Digestive system

The digestive system of the human body comprises a group of organs working together to convert food into energy for the body. Anatomically, the digestive system is made up of the gastrointestinal tract, along with accessory organs such as the liver, pancreas and gallbladder. The hollow organs that make up the gastrointestinal tract (GI tract) include the mouth, stomach, oesophagus, small intestine and large intestine that contains the rectum and anus.

Human Digestive System and Nutrition involve the intake of food by an organism and its utilization for energy. This is a vital process which helps living beings to obtain their energy from various sources. The food which we eat undergoes much processing before the nutrients present in them are utilized to generate energy. This processing is known as digestion. Humans and other animals have specialized organs and systems for this process.

The digestion process involves the alimentary canal along with various accessory organs and organ systems. In humans, the process is quite simple due to our monogastric nature. This means that we have a one-chambered stomach, unlike other animals such as cows, which have four chambers.

Some parts of nervous and circulatory systems also play a significant role in the digestion process. A combination of nerves, bacteria, hormones, blood and other organs of the digestive system completes the task of digestion.

Parts of Digestive System

Mouth

Food starts its journey from the mouth or the oral cavity. There are many other organs that contribute to the digestion process, including teeth, salivary glands, and tongue. Teeth are designed for grinding food particles into small pieces and are moistened with saliva before the tongue pushes the food into the pharynx.

Pharynx

A fibro muscular y-shaped tube attached to the terminal end of the mouth. It is mainly involved in the passage of chewed/crushed food from the mouth through the oesophagus. It also has a major part in the respiratory system, as air travels through the pharynx from the nasal cavity on its way to the lungs.

Oesophagus

This is a muscular tube that connects the pharynx, which is a part of an upper section of the gastrointestinal tract. It supplies swallowed food along with its length.

Stomach

It serves as a muscular bag which is situated towards the left side of the abdominal cavity, beneath the diaphragm. This vital organ acts as a storage for the food and provides enough time to digest meals. The stomach also produces digestive enzymes and hydrochloric acid that maintains the process of digestion.

- **Mucous**: It is an aqueous secretion produced by the mucous membranes. It functions by protecting the stomach lining and gastric pits from the acid, which is produced by the glands to destroy the bacteria that entered along with the food particles.
- **Digestive enzymes**: They are the group of enzymes which functions by breaking down polymeric macromolecules like biopolymers into their smaller and simpler substances.
- **Hydrochloric acid**: It is the digestive fluid formed by the stomach during the process of digestion. It functions by destroying harmful microorganisms present in the food particles.

Small Intestine

The small intestine is a thin, long tube of about 10 feet long and a part of the lower gastrointestinal tract. It is present just behind the stomach and acquires a maximum area of the abdominal cavity. The complete small intestine is coiled and the inner surface consists of folds and ridges.

Large Intestine

This is a thick, long tube measuring around 5 feet in length. It is present just beneath the stomach and wraps over the superior and lateral edges of the small intestine. It absorbs water and consists of bacteria (symbiotic) that support the breakdown of wastes to fetch small nutrients.

Rectum

Waste products are passed into the end of the large intestine called the rectum and eliminated out of the body as a solid matter called stool. It is stored in the rectum as semi-solid faeces which later exits from the body through the anal canal through the process of defecation.

Accessory Organs

Pancreas

It is a large gland present just behind the stomach. It is short with its anterior connected to the duodenum and posterior pointing towards the left part of the abdominal cavity. The pancreas releases digestive enzymes to complete the process of chemical digestion.

Liver

The liver is a roughly triangular, reddish-brown accessory organ of the digestive system located to the right of the stomach. It produces bile, which helps in the digestion of fat in the small intestine. The bile is stored and recycled in the gallbladder. It is a small, pear-shaped organ which is located just next to the liver

Functions of Saliva

Saliva initiates the process of digestion in the mouth. The food substance which gets mixed with the food in the mouth during chewing by teeth is saliva. It acts as digestive juice and softens the food, which further leads to the easy process of digestion. It is secreted by salivary glands.

The role of saliva in the digestion of food are,

- It moistens the food for easy swallowing.
- It contains a digestive enzyme called salivary amylase, which breaks down starch into sugar.
- Lubricates and moistens food, thus aiding in swallowing
- Aids in food particles to stick together for the formation of the bolus, so that they cab swallowed as a mass
- Cleans the mouth, tending to destroy germs to prevent tooth decay
- Brings about the conversion of starch into maltose through the enzyme ptyalin

Arrangement of Teeth & its formula

All humans have four types of teeth:

- Incisors.
- Canines.
- Premolars.
- Molars.

