes of nutrients from food.
- Stores sugars for later use.
- Production of bile and cholesterol.
- Removing various toxins and combating infection.

- Processing and storage of vitamins and other essential nutrients.
- Maintain level of fats, amino acid and glucose in the blood.
- Protein synthesis.
- Manufacturing and regulating hormones including these that helps platelets (blood clotting) formation.

9. Gall bladder

- Gall bladder is a pear shaped organ.
- This membranous muscular sac like structure is nearly 8 cm in length and 4 cm in width.
- Gall bladder function to store and concentrate bile which is produce by the liver and helps in digestion process.
- It has a capacity of about 70 ml

Structure

- Gall bladder comprises of a fundus (broad part) the body (central part) and the neck (tapered parts).
- Wall of gall bladder is lined by three layer of tisssue-
  - An inner mucosal layer
  - A muscularis layer
  - An outer Layer of serosa

Function -

It store the bile till required by the intestine for digestion.

- Gall bladder can remove toxins from the blood and ingested food.
- The alkaline nature of bile helps in neutralization of the hydrochloric acid in stomach during starvation.
- It can also emulsify the dietary lipid or fatty substances.

Physiology of digestion and absorption-

The process of digestion can be divided into the following steps;

Ingestion:

- In this step, food enters into the alimentary canal through the mouth and is chewed and mixed with saliva containing enzymes ptyalin or amylase. Breakdown of carbohydrates and lipid starts.
- The process of chewing increase the surface area of the food and the food mixed with saliva is called bolus.

Propulsion-

- Tongue and pharyngeal muscles propel the bolus into the esophagus. This phenomenon of swallowing is the last voluntary acts up to defecation and is an example of propulsion.

Mechanical digestion:

- Mechanical digestion is a physical process that does not affect the chemical nature of the food instead, it breaks food in smaller particles to increase both surface area and mobility.

Chemical digestion:

Chemical digestion of the food starts in the mouth. In this process, the complex food particles are broken down into their chemical building blocks by the various digestive secretions.

- **Absorption -** The food that has been disintegrated into simpler units is of no value unless it enters the blood circulation and its nutrients are utilized.
  - **Active transport -** Movement from an area of lower concentration to the area of higher concentration.
  - **Passive diffusion -** In this types of absorption substances moves from an area of lower concentration to the area of higher concentration.
  - **Facilitated diffusion -** Movements of substance form the region of higher concentration to the region of lower concentration.
- **Defecation -** It is the final step in which the undigested material are voluntarily removed from the body as faecus.

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