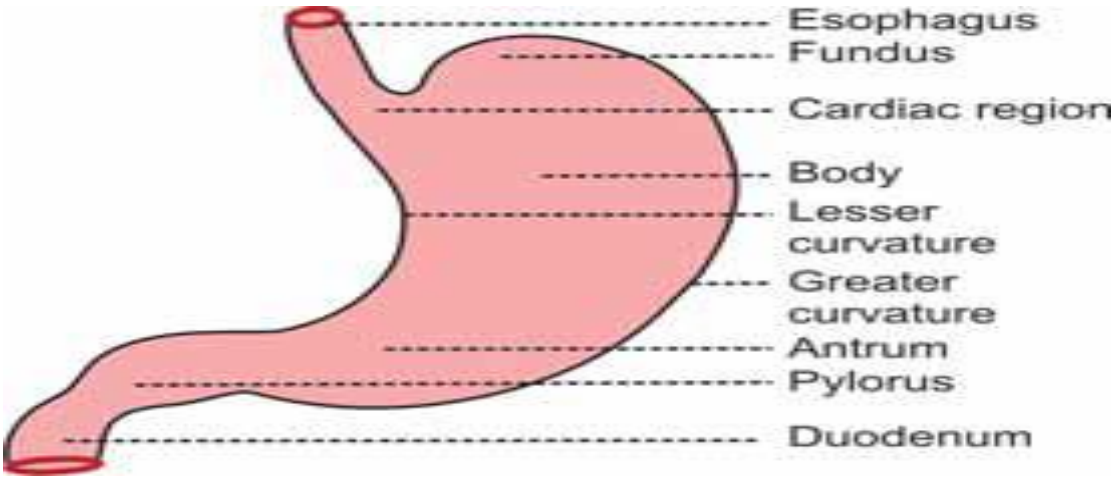
Stomach

PARTS OF STOMACH

In humans, stomach has four parts:
1. Cardiac region
2. Fundus 3. Body or corpus
4. Pyloric region.



STRUCTURE OF STOMACH WALL

- The wall of the stomach is formed by four layers of structures:

1. Outer serous layer formed by peritoneum

2. Muscular layer made up of three layers of smooth muscle fibers namely, inner oblique,

middle circular and outer longitudinal layers

3. Submucus layer formed by areolar tissue, blood vessels and lymph vessels

4. Inner mucus layer lined by mucus secreting columnar epithelial cells. The gastric glands

are situated in this layer. The inner surface of mucus layer is covered by 2 mm thick mucus.

GLANDS OF STOMACH

- Glands of the stomach or gastric glands are tubular structures made up of different types of cells. These glands open into the stomach cavity through gastric pits.

CLASSIFICATION OF GLANDS OF THE STOMACH

- Gastric glands are classified into three types depending upon their situation:

1. Fundic glands situated in body and fundus of stomach. Fundic glands are also called

main gastric glands or oxyntic glands.

2. Pyloric glands present in the pyloric part of the stomach.

3. Cardiac glands located in the cardiac region of the stomach.

All the gastric glands open into the cavity of stomach through gastric pits.

STRUCTURE OF GASTRIC GLANDS

Fundic Glands

- The fundic glands are considered as the typical gastric glands. These glands are long and tubular glands. Each gland has three parts viz. body, neck and isthmus.
- The cells present in the fundic glands are:

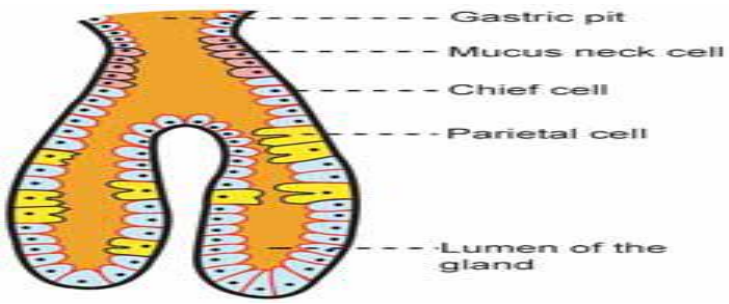
1. Chief cells or pepsinogen cells

2. Parietal cells or oxyntic cells

3. Mucus neck cells

4. Enterochromaffin (EC) cells

5. Enterochromaffin-like (ECL) cells.



FUNCTIONS OF STOMACH

1-MECHANICAL FUNCTION

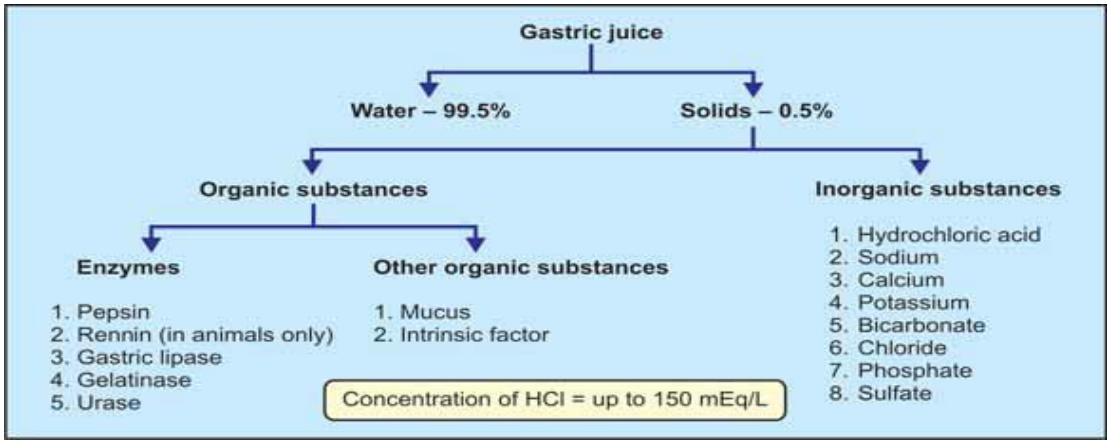
I. Storage Function

The food is stored in the stomach for a long period, i.e., for 3 to 4 hours and emptied into the

intestine slowly. The maximum capacity of stomach is up to 1.5 L.
The slow emptying of stomach provides enough time for proper digestion and absorption of food substances in the small intestine.

Ii. Formation of Chyme

The peristaltic movements of stomach mix the bolus with gastric juice and convert it into the semisolid material known as chyme.



Composition of gastric juice

PROPERTIES AND COMPOSITION OF GASTRIC JUICE

- Gastric juice is the mixture of secretions from different gastric glands.

Properties of Gastric Juice

- Volume: 1200 to 1500 mL/day

- Reaction: Gastric juice is highly acidic with pH of 0.9 to 1.2 due to hydrochloric acid.

FUNCTIONS OF GASTRIC JUICE

1. DIGESTIVE FUNCTION

- The gastric juice acts mainly on proteins. The proteolytic enzymes of the gastric juice are pepsin and rennin. Gastric juice also contains

some other enzymes like gastric lipase, gelatinase, urase and gastric amylase.

Pepsin

- Pepsin is secreted as inactive pepsinogen.
- Pepsinogen is converted into pepsin by hydrochloric acid which is secreted by parietal cells.
- The optimum pH for activation of pepsinogen is below 6.

Action of pepsin

- Pepsin converts proteins into proteoses, peptones and polypeptides. Pepsin also causes curdling and digestion of milk (casein).

Gastric Lipase

Gastric lipase is a weak lipolytic enzyme. It needs acidic medium with pH is between 4 and 5 for its action. But it becomes inactive when the pH falls below 2.5. Gastric lipase acts on tributyrin (butter fat) and hydrolyzes it into fatty acids and glycerols.

Actions of Other Enzymes of Gastric Juice

i.Gelatinase degrades gelatin and collagen into peptides

ii. Urase acts on urea and produces ammonia

iii. Gastric amylase degrades starch

iv. Rennin curdles milk (present in animals only).

2. HEMOPOIETIC FUNCTION: The intrinsic factor of Castle secreted by parietal cells of gastric glands plays an important role in

erythropoiesis. It is necessary for absorption of vitamin B12 (which is called extrinsic factor) from

GI tract into the blood. Vitamin B12 is an important maturation factor during erythropoiesis.