All four types of teeth are present on the jawbones, extending into the buccal cavity. All four types of teeth serve various functions such as cutting, crushing, tearing and shredding the food. Teeth are quite important in many ways. Obviously, teeth are very essential when eating, as it helps us to consume a wider palate of food and also plays a major role in digestion.

Apart from eating, our teeth keep our jaw bone strong, provide shape to our face, and also helps in our speech. Overall, teeth are our crowning glory and its features make us look attractive.

Dentition

The term dentition is mainly used to describe the arrangement of teeth, including their number and types. A normal adult has 32 teeth. Animals have different types and shapes of teeth, which are specialised based on **Nutrition in animals** or their eating habits.

What is a Dental Formula?

The method of expressing or describing the total number of teeth in man and animals according to the arrangement is termed as the Dental Formula. This formula is expressed using letters and figures. The letters used in this formula are based on the 4 types of teeth like– Incisor, Canine, Premolar, and Molar.

The Dental Formula is expressed as:
(The number of each type of teeth in the upper jaw) / (The number of teeth on one side of the lower jaw)

Dental Formula = (2 incisors 1 canine 2 premolar 3 molar) / (2 incisors 1 canine 2 premolar 3 molar)

Humans have two dental formulae:

The primary dentition (20 teeth):

I2/2 C1/1 M2/2 = 10

The permanent dentition (32 teeth):

I2/2C1/1 P2/2 M 3/3 = 16.

Where: I – Incisors, C-Canine and M-Molar

Among all other mammals, both humans and apes have similar sets of teeth and dental formulae.

Taste buds of Tongue

The surface of our tongue is covered with tiny bumps called papillae, which contain our tastebuds and also some glands that help in the creation and secretion of saliva. There are four different types of papillae, which come in different shapes and sizes and can be found in different regions of our tongue in varying numbers.

Tastebuds are a combination of cells—basal cells, columnar (structural) cells, and between 10 and 50 taste receptor cells, which are renewed every 9-10 days. The receptors for sweet, bitter, sour and umami tastes are proteins (produced and coded for by particular genes in our DNA) found on the surface of the cells. The salt receptor, called the epithelial sodium channel, is essentially a membrane that allows sodium ions into certain cells in our body.

Types of papillae

The taste buds on the tongue sit on raised protrusions of the tongue surface called papillae. There are four types of lingual papillae; all except one contain taste buds:

- Fungi form papillae - as the name suggests, these are slightly mushroom-shaped if looked at in longitudinal section. These are present mostly at the dorsal surface of the tongue, as well as at the sides. Innervated by facial nerve.
- Foliate papillae - these are ridges and grooves towards the posterior part of the tongue found at the lateral borders. Innervated by facial nerve (anterior papillae) and gloss pharyngeal nerve (posterior papillae).
- Circumvallated papillae - there are only about 10 to 14 of these papillae on most people, and they are present at the back of the oral part of the tongue. They are arranged in a circular-shaped row just in front of the sulcus terminalis of the tongue. They are associated with ducts of Von Ebner's glands, and are innervated by the gloss pharyngeal nerve.
- Filiform papillae - the most numerous type but do not contain taste buds.[4] They are characterized by increased keratinisation and are involved in the mechanical aspect of providing abrasion.

GERD

GERD or Gastro-oesophageal Reflux Disease is a condition where the stomach acids flow back into the tube (oesophagus) which connects the mouth with the stomach. Usually, GERD arises in people who have prolonged acid reflux (or heartburn).
GERD Symptoms can induce acute irritation and discomfort, and in more severe cases, it can lead to ulcers in the oesophagus. Furthermore, if this condition is left untreated, it increases the risk of oesophageal cancer.

The discomfort caused due to GERD can be managed by a change in lifestyle. However, a few need strong medications to cure the problem.

GERD Causes

GERD can be caused by the following ways:

- Hiatal hernias
- Lower oesophagal sphincter abnormalities
- Abnormal oesophagal contractions
- Slow emptying of the stomach

GERD Symptoms

Acid reflux or heartburn is one of the most common symptoms of GERD. But besides these, there are other symptoms that are actually less apparent. Symptoms include:

1. Hoarseness of voice
2. Difficulty breathing
3. Shortness of breath
4. Acid can wear away the enamel of the teeth, causing tooth decay
5. Barrett’s esophagus – No symptoms, but increases the risk of esophageal cancer
6. Persistent cough
7. Burning sensation in the chest

GERD Prevention

GERD can be treated with proton pump inhibitors. They reduce the amount of acid produced by the stomach. Other treatment methods include:

- **H2 Blockers:** These help to decrease acid production.
- **Antacids**: These counteract the acid in the stomach with alkaline chemicals.
- **Prokinetics:** These help in quick emptying of the stomach.
- **Erythromycin:** This antibiotic also helps in emptying the stomach.