Plant Growth and Development

Human Alimentary Canal

Digestion

- It is the chemical and mechanical breakdown of complex nutrients into simple absorbable forms.

Human digestive system or alimentary canal

- Alimentary canal is a long tube that extends from the mouth to the anus.
- It consists of **mouth**, **buccal cavity**, **pharynx**, **oesophagus**, **stomach**, **small intestine**, **large intestine**, **rectum**, and **anus**.
- The accessory digestive glands include **salivary glands**, **the liver, gall bladder**, and **the pancreas**.
- Digestion of food begins in mouth. It includes **teeth**, **saliva**, and **tongue**.

- **Teeth**

- **Diphyodont:** Two successive sets of teeth, which are deciduous (milk teeth) and permanent teeth, developed during complete life span Example: as in human beings.

- There are 20 teeth in the milk teeth set. Each half of upper jaw and lower jaw has 2 incisors, 1 canine, and 2 molars. Premolars are absent in milk teeth.

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Dental formula for permanent teeth in humans is It means that each half of upper jaw and lower jaw has 2 incisors, 1 canine, 2 premolars, and 3 molars.

- An adult human has 32 permanent teeth. These are of four types – molars, premolars, incisors, and canines.
- **Enamel** forming hard surface of teeth is the hardest substance of human body.

- **Saliva**

- It is secreted by salivary glands, which are located under the tongue.

- It contains a digestive enzyme called **salivary amylase**, which breaks down starch into sugar.

- **Tongue**

- It helps in chewing and swallowing of food.

- **Epiglottis** closes the windpipe (trachea) when we swallow food to prevent choking.
- **Cardiac sphincter** regulates the movement of food from oesophagus to stomach.
- Stomach is divided into 3 parts – **cardiac**, **fundic**, and **pyloric region**.
- Small intestine is further divided into **duodenum**, **jejunum**, and **ileum**.
- **Pyloric sphincter** regulates the movement of food from stomach to duodenum.
- Large intestine is divided into **caecum**, **colon**, and **rectum**. The opening of rectum is
- called **anus**.
- **Ileo-Caecal valve** guards opening of ileum into caecum.
- **Vermiform appendix** arises from the caecum. It is a vestigial organ.

- **Wall of alimentary canal comprises of four layers:**

Serosa → Muscularis → Sub-mucosa → Mucosa
(outer most) (inner most)

- **Mucosal layer of the small intestine forms finger-like projections called villi.**
- **Goblet cells** are present in the mucosal epithelium of small intestine and secrete mucus
  for lubrication.
- **Rugae** are irregular folds present in the innermost lining of stomach.
- **Rugae** and **villi** increase the surface area for efficient food absorption.

Digestive glands

- Three pairs of salivary glands are the parotids, the sub maxillary or sub mandibular, and the sub lingual.

- **Liver** is the largest gland.
- **Cystic duct** (duct of gall bladder) and **hepatic duct** (duct of liver) form a common **bile duct**.
- **Bile duct** and **pancreatic duct** opens together into duodenum as **hepato-pancreatic duct.**
- **Sphincter of Oddi** is located at the surface of duodenum and controls the secretions from liver, pancreas, and gall bladder into the duodenum of small intestine.
- **Crypts of lieberkuhn** are intestinal glands found in epithelial lining of small intestine and colon. These glands secrete maltase, sucrase, etc.
- **Pancreas** act as both exocrine and endocrine gland.
    i. **Exocrine part** secretes pancreatic juice.
    ii. **Endocrine part** secretes hormones - insulin and glucagon.
- Glands present in the mucosa of stomach are called gastric glands. Gastric glands have three major types of cells.
    - Mucus cells – Secrete mucus
    - Peptic or chief cells – Secrete pepsinogen
    - Parietal or oxyntic cells – Secrete HCl

Digestion of food

- **Digestion of carbohydrate**
- It takes place in **mouth** and in the **small intestine** region of alimentary canal.

  In mouth:

- Carbohydrate digestion stops in stomach and is then resumed in small intestine. Mainly, protein digestion takes place in stomach.

In small intestine:

- **Pancreatic juice** contains pancreatic amylase.
- **Intestinal juice** contains enzymes such as maltase, lactase, sucrase, etc., which convert complex sugars into simple sugars.

- **Digestion of protein**
- It begins in **stomach** and gets completed in **small intestine.**
- Enzymes involved are called **proteases**.
- **In stomach:**
- **Gastric juice** contains **HCl, pepsinogen, and rennin.**
- **HCl** creates acidic medium that activates pepsinogen into pepsin.

Proteins + pepsin-------- Proteoses + peptones

- **Rennin** plays a role in coagulation of milk.

- **In small intestine:**
- **Pancreatic juice** contains inactive enzymes such as **trypsinogen, chymotrypsinogen,** and **carboxypeptidases.**
- **Enterokinase** secreted by **intestinal mucosa** activates trypsinogen into trypsin.
- **Intestinal juice** contains dipeptidases, which digest dipeptides into amino acids.

- **Digestion of fat**

- It takes place in **small intestine**.
- **Bile juice** is secreted by **liver** and is stored in **gall bladder.**
- **Bile juice** contains bile salt that helps in breakdown of fat into smaller globules. It is known as **emulsification of fat.**

Absorption of digested products:

- The absorption of food materials is carried out by passive (e.g. chloride ions), active (e.g. amino acids, glucose), or facilitated diffusion (e.g. fructose).
- Digested food is absorbed mainly through intestinal walls.
- The inner lining of small intestine has **villi. Villi** contain lymph vessels called lacteal to absorb the products of fat digestion.
- **Large intestine** absorbs water and minerals from undigested food.
- **Rectum** stores the undigested matter before they are excreted out from body via **anus.**

Digestive system disorders

- **Jaundice –** Yellowing of eyes due to deposition of bile pigments
- **Vomiting –** Ejection of food through mouth
- **Diarrhoea –** Frequent bowel movement and liquefied faecal discharge
- **Constipation –** Irregular bowel movement
- **Indigestion –** Improper digestion of food

All the nutrients required by our body in the right quantities constitute a balanced diet. It should also contain a good amount of roughage and water.
Deficiency of a particular nutrient can lead to a deficiency disease.

- **Disorders** caused by deficiency of vitamins and minerals
    - Deficiency of Vitamin A - **Night blindness**
    - Deficiency of Vitamin B1 - **Beriberi**

    - Deficiency of Vitamin C – **Scurvy (bleeding gums)**
    - Deficiency of Vitamin D - **Rickets**
    - Deficiency of Iron - **Anaemia**
    - Deficiency of Iodine - **Goitre**
    - Deficiency of Calcium – **Weak bones and teeth**
- **Carbohydrates, fats and proteins**
    - Sources of **carbohydrates** - wheat, potato, maize, sweet potato, etc.
    - Sources of **proteins** - pulses, milk, fish, meat, etc.
    - Sources of **fats** - oil, ghee, milk, butter, etc.
    - Deficiency of proteins – kwashiorkor characterized by oedema, matchstick legs, bulging eyes, etc.
- **Deficiency of proteins and carbohydrates** – marasmus characterized by total disappearance of fat layer, thin and wrinkled skin, retarded physical and mental growth.