Absence of intrinsic factor in gastric juice causes deficiency of vitamin B12 leading to pernicious anemia

3. PROTECTIVE FUNCTION –FUNCTION OF MUCUS

The mucus present in the gastric juice protects gastric wall

Mucus:

i. Protects the stomach wall from irritation or mechanical injury by virtue of its high viscosity.

ii. Prevents the digestive action of pepsin on gastric mucosa

iii. Protects the gastric mucosa from hydrochloric acid of gastric juice because of its power alkaline nature and its acid combining.

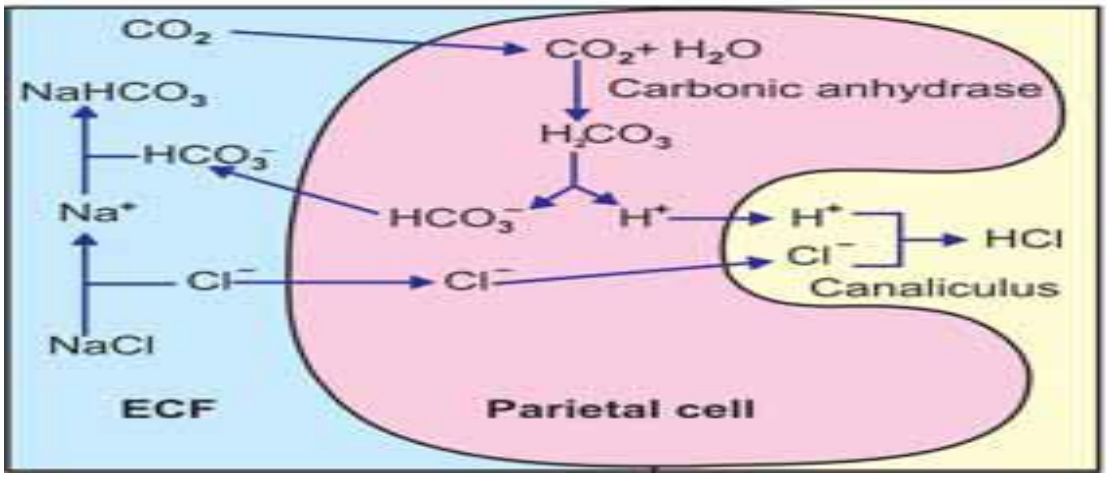
4. FUNCTIONS OF HYDROCHLORIC ACID

Hydrochloric acid present in the gastric juice:

i. Activates pepsinogen into pepsin

ii. Kills some of the bacteria entering the stomach along with food substances – this stomach along with food substances – this action is called bacteriolytic action.

iii. Provides acid medium which is necessary for the actions of the hormones.



SECRETION OF HYDROCHLORIC ACID

PHASES OF GASTRIC SECRETION

- Gastric juice is secreted in three different phases:
- I. Cephalic phase
- II. Gastric phase
- III. Intestinal phase.

- In human beings, a fourth phase called inter digestive phase exists. All the phases are regulated
- by neural mechanism or
- Hormonal mechanism or both.

CEPHALIC PHASE

- Secretion of gastric juice by the stimuli arising from head region (cephalus) is called cephalic
- phase. This phase is regulated by nervous mechanism.
- During this phase, the gastric secretion occurs even without the presence of food in the
- stomach. The quantity of the juice is less but it is rich in enzymes and hydrochloric acid.

- The nervous mechanism that regulates cephalic phase operates through reflex action.

- Two types of reflexes occur:

1. Unconditioned reflex
2. Conditioned reflex.

Unconditioned Reflex

- Unconditioned reflex is the inborn reflex. When food is placed in the mouth, it induces salivary

secretion .Simultaneously, gastric secretion also occurs.
- Stages of the reflex action
- i. The presence of food in the mouth stimulates the taste buds and other receptors in the mouth
- ii. The sensory (afferent) impulses from mouth pass via afferent nerve fibers of glossopharyngeal and facial nerves to appetite center present in amygdala and hypothalamus.
- iii. From here, efferent impulses pass through dorsal nucleus of vagus and vagal efferent nerve fibers to the wall of the stomach.
- iv. Acetylcholine is secreted at the vagal efferent nerve endings stimulates gastric glands to increase the secretion.

