

30/12/25

Ch-11 Digestive system

Notes:-

Digestion: Process that makes the food soluble and of such chemical nature they can be absorbed through living membranes.

Enzymes: Proteins that acts as biological catalysts by accelerating chemical reactions.

The Digestive System: Alimentary canal and digestive glands (9 metres long).

Mouth

- Lips - Helps in closing the mouth, sucking and sipping liquids, speaking etc.
- Tongue - Helps in manipulation the food while chewing and mixing it with saliva, tasting, cleaning the food particles from teeth after eating and helping in speaking.

Teeth - Dentition (Arrangement of ^{teeth} jaws in the jaws).

- Incisors (Four front, for biting and cutting).
- Canines (One on either side for holding and tearing).
- Premolars / Bicuspids - (Two on each side for grinding and crushing).
- Molars (Last three teeth on each side, grinder and crusher of food).

⇒ Mammalian Teeth

Milk Teeth/Deciduous teeth Temporary teeth - 20 teeth
Permanent Teeth = milk teeth are replaced by 2 years of age.

Dental Formula: $\frac{2120}{2120}$ (child), $\frac{2122}{2122}$ or $\frac{2123}{2123}$ (Adolescent/Adult).

Heterodont (Different in shape), Homodont (Similar in ~~shape~~ shape).

Structure = Enamel (Hardest material), Dentine (not harder than enamel, has minute canals through which runs the strands of cytoplasm of the cells of pulp cavity), Cement (bone-like structure covering and fixing the root), Pulp (soft connective tissue, consists of blood capillaries, lymph vessels and nerve fibres).

⇒ Salivary glands

a) Parotid gland = located just in front and below each ear.

b) Submandibular gland = lying close to the inner side of the lower jaw (each side).

c) Sublingual gland = Below the tongue.

→ Composition = Slightly acidic (pH 6.8), water (99%), salt, mucus, salivary amylase

→ Functions = (i) Facilitates speaking and swallowing, stimulates taste buds and aids in water balance of the body.

(ii) Helps in forming bolus.

(iii) Starch $\xrightarrow{\text{Salivary amylase}}$ Maltose

Peristalsis movement: Wave of constrictions

caused by the circular muscles of the gut pushing the food along. Occurs in all region of gut.

~~Esophagus~~ Oesophagus

Tube like that conducts the food from the throat to the stomach. No digestive enzymes present.

Stomach

Cardiac sphincter: Prevents backflow of food into the oesophagus.

Pyloric sphincter: Prevent regurgitation from the duodenum.

Vomiting: Caused by cardiac sphincter opening and anti-peristalsis.

Chyme: Food stays in the stomach for 3 hours and attain a pulp-like form.

Gastric juice: Secreted by inner lining of stomach. Colourless highly acidic liquid.

• HCl → Kills ~~germs~~ germs.

→ Pepsinogen $\xrightarrow{\text{HCl}}$ Pepsin (active)

→ Prorennin $\xrightarrow{\text{HCl}}$ Rennin (active)

• Mucus → Lubricate and protect the mucosal epithelium from ^{acid}.

• Pepsin → Digests proteins (20%) into peptides.

• Rennin → Digests milk protein (casein) into paracasein (insoluble).

Small Intestine

→ Tube about 7 metres long and 2.5 cm wide, coiled and folded in the abdomen.

- Duodenum: Short upper part next to stomach, common bile duct opens in it.
 - Jejunum: Short region of about 2m long empty after death.
 - Ileum: About 4m long (twist & rolls).
- ⇒ Villi: Increase the inner surface area of intestine by 8 times. Covered by a single cell thick epithelium.
- ⇒ Lacteal: Lymphatic capillaries (inside an artery and a vein, interconnecting blood capillaries and a lymph).

Bile: ⇒ Yellowish green watery fluid produced in the liver.

⇒ Transported through hepatic duct into the duodenum.

⇒ Colour is due to bilirubin and biliverdin (worms/dead RBCs).

Fat $\xrightarrow{\text{Bile}}$ Emulsion/emulsified fat
 Acidic chyme $\xrightarrow[\text{NaHCO}_3]{\text{Bile}}$ Alkaline chyme

Pancreatic juice ⇒ Trypsinogen $\xrightarrow{\text{Enterokinase}}$ Trypsin (active)
 (inactive)

• Proteins or Polypeptides $\xrightarrow{\text{Trypsin}}$ Smaller peptides

• Left over starch $\xrightarrow{\text{Amylase}}$ Maltose

• Emulsified fat $\xrightarrow{\text{steapsin}}$ Fatty acids + Glycerol

Intestinal juice ⇒ Peptides $\xrightarrow{\text{Erepsin (peptidases)}}$ Amino acids

• Maltose $\xrightarrow{\text{Maltase}}$ Glucose

- Sucrose $\xrightarrow{\text{Sucrase}}$ Glucose + fructose
- Lactose $\xrightarrow{\text{Lactase}}$ Glucose + galactose
- Emulsified fat $\xrightarrow{\text{Lipase}}$ Fatty acids + glycerol

Large Intestine

⇒ About 15 metres long.

- Caecum = Small blind pouch (junction of small and large intestine), Vermiform appendix projects from it.
- Colon = Passes upto the abdomen on the right (ascending colon), crosses to the left just below the stomach (transverse colon) and down to descending colon.
- Rectum = Last part, 15cm long, opens at the anus, has sphincter (circular muscles) to keep it.

⇒ Functions:-

- Absorbs excess water from undigested food.
- After water absorption, faeces (75% water, 25% dead bacteria, fat, proteins) that passes into the rectum and expelled at intervals.
- Defaecation: Nitrogen - Expulsion of the undigested remains of the food is removed and excretion and remain from the alimentary canal.

Assimilation of food

⇒ Conversion of the absorbed digested food into body material.

⇒ Absorbed digested food transported by two ways.

- Hepatic portal system → Simple sugars, amino acids, vitamins, minerals (liver).
 - Lymphatic system → Fatty acids and glycerol.
- Glucose: Excess glucose converts into insoluble glycogen by liver.
- Amino acid: Excess amino acids are broken down in the liver.
- Deamination: Nitrogen-containing amino group is removed and converted into urea for excretion and remaining part forms the glucose.

Liver

- Largest gland, 1500gm on an average. Reddish brown colour, located in the upper right side of the abdomen just below the diaphragm.
- Functions: a) Control of blood sugar levels and amino acid levels.
b) Synthesis of portal ~~and~~ RBCs.
c) Produces heparin, fibrinogen and prothrombin.
d) Regulates blood volume and many more.

Experiment on Digestion

- The ~~saliva~~ action of saliva on starch: Saliva converts starch to sugars, which do not give blue-black colour with iodine. Boiled rice does not contain starch.
- The action of pepsin on egg-white:

- Pepsin can digest protein only when it is acidic.
- Acid alone has no effect on the protein.
- Boiled pepsin fails to digest protein.

Food Tests

- Glucose
Positive test - Fehling's solution (Blue-green → Deep red brick)
E.g. Test for diabetes mellitus.
Sucrose (give test when boiled with dilute HCl) and neutralise with NaHCO_3 .
- Starch
Positive test - Iodine solution (Blue-black in starch containing sample). E.g. Potato and rice.
- Protein
Positive test - adding ammonium hydroxide (white to yellow then yellow to orange) in nitric acid treated, hard boiled. ~~tube~~
E.g. egg-white (in test ~~tube~~ tube).
- Walter Walker
Positive test - Cobalt chloride (blue to pink).
- Minerals
Positive test - Ash/minerals doesn't burn when a piece of banana/potato is soaked heated till it burns completely.