

Q1. Describe Gastro-intestinal system and write about the metabolism of Carbohydrate?

Ans.

The alimentary canal begins at the mouth and ends at anus

The digestive process gradually breakdown the food eaten until they are in the form suitable for absorption.

After absorption, nutrients are used to synthesize body constituent

Steps related to digestion:-

Ingestion:- This is the intake of food into the alimentary tract.

Eating and drinking

Propulsion:- This mixes and moves the content along the alimentary tract

Digestion:- This consist of-

a) Mechanical breakdown of food by mastication

b) Chemical digestion of food into small molecules by enzymes

Absorption:- This is a process by which digested food substance pass through the walls of some organs of the alimentary canal into the blood for circulation and use by the body

Elimination:- Food substance that have been eaten but cannot be digested and absorbed are excreted from the the alimentary canal

Alimentary canal consist of mouth (tongue, teeth, saliva)

Esophagus.

Pharynx

Small intestine

Large intestine

Stomach

Anus

Mouth

It is lined with stratified squamous epithelium

a. Tongue: Tongue lies in the floor of the mouth and it is attached to hyoid bone. It is voluntary muscular structure.

Function: Sense of teeth

Speech

Mastication

Swallowing

b. Teeth: Teeth are concerned with mastication

It is a living structure

In humans more than one type of teeth are present viz

1. Incisors (cutting teeth)
2. Canines (tearing teeth)
3. pre-molar (grinding teeth)
4. molar (grinding teeth)

c. Saliva: Three pairs of salivary glands are present in human

1. Parotid

2. Sub-mandibular

3. Sub-lingual

Saliva is the mixed secretion of all the 3 pairs of salivary glands. It is an alkaline fluid containing water to the extent of 99%

Function: It converts cooked starch into a soluble sugar called maltose.

It lubricates and cleans the mouth

It acts as solvent for food and helps in swallowing

Pharynx:

Pharynx lies between the mouth and Oesophagus

- Pharynx consist of 3 parts
1. Nasopharynx - imp in respiration
 2. Oropharynx - common pathway
 3. Laryngopharynx

Oesophagus:-

It is also known as food pipe and is 25-40 cm long

It runs through neck and thorax to reach abdominal cavity by piercing the diaphragm.

It is lined by stratified squamous epithelium

Function:

In the mouth, the food is masticated and mixed with saliva, the action of tongue converts food into a round mass called bolus. This bolus is swallowed

In the oesophagus, contraction of its muscular walls carries the food down to stomach.

Stomach:

It is a J-shaped structure and present on left side of abdomen
It is differentiated into 3 parts.

1. Cardiac stomach
2. fundic stomach
3. pyloric stomach.

Fundic is the most active part of the stomach

The secretion of gastric gland is called gastric juice

It is highly acidic in nature due to the presence of HCl

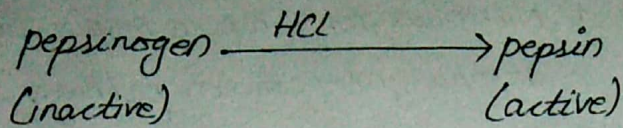
The secretion of gastric juice is controlled by gastrin hormone

In man 2-3 l per day of gastric juice is secreted

The gastric juice in man contain pepsinogen + xanin + HCl + lipase

Gastric juice kills micro-organisms

It also convert inactive enzymes into their active form



Function:

Stomach stores food & break it

It sterilise the food by adding HCl

It absorb alcohol, water and some drug

It secretes intrinsic factor for absorption of vit B₁₂

Small Intestine :-

It is the longest part of the alimentary canal present in the abdominal cavity. about 6.2m long

It is rejoined into 3 parts.

1. Duodenum

2. Jejunum

3. Ileum

Duodenum :- C-shaped structure and 25 cm long. It contain mucus and neutralize the acidity of food

Jejunum :- It is about 2.5 long. It is rich in digestive gland

Ileum :- It is the longest part about 3.5m long.
It is the most active part of intestine

Large intestine :-

Ileum open into caecum of large intestine

At the junction, rounded structure is present

Diameter is larger

It is divided into 4 parts

- Caecum
- Colon
- Rectum
- Anal Rectum

Calcum: It is the frontal part of large intestine. It is a tube like structure.

Colon: It has 4 segment

Ascending

Descending

Transverse

Sigmoid.

No digestive enzyme is secreted from colon.

Rectum: It stores undigested food & waste containing 30% bacteria, 30% undigested food, 10-20% fat & very low protein content.

Anal Canal: 3cm long. It connects rectum with anus.

Anus: It is a terminal distal opening of alimentary canal.

