

PHYSIOLOGY OF DIGESTION AND ABSORPTION:

The food is masticated or chewed by the teeth and moved round the mouth by the tongue and the muscles of the cheeks. It is mixed with saliva and formed into a soft mass or bolus ready for swallowing. The secretions of the salivary glands contain an enzyme 'ptyalin' which converts starches into maltose. The salivary secretion also moistens and lubricates the food. It also cleans the mouth and keeps the structures within the mouth soft and pliable. The bolus of food is pushed back into the pharynx by the upward movement of the tongue.

The muscles of the pharynx further propel it down into the esophagus. The presence of bolus in the pharynx stimulates a wave of peristalsis and propels the bolus through the esophagus to the stomach. The walls of the esophagus are lubricated by mucous which assists the passage of the bolus during peristaltic contraction of the muscular wall.

The stomach acts as a temporary reservoir for food thus allowing the digestive juices to act on food. It also produces gastric juice which contains water, mineral salts, mucous, hydrochloric acid, enzymes, i.e., pepsinogen, renin and the intrinsic factor. Water in the gastric juice further liquefies the swallowed food. Hydrochloric acid acidifies the food and stops the action of salivary ptyalin. It also converts pepsinogen to the active enzyme pepsin and kills many microbes which may be harmful to the body. Pepsin converts proteins into peptones, and renin changes soluble caseinogen from the milk to insoluble casein which in turn is converted by pepsin into peptones. Renin is present in gastric juice of infants only.

The intrinsic factor is necessary for the absorption of vitamin B₁₂. The mucous in the gastric juice prevents mechanical injury to the stomach wall by lubricating the contents. It also prevents chemical injury by acting as a barrier between the stomach wall and other constituents of gastric juice. Muscular action of the stomach mixes the food with gastric juice and moves it to the small intestine. Absorption takes place in the stomach and to limited extent water, glucose, alcohol and some drugs are absorbed through the walls of the stomach into the venous circulation.

The small intestine further progresses the movement of its contents by its peristaltic, segmental and pendulum movements; besides it secretes intestinal juice which consists of water, mucous and various enzymes. The intestinal juice is alkaline in nature. The enzymes in the intestinal juice perform various functions. Enteropeptidase converts inactive pancreatic trypsinogen and chymotrypsinogen to active trypsin and chymotrypsin which further convert peptones into peptides and polypeptides. Intestinal and pancreatic amylase convert polysaccharides to disaccharides. Peptidases convert peptides and polypeptides into amino acids. Lipase converts fats into fatty acids and glycerol. Sucrose, maltase and lactase act on corresponding disaccharides to convert them into monosaccharides. The intestinal juice thus completes digestion of carbohydrates, proteins and fats. The solitary lymph follicles and aggregated lymph follicles in the villi of small intestine help in protection against infection by micro-organisms. All the digested materials are also absorbed in the small intestine.

The end products of digestion of carbohydrates, proteins and fats are monosaccharides (mainly glucose), amino acids, fatty acids and glycerol respectively. Glucose is absorbed into the capillaries of the villi and transported in the portal circulation to the liver. Amino acids also follow the same path. Fatty acids and glycerol are absorbed into the lacteals of the villi and are transported via, the thoracic duct to the left subclavian vein. Then they are carried to the liver where they are reorganized and recombined.

The food passing through the small intestine enters the large intestine. In the large intestine, absorption of water continues till semi-solid consistency is achieved. Mineral salts and some drugs are also absorbed into the blood capillaries from the large intestine. The large intestine exhibits a wave of strong peristalsis only at long intervals. This forces its contents into the descending and pelvic colon and finally to the anus.

TABLE: DIGESTION OF FOOD IN ALIMENTARY CANAL

ORGAN	SECERETION	ENYME	SUBSTRATE	END PRODUCT
1. Mouth	Saliva	(a) Salivary Amylase	Starch	Maltose
2. Stomach	Gastric Juice	a) Renin (infants)	Casein	Paracasein
		b) Pepsin (obtained by action of HCl on Pepsinogen)	Proteins Paracasein	Proteases Peptones and Polypeptides
		c) Gastric lipase	Emulsified fats	Fatty acids + glycerol
3. Small Intestine	1. Pancreatic juice from Pancreas	(a) Trypsin (obtained from Trypsinogen and enterokinase)	Chymotrypsinogen Proteins Proteases Peptones Polypeptides	Chymotrypsin Polypeptides, dipeptides
		b) Chymotrypsin	Proteins Proteases Peptones Polypeptides	Polypeptides, dipeptides
		c) Pancreatic Amylase	Starch, Glycogen	Disaccharides
		d) Pancreatic Lipase	Emulsified fats	Fatty acids + glycerol
	2. Bile from liver	-	Unemulsified fats acted upon by bile salts	Emulsified fats
		a) Peptidase	Polypeptides, dipeptides	Amino acids
		b) Enteric lipase	Emulsified fats	Fatty acids + glycerol
		c) Sucrose	Sucrose	Glucose + Fructose
		d) Maltase	Maltose	Glucose
		e) Lactase	Lactose	Glucose + Galactose
		f) Enterokinase	Trypsinogen	Trypsin