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B.Sc HONS Part III Paper - V

Topic - Physiology of Digestion in Mammals

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Q. Q Given an account of physiology of digestion in mammals.

Ans. Digestion is an adaptation to deal with larger particles in order to break them to such a size that intracellular digestion can take place. In this process digestion occurs outside the cells in a tube called as gut or alimentary canal.

Digestion may be studied under the following heads—

1. Buccal digestion
2. Gastric digestion
3. Intestinal digestion.

1. Buccal Digestion : In buccal cavity, the food is chewed so that it may be swallowed easily; while chewing there is also an increase in the secretion of saliva which softens the food and swallowing becomes easier.

The saliva coming from salivary gland is viscous and colourless. Its pH ranges from 6.2 to 7.4. The saliva contains a digestive enzyme ptyalin which hydrolyses the starch first to split it into dextrins and then to maltose.

Ruminants (cow, buffalo, etc.) have no ptyalin in their saliva. A few other enzymes are also found in human saliva, such as lipase, proteinase, sulphatase etc. whose functions is to digest food particles sticking on the teeth and thus to keep the mouth clean.

2. Gastric Digestion : After swallowing the food passes down the oesophagus by peristaltic movements gastric juice is poured out in the stomach. The gastric juice contains 97-99 percent water. The rest of the gastric juice contains HCl, pepsinogen, mucin and inorganic salts.

The enzymes secreted in the stomach are pepsinogen and gastric lipase.

(i) Digestion of Protein : The pepsin is secreted by the chief cells in the inactive state called pepsinogen. The HCl activates this enzyme into pepsin at a pH of 4.6 below.

Native protein $\xrightarrow[\text{pH 1.5-3}]{\text{Pepsin}}$ Proteoses, peptony polypeptides.

Calcium casein (milk) $\xrightarrow[\text{Pepsin}]{\text{Pepsin}}$ Calcium paracasein + proteoses.

Calcium paracasein $\xrightarrow{\text{Pepsin}}$ proteoses, pepton polypeptides.

The renin is the milk-coagulating protein of enzyme changing soluble protein of the (casein) into insoluble paracasein in presence of Ca^{++}

Renin + milk protein (casein) $\xrightarrow{\text{Ca}^{++}}$ paracasein.

(ii) Digestion of Fat : Gastric lipase is produced only in traces by the gastric glands which digest same the amulsified fat into fatty acids and glycerol.

Gastric lipase + fat \rightarrow Glycerol + fatty acids.

No digestion of carbohydrates occurs in the stomach.

3. Intestinal Digestion : The gastric chyme moves to the next region, the duodenum, by passing through the phylorus little by little. He first of all the pancreatic and bile juices mix with the chuyme, the average PH of the pancreatic juice ranges from 7.5 to 8.0.

Following enzymes occur in the pancreatic juice—

Trypsin, Chymotrypsin, Peptidase, Nuclease, lipase Amyleso, Esterase, Collagense.

Trypsin and chymo trypsin are found in the form of their respective precurs trysinogen and chymotrysinogen, which are inactive.

(i) (a) Native Protein $\xrightarrow[\text{Chymotropsis}]{\text{Trypsin}}$ Proteoses + peptone + polypeptide

(b) Proteoses + pepton + polypeptide $\xrightarrow[\text{Chymotropsis}]{\text{Trypsin}}$ polypeptides

dipeptides.

(ii) Carboxy Peptidase : It can not spilt protein like the above endepeptidase. It is an exopeptidase acts an proteoses, peptones. polypeptidase ect. connecting them into dipetias and amino acid.

(iii) Amino Peptidase : It is also an exopeptidase and its reaction is like that of carboxy peptidase.

Proteoses + peptonas + Polypeptidase

$\xrightarrow{\text{A min opeptidase}}$ dipeptidase + Amino — acids.

Dipeptidase \rightarrow Amino — acids.

(iv) Amylopsin (Amylox) : Like ptyalin it coverts (hydrolyze starch (carbohydrates), dextrins and glycogen into maltose. It has greater digestive power than salivary amylase.