• Digestion of Carbohydrate;

Ptyline (salivary amylase) present in saliva



converts food into sugar (maltose)



All sugars are converted into simple monosaccharides into glucose



Sucrose, maltose, lactose (present in small intestine)

maltose $\xrightarrow{\text{maltose}}$ Glucose + Glucose (Blood sugar)

Sucrose $\xrightarrow{\text{sucrose}}$ Glucose + fructose (fruit sugar)

Lactose $\xrightarrow{\text{lactose}}$ Glucose + Galactose (Brain sugar)

Q Write about the anatomy and physiology of liver

Ans: Study - Hepatology

Liver is the largest abdominal organ and gland in overall body

Weight - Male - 1.4kg - 1.8kg

Female - 1.2kg - 1.4kg

It lies in the upper part of abdominal cavity below the diaphragm & under the cover of lower ribs.

There are 4 lobes in the liver

Right lobe

Left lobe

quadrate lobe

Caudate lobe

Structure :-

It has maximum regeneration power

The structural & function unit of liver is lobules

Each lobules is surrounded by a connective tissue covering called glisson's capsule

In the centre of lobules there is a branch of hepatic vein

The phagocytic cell lie glisson's capsule (Kupffer cells)

Gall bladder lie on the inferior surface of liver.

function of gall bladder is to store bile & concentrate it

Function of liver :-

Bile production :-

Liver produce 700-900 ml bile/day

pH of bile is 8.6 (alkaline)

Bile salts helps in emulsification of fat & activation of lipase system.

Bile juice helps in digestion but it is not an enzyme

Urea formation & Ornithine cycle. Urea cycle is also known as kreb's cycle runs into liver.

Storage formation :- Liver act as storage part of emergency water
liver is second reservoir of blood

Regulation of blood sugar level :- Liver regulates the blood sugar level by glycogenesis and glycogenolysis.

Production of plasma protein:-

- Liver produce all plasma protein albumin, globulin, fibrinogen, prothrombin.
- " also " anti-coagulants eg. heparin except γ -globulin which is produced in lymphoid organ.

Digestion of food in alimentary canal :- food contain carbohydrate, protein, fat all these constituent of food are digested in the alimentary canal. as follows.

1) Digestion of protein:-

Digestive enzyme (pepsin of stomach, trypsin)



converts protein into peptones & poly peptide & finally AA's.



AA's are absorbed through villi of small intestine



carried to liver

2) Digestion of fat:-

Fat is synthesized when we take a diet very much rich in carbohydrate & protein



stored in fat under the skin



Absorbed as fatty acid & glycerol



Transported to the blood stream



Some fatty acids & glycerols are used to provide energy & heat

3/ Digestion of Carbohydrate

Other's function of liver

a. Homeostatic - liver is site of heat production.

Liver participate in all main process directly or indirectly so in all the internal process it maintain our body temperature.

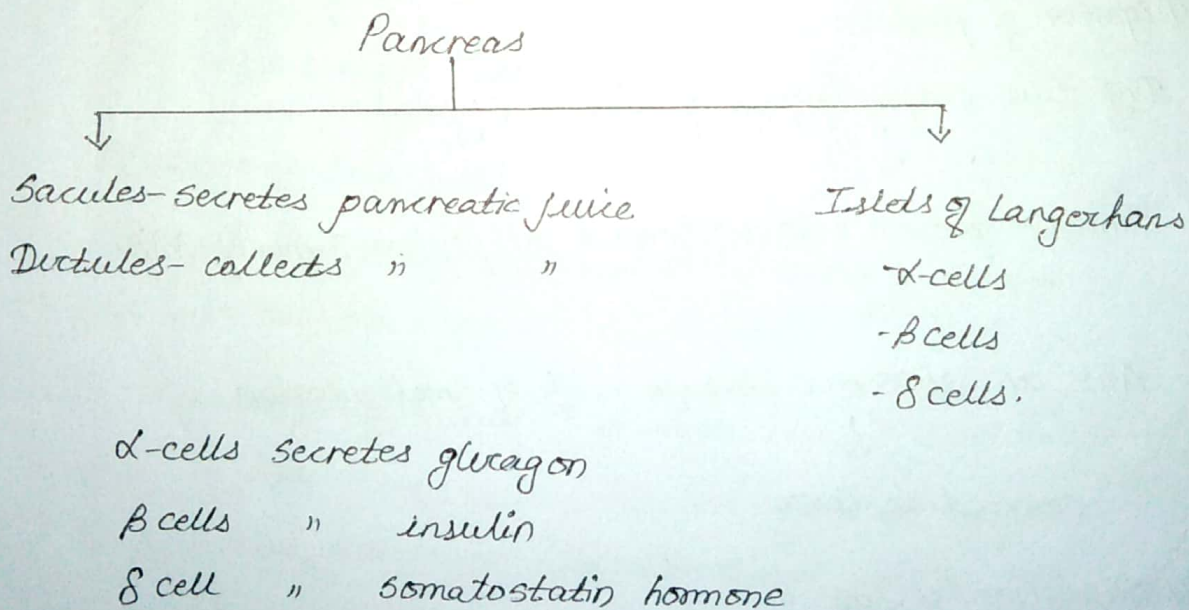
b. Kupffer cells of liver acts as phagocytes

c. Liver also stores minerals like Cu, Fe, Vit A, D, E & B₁₂

NOTE: Blood supply to liver in human is 1500ml/min. (1000ml from hepatic portal vein & 500ml from hepatic artery)

Q3. Role of Pancreas in Diabetes mellitus.

