

Physiology of digestion

Lecture- II

Digestion in the stomach

Digestion in stomach takes place mainly by the action of gastric juice. Contraction of three layers of muscle fibres present in the stomach wall, causes peristaltic movement, mixes the food with gastric juice.

Gastric juice

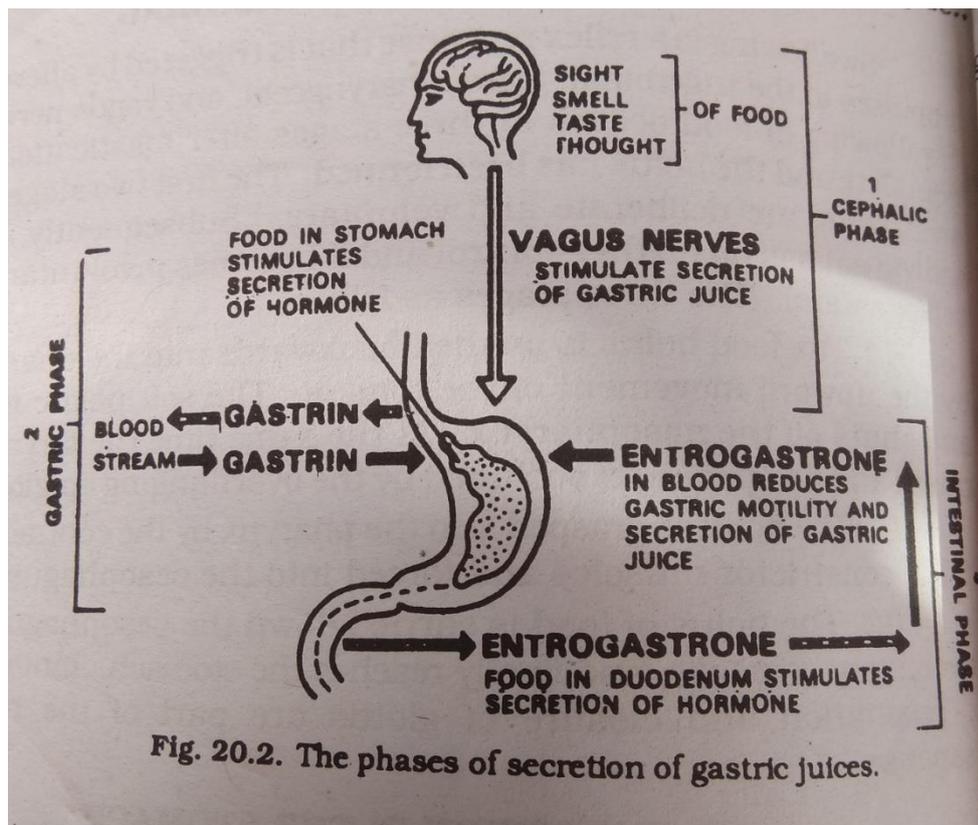
Gastric juice is secreted in two phases

cephalic phase.

-release due to sight, smell or taste of food, occurs before the food reaches to the stomach.

gastric phase.

- Due to presence of food the gastric mucosa stimulates the release of gastrin hormone. This hormone further stimulates the gastric glands present in the stomach to produce gastric juice.



In the mucosa of the stomach wall two types of secretory glands are found

-Chief cells (Single layer of secretory cells)

-Parietal cells (multi layered secretory cells), sole source of hydrochloric acid.

Secretions from both of these glands goes directly in the gastric glands. The mixed secretion is known as gastric juice.

The gastric juice is clear, pale yellow fluid of high acidity, 0.2 to 0.5% HCl with a pH of about 1.0.

Daily secretions of gastric juice is about 2500ml.

Enzymes present are pepsinogen, rennin and gastric lipase. Gastric juice also contains mucous, inorganic salts and intrinsic factors.

Various constituents of the gastric glands perform different functions.

Water - constitutes about 97 to 99% of gastric juice. It further liquifies the food swallowed.

HCl - secreted by the parietal cells performs following function-

1. It acidifies the food and stop the function of ptyalin.
2. Inactivate pepsinogen is converted to active enzyme pepsin.

HCl

pepsinogen ----> Pepsin

(inactive) (active)

3. The acid kills bacteria ingested by the food.

Enzymes

1. **Pepsin:** main digestive function of the stomach is partial digestion of protein. Gastric pepsin is produced by the chief cells as the inactive zymogen, pepsinogen, which is activated to pepsin by the action of HCl and autocatalytically, by itself.

H⁺

Pepsinogen -----> Pepsin

Autocatalysis by pepsin itself

More pepsinogen -----> pepsin

The enzyme pepsin transforms native protein into proteoses and peptones. These are still reasonably large protein derivatives.

i. Pepsin + proteins -----> proteoses and peptones

Ca⁺⁺

ii. Pepsin + Caseinogen -----> Casein -----> Ca Paracaseinate

Pepsin

-----> Peptones and Proteoses

2. Renin (Chymosin, Rennet). The enzyme causes coagulation of milk. This is important in the digestive processes of calf because it prevents the rapid passage of milk from the stomach. In the presence of calcium, renin changes irreversibly the casein of milk to paracasein. Pepsin acts on the paracasein and get converted into proteoses and peptones.

*Renin is absent in the human gastric juice.

Mucous

It is a glycoprotein which helps in neutralising the acid in the stomach. It reduces the gastric acidity and prevents the gastric mucosa by forming a coating on the mucous membrane.

It also acts as lubricant.

Inorganic Salts: These includes NaCl, KCl, CaCl₂, Ca (PO₄)₂, Mg (PO₄)₂ and MgHCO₃ etc.

Intrinsic factor: Gastric juice contains the intrinsic factors which is necessary for the absorption of vitamin B₁₂ (erythrocyte maturing factor).

Regulation of gastric secretions

When the partially digested content of the stomach reaches the duodenum having considerable amount of fat, a hormone enteropogasterone is produced which slows down the gastric secretion and reduces gastric motility.

Movement of the stomach

The food remains in the stomach about five hours providing ample time to digestive juices to act upon food. By the peristaltic movement muscle of the stomach churn the food and mix it with water and gastric juice. Food leaves the stomach in semisolid condition and it is called chyme. Chyme (partially digested food of stomach) passes into the duodenum in small jets.

Measures against the autodigestion of the stomach

The stomach and duodenum wall are on high risk of auto digestion as high concentration of acid and proteolytic enzymes are present in the stomach. It generates curiosity because stomach doesn't auto digest itself. Several factors which play role in preventing autodigestion are-

1. Mucous layer- The surface of the gastric mucosa is lined with cells which secrete slightly alkaline mucous it forms about 1 to 1.5 mm thick layer. This helps in neutralising the H⁺ in the immediate area of epithelial cell layer. Cell membrane lining the stomach also have very low permeability to H⁺.
2. Tight junction: Epithelial cells lining the stomach lumen are joined together by tight junctions, thus leaving no extracellular passage between the cells.
3. Cell replacement: The mucosal cell lining the wall of the stomach are continually being shed and replaced and lining of the stomach completely renew itself in every three days.