GASTRIC PHASE

- The secretion of gastric juice when the food enters the stomach is called gastric phase. This phase

is regulated by both nervous and hormonal mechanisms. The gastric juice secreted during this phase is rich in pepsinogen and hydrochloric acid. The mechanisms involved in this phase are:

1. Nervous mechanism through local myenteric reflex and vasovagal reflex

2. Hormonal mechanism through gastrin.

1. Nervous Mechanism

- Local myenteric reflex
- Local myenteric reflex is elicited by stimulation of myenteric nerve plexus in stomach wall. After

entering stomach, the food particles stimulate the local nerve plexus present in the wall of the stomach.

- These nerve fibers release acetylcholine, which stimulates the gastric glands to secrete a large quantity of gastric juice.
- Simultaneously, acetylcholine stimulates G cells to secrete

Vagovagal reflex

- is the reflex in which both afferent and efferent vagal fibers are involved.
- Presence of food in stomach stimulates the sensory (afferent) nerve endings of vagus which generate sensory impulses.
- The sensory impulses are transmitted to the brain stem via sensory fibers of vagus. Brainstem in turn sends efferent impulses through the motor (efferent) fibers of vagus back to stomach and cause secretion of gastric juice. Since, both afferent and efferent impulses pass through vagus, this reflex is called vagovagal reflex.

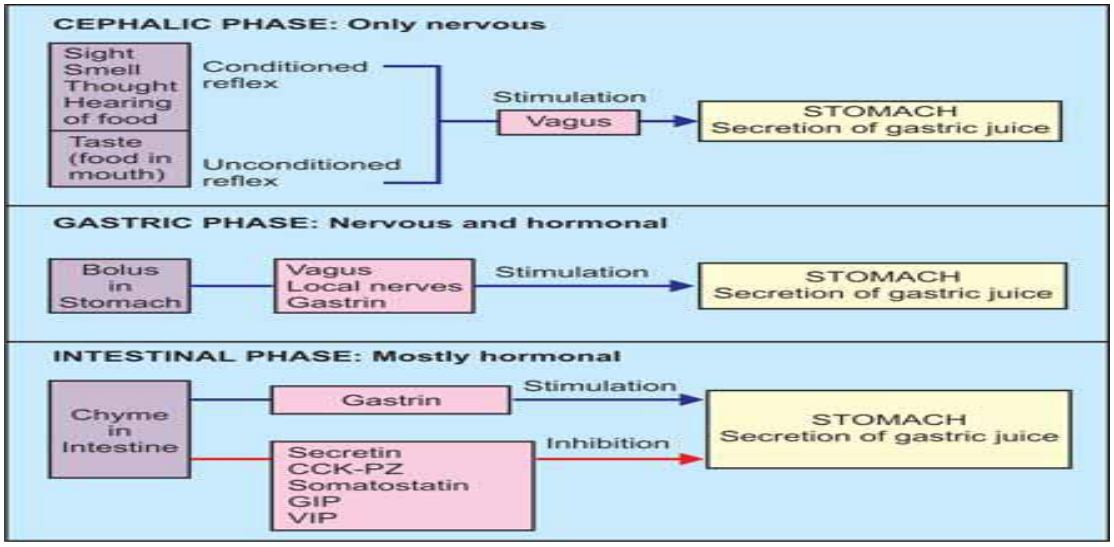
2. Hormonal Mechanism – Gastrin

- Gastrin is a gastrointestinal hormone secreted by the G cells which are present in pyloric glands

  of stomach.
- The nerve endings release the neurotransmitter called gastrin releasing peptide which stimulates the G cells to secrete gastrin.

- Actions of gastrin on gastric secretion

Gastrin stimulates the secretion of pepsinogen and hydrochloric acid by the gastric glands.



Regulation of gastric secretion