Amylase

Starch \longrightarrow Maltase.

(v) Steapsin (Pancarectic Lipax) : It hydrolyses fats into glycerol, fatty acids, monoglycerides and diglycerides in a medium having pH between 7 and 8. steapsin

Steapsin

fats \longrightarrow fatty acid + glycerol

(vi) Pancreatic Renin : It converts remaining milk -protein (casein) into solid paracasein.

(vii) Pancreatic Lactax : Transforms lactose (sugar) into maltose.

Lactose

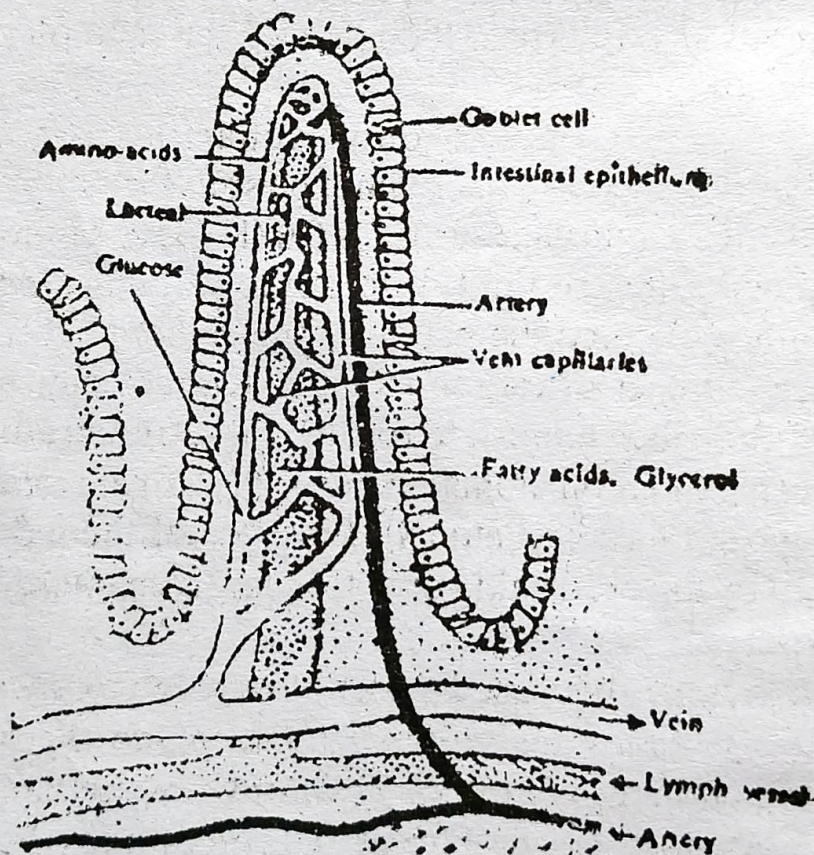
Lactose \longrightarrow Glucose + galactose

(viii) Cholesterol Esterase : It esterifies the cholesterol into cholesterol esters which is absorbed.

(ix) Pancreatic Nucleases : They are found in the pancreatic juices as deoxyribonuclease and ribonuclease which hydrolyze nucleic acids into mononucleotides.

Absorption of Food : The villi are in constant motion during the digestion and absorption.

(a) Absorption of Protein : The smaller peptides and amino acids produced in digestion are quickly absorbed through the intestinal mucosa and reach the hepatic portal vein.



(b) Absorption of Carbohydrates : The final digested form of carbohydrates is chiefly in the form of simple monosaccharides. The hexose sugars are absorbed much faster than the pentose sugars; glucose reaches the blood capillaries and probably in smaller quantities it also reaches the lacteals.

(c) Absorption of Fats : Fatty acids and monoglycerides are almost wholly insoluble in water, so they cannot be absorbed directly. Bile salts combine with fatty acids to produce water-soluble substances which can be absorbed.