Salivary Glands secretion

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Introduction:
• Salivary glands: 3 pairs
  - Parotid gland: largest, one on either side, located in the groove b/w the ramus of mandible & mastoid process i.e. below the ear.
  - Duct is Stensen’s duct → opens into the vestibule of the mouth cavity, near the crown of the upper 2nd molar tooth.
• purely serous glands
• containing more than 90% water.

• Submandibular gland: located in submaxillary triangle, medial to the mandible. Duct → Wharton’s duct.Opens in the floor of the mouth.
• Sublingual gland: situated in the mucosa at the floor of the mouth, beneath the tongue. has small 5-15 ducts(ducts of Ravinus).
  One of the duct is larger and known as bartholin duct
  Opens into the floor of the mouth.
  contains both serous and mucous acini

• Minor salivary glands:
  - lingual mucous glands: posterior 1/3rd of the tongue.
  - lingual serous glands: located near taste buds.
  - buccal glands: between mucous membrane and buccinator muscle.
  - labial glands: around the orifice of mouth.
  - palatal glands: beneath the mucus membrane of soft palate.

Functional anatomy:
• Glands → tubuloalveolar structure.
• Acinar aspect → referred as secretory end piece → 3 main groups- serous , mucous & mixed.
• Parotid → purely serous
• Sublingual – largely mucus
• Submandibular - mixed

• Serous cells:
  - Pyramidal in shape.
  - Basally located nucleus & RER.
  - Nucleus round.
  - Apically located secretory opaque zymogen granules.
  - Form watery secretions containing ptyalin
Mucus cells:
- Cuboidal in shape.
- Basally located nucleus and RER.
- Nucleus flattened.
- Apically located secretory translucent granules.
- Form viscid secretions containing mucin.

Properties of saliva:-
- Volume: 1000-1500 ml/day.
- Specific gravity: 1.002-1.012.

Composition of saliva:-

Organic substances:
- Enzymes:
  - Amylase (ptyalin)
  - Maltase
  - Lingual lipase
  - Lysozymes
  - Carbonic anhydrase
- Others:
  - Proteins – mucin & albumin
  - Blood group antigens
  - Immunoglobulin IgA
  - Glycoprotein
  - NPN – urea, uric acid, creatinine, xanthine, Kallikrein

Inorganic substances:
- Na+, K+, Ca++, HCO$_3^-$, Cl$^-$, bromide, fluoride, phosphate, magnesium.

Others:
- Antibacterial compounds – thiocyanate, H$_2$O$_2$
- Lactoferrin – binds iron and bacteriostatic.
- Proline rich proteins – protects tooth enamel & binds toxic tannins.
- Opiorphin – pain killing substance found in saliva.

Secretions of ions in saliva:
- It is a 2 stage operation. 1st stage involves acini. 2nd stage involves ducts.
- Acini secretes primary secretion → contains ptyalin & or mucin which is isotonic to plasma electrolyte content.
- Primary secretion is modified along the gland ducts.
- Na & Cl ions are reabsorbed from the ducts & K & HCO$_3^-$ ions are actively secreted in exchange of Na.
- K enters the cells by way of Na$^+$-K$^+$ ATPase & leaves the cell by apical K-H antiport.
- Ducts are relatively impermeable to water resulting in a hypotonic fluid.
Effects of flow rate on the composition of saliva

- **At high flow rates**
- there is less time for reabsorption and secretion
- Sodium ion (Na⁺) concentration increases.
- Chloride ions (Cl⁻) concentration increases.
- Potassium ion (K⁺) concentration decreases.

- VICE-VERSA for low flow rate.

**PHASES OF SALIVARY SECRETION**

1. **Cephalic phase**
   - secretion of saliva before entering of food into the mouth.
   - Conditioned reflex initiated by sight or smell of food.
2. **Buccal phase**
   - stimulation of buccal receptors by the presence of food in mouth.
   - unconditioned reflex by appetite area of the brain.
3. **Oesophageal phase**
   - stimulation of salivary glands by food passing through oesophagus.
4. **Gastric phase**
   - presence of food in the stomach.
   - Occurs when irritant food is present in the stomach (e.g. increased salivation before vomiting).
5. **Intestinal phase**
   - the presence of irritant food in the upper intestine.

**Functions of saliva:**

1. Preparation of food for swallowing: saliva moistens the food, facilitates chewing, by the movement of tongue, the moistened & masticated food is rolled into a bolus.
2. Appreciation of taste:-
3. Role in speech:-
4. Regulation of water balance.
5. Regulation of body temperature in animals.
Functions of saliva:

6. Digestive function:
   - Salivary amylase - acts on boiled starch & converts into dextrin & maltose.
   - Maltase - converts maltose into glucose.
   - Lingual lipase - digests milk fats & hydrolyses triglycerides.

7. Excretory function:
   - substances like mercury, lead & thiocynate. Also excretes viruses causing rabies and mumps.

8. Cleansing & protective function:
   - mouth & teeth are rinsed & kept free from food debris.
   - dilutes hot & irritant substances.
   - lysozymes → bactericidal action.
   - lactoferrin → bacteriostatic
   - dilutes any HCl & bile which regurgitates into esophagus & mouth.

Regulation of salivary secretion

- Secreted continuously
- During mastication, secretion increases
- During sleep, secretion decreases.
- Regulated by nervous mechanism.
- Parasympathetic fibres: arise from superior & inferior salivatory nuclei in pons & medulla.
- Sympathetic fibres: preganglionic nerves arise from lateral horns of T1-T3 → synapse in superior cervical ganglion with postganglionic neurons that release norepinephrine which is then received by β adrenergic receptors on acinar & ductal cells of salivary glands leading to an increase in cAMP levels & increase in saliva secretion.
Effects of parasympathetic supply:
- Profuse & watery saliva.
- Amount of organic constituents less.
- Liberates proteolytic enzymes kallikrein from the gland cells → acts on plasma α₂ globulins to form vasodilator bradykinin.

Effect of sympathetic supply:
- Thick saliva rich in mucus.
- Activates acinar cells & cause vasoconstriction by secreting noradrenaline.

Hyposalivation:
- Reduction in secretion of saliva.
  - Temporary → fear, fever, dehydration.
  - Permanent → sialolithiasis, hypoplasia of salivary glands, Bell’s palsy.

Hypersalivation:
- Physiological → pregnancy
- Pathological → ptalism, sialorrhoea
  Causes: decay of tooth or neoplasm, cerebral palsy, Parkinsonism.

Mumps: acute viral infection affecting the parotid glands.(paramyxovirus).features r puffiness of cheeks (due to swelling of parotid glands), fever, sore throat.

Drooling: uncontrolled flow of saliva outside the mouth, occurs because of excess production of saliva

Chorda tympani syndrom: characterized by sweating while eating