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Digestive Physiology:

In a short, **digestion** involves breaking down large food molecules into water-soluble molecules that can be passed into the blood and transported to the body's organs. For instance, carbohydrates are broken down into glucose, proteins into amino acids, and fats into fatty acids and glycerol. The processes of digestion include **six** activities:

Ingestion refers to the entry of food into the alimentary canal through the mouth.

Propulsion is the movement of food along the digestive tract. The major means of propulsion is peristalsis.

Mechanical digestion involves physically breaking the food into smaller pieces. It begins in mouth as the food is chewed and continues into the stomach.

Chemical digestion begins in the mouth when food mixes with saliva and continues into the intestines. Several different enzymes break down macromolecules into smaller molecules that can be absorbed.

Absorption is the process by which the products of digestion are absorbed by the blood to be supplied to the rest of the body.

Defecation is the final act of digestion, by which organisms eliminate waste material from the digestive tract via the anus.

The Gastrointestinal System (GIT) is responsible for the breakdown and absorption of various foods and liquids needed to sustain life. Many different organs have essential roles in the digestion of food, from the mechanical disrupting by the teeth to the creation of bile by the liver. Bile production in the liver plays an important role in digestion: from stored and concentrated in

the gallbladder to discharge to the small intestine. During digestion, the mechanical and chemical digestion occur at the same time. The GI tract starts with the mouth and proceeds to the esophagus, stomach, small intestine (duodenum, jejunum, ileum), and then to the large intestine (colon), rectum, and terminates at the anus.

General function of Digestion:

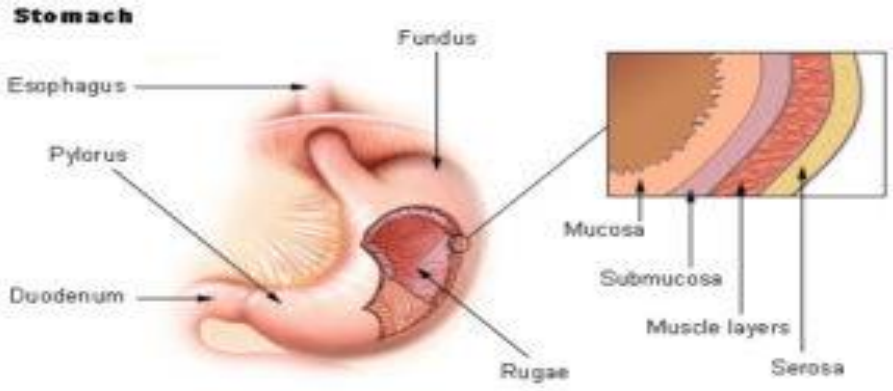
Human Digestive system includes Gastrointestinal Tract and other accessory parts like the liver, pancreas and gallbladder. The food that you eat has biomacromolecules, the carbohydrates, proteins, lipids, and nucleic acids. These have to be converted to their simpler forms so that the body can absorb it. The digestion starts in the oral cavity, where the saliva from the salivary glands mixes with the food and starts to begin the breakdown of food. From the mouth, the food passes to the esophagus, then travels to the stomach, where it breaks down further with the acids and powerful enzymes secreted by the stomach. This semi-digested food then travels down to the small intestine, where secretions from the liver, gallbladder, and pancreas further act on the food particles. Most of the digestion takes place in the small intestine, where absorption also occurs. Once most of the absorption of water and digested nutrients is completed in the small intestine, the remaining waste products move to the large intestine. The large intestine divides into appendix, caecum, colon, and rectum. The fecal comes out through the anus.

Parts of Digestive System:

Mouth: The anterior opening of the alimentary canal is the mouth. It leads to a buccal cavity or oral cavity, where teeth, tongue and salivary glands are present. Here, ingestion, mastication, and swallowing of food occur. In humans mouth, there are a total of 32 permanent teeth. There are four different types of teeth, namely, **incisors, canines, premolars,** and **molars**. These help in the chewing of food.

Salivary Glands: They are exocrine glands that produce saliva in the oral cavity. They secrete an enzyme called amylase, which helps in the breakdown of starch into maltose. There are three types of salivary glands, namely:

- Parotid gland
- Submandibular gland
- Sublingual gland

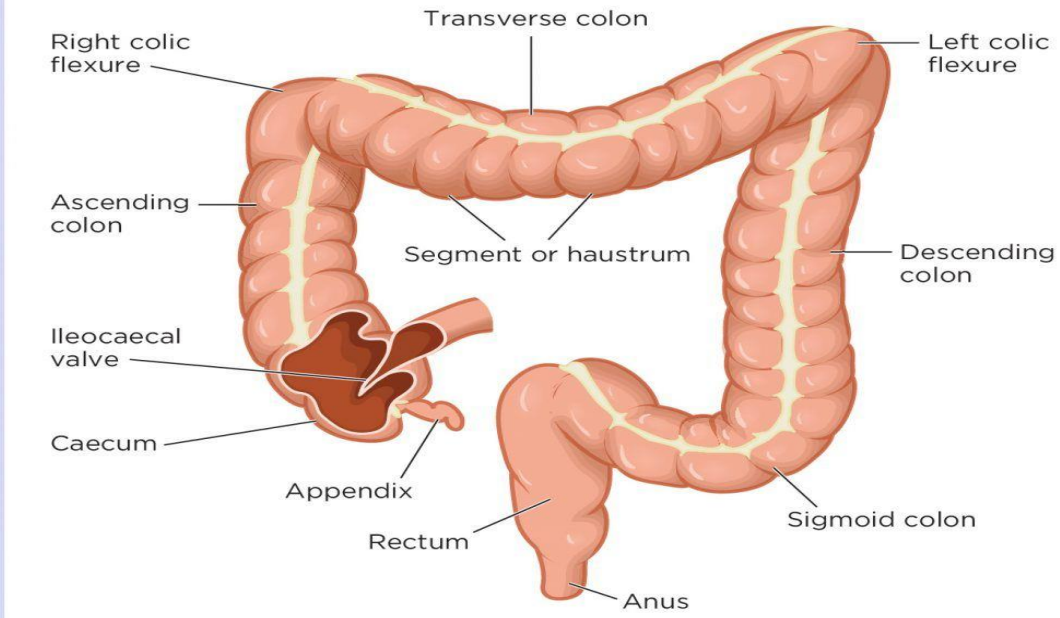


Stomach: It is a muscular, hollow organ, having a capacity of 1 litre. The stomach holds food and also is a mixer and grinder. It mixes the food and liquid with digestive juice it produces, stomach secretes strong acids and powerful enzymes that help in the process of breaking down of food. Food is generally in a liquid or pastes consistency when it leaves the stomach.

Small Intestine: It is a long tube, which coils in the abdomen area. Here, enzymes from the pancreas and liver further break down the food. Three segments make up the small intestines, which are the duodenum, jejunum, and ileum. The contractions of the small intestine help in the movement of food, along with its breakdown, after mixing with the digestive secretions. The jejunum and ileum areas of the small intestine are responsible for the absorption of food into the blood, through their villi.

Large Intestine: The large intestine is a long muscular tube that has different parts, which are caecum, colon, and rectum. It is the last part of the digestive system in vertebrates.

Fig 1. **Anatomy of the large intestine**



Water is absorbed here and the remaining waste material is stored as feces before being removed by defecation. In humans, the large intestine begins in the right iliac region of the pelvis, just at or below the waist, where it is joined to the end of the small intestine at the cecum, via the ileocecal valve. In humans, the large intestine is about 1.5 meters long, in mammals, the colon consists of the following sections, they are:

- The ascending colon including the caecum and appendix
- The transverse colon including the colic flexures and transverse mesocolon
- The descending colon
- The sigmoid colon the s-shaped region of the large intestine
- The rectum.

Pancreas, Liver and **Gall Bladder** play a significant role in the human digestive system. The pancreas secretes enzymes which help in the breakdown protein, fat, and carbohydrate. The liver secretes bile, cleanses, and purifies the blood coming from the small intestine. The gallbladder stores the bile that the liver produces and releases into small intestine.

Food movement:

The large, hollow organs of the GI tract contain a layer of muscle that enables their walls to move. The movement of organ walls—called peristalsis—propels food and liquid through the GI tract and mixes the contents within each organ. Peristalsis looks like an ocean wave traveling through the muscle as it contracts and relaxes.

The muscular tube of esophagus that carries food and liquids from the mouth to the stomach. Once swallowing begins, under the control of the esophagus and brain, the lower esophageal sphincter, a ring like muscle at the junction of the esophagus and stomach, the muscle relaxes and lets food pass through to the stomach. Stomach slowly empties its contents, called chyme, into the small intestine. The muscles of the small intestine push the food forward to help with further digestion. The walls of the small intestine absorb the digested nutrients into the bloodstream. The blood delivers the nutrients to the rest of the body.

In large intestine, the waste products of the digestive process include undigested parts of food and older cells from the GI tract lining, pushed and changes from liquid into stool. The rectum stores stool until it pushes out of the body during a bowel movement.

Digestive System Controls:

Cells lining of the stomach and small intestine make and release hormones, which tell the body when to make digestive juices and send signals to the brain that you are hungry or full. The pancreas also makes hormones that are important to digestion. Hormones and nerves control the human digestive system. The walls of the alimentary canal have many sensors which regulate the digestive functions. The main digestive hormone, gastrin is secreted in response to the presence of food. It stimulates the gastric acid secretion. Gastrin, a hormone released by the stomach and the small intestine when you eat. It is stimulates the release of

hydrochloric acid and pepsinogen in the stomach, and speeds up digestion.

Swallowing Reflex: The swallowing reflex is phase of the swallow, which is under reflexive or involuntary control. This stage of the swallow begins after food which masticated has been gathered together in the mouth and formed into a bolus which is passed to the stomach.

Swallowing, is the process in the human or animal that allows for a substance to pass from the mouth to the pharynx, and into the esophagus, while shutting the trachea by epiglottis. Swallowing is an important part of eating and drinking. If the process fails and the material goes through the trachea, then choking can occur. In the human body the automatic temporary closing of the epiglottis, occur by the swallowing reflex. Swallowing comes so easily to most people, however from the viewpoints physiology, people with difficulty in swallowing called dysphagia.