Ans. Second largest gland of body about 12-15cm long & 2.5cm wide
Pancreas is a mix gland (endocrine or exocrine)



The normal blood glucose level is between 60-140mg/100ml of blood

The blood glucose level is controlled by the antagonistic action of insulin & glucagon.

Glucagon inc. blood glucose level & insulin decrease blood glucose level

Function of insulin:-

- Increase the permeability of cell membrane for utilization
- Insulin promotes the entry of glucose into all cells of body except cell of liver, Brain, cells & RBC
- Insulin also promote the entry of fatty acids & amino acids into the cell
- It helps the entry of potassium inside the cell & promote the synthesis of glycogen from glucose
- Insulin promotes lipogenesis (lipid formation)
- Inhibit the formation of ketones
- promote the protein synthesis
- Inc the synthesis of DNA & RNA
- Once glucose enters muscles cells it is either used immediately as fuel or stored as glycogen.
- It also inhibit liver cells for releasing glucose

Function of Glucagon.

The action of glucagon is opposite to those of insulin. so the effect of glucagon inc blood glucose level by

- 1- Stimulating of Insulin & glucagon directly controlled by blood glucose level
- 2 promoting gluconeogenesis (formation of new glucose molecules)
- 3: Increase adipose (Lipolysis) other than carbohydrate

Regulation:-

Secretion of Insulin & glucagon is directly controlled by blood glucose level.

After a meal the concⁿ of glucose in the blood inc. Its stimulates the β cells to inc. the insulin secretion

Glucose concn too high (in Blood)



β cells secrete insulin



Blood glucose concn decrease



Homeostatic (Balanced condition)

- When one has not eaten food for several hours the glucose concn in the blood begins to fall.

- When it falls from its normal fasting level of about 90mg/dm to 70mg/dm the α -cells of islets Glucagon.

Glucose concn too low (in blood)



α -cells secrete Glucagon



Blood glucose concn increase



Homeostatic (Balanced condition)

- Diabetes Mellitus
 - Insulin dependent DM + Injection \rightarrow Type I
 - Non-insulin dependent DM + (oral hypoglycemic agents) \rightarrow Type II

The main disorder associated with pancreas hormone "Diabetes Mellitus". Two type;

The insulin is not sufficient to the amt. of carbohydrate digestion
The insulin not able to penetrate the cells.

Q4 Discuss the structure and role of small intestine in food absorption.

Ans. Small intestine is the part of alimentary canal which extends from the pyloric end of stomach to caecum (the 1st part of large intestine)

Parts:- i. Duodenum ii. Jejunum iii. Ileum

Structure:- Small intestine consist of the same four coat which are present in stomach. They are

1. Peritoneal coat (made of serous membrane)
2. Muscular coat (made of only circular and longitudinal fibres)
3. Submucous coat (made of areolar tissue)
4. Mucous coat (which is the inner lining)

The mucous coat contains;

- 1 Plicae circulares which are a number of folds of a mucous membrane
- 2 Villi which absorb carbohydrate, protein & fat

Digestion in small intestine:- The acidic chyme from the stomach enters the duodenum. There it mixes with

1. The alkaline intestinal juice called succus entericus
- 2 Alkaline secretion from liver & pancreas

In the small intestine, digestion is carried out by the following enzymes of intestinal juice

1. Enterokinase which convert trypsinogen of pancreatic juice into trypsin
2. Trypsin which convert polypeptide into amino acids.
3. Sucrose, maltase and lactase which convert the corresponding disaccharides into monosaccharides

Absorption in small Intestine:- The absorption of digested food occurs in small intestine through villi

Villi = Villi are minute projection which are present in the inner mucous coat of the intestine. The villi gave a velvety appearance to the intestinal mucous membrane. Each villi has

1. A central lymphatic vessel called lacteal. fats are absorbed into lacteal and carried to thoracic duct

2. A network of capillaries surrounding the lacteal. Digested product of carbohydrate and protein are absorbed into these capillaries. They are carried to liver by portal vein

3. Lymphoid tissue which holds together the lacteal and capillaries.