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M1 - GI Sequence

Salivary Glands and Esophagus

John Williams, M.D., Ph.D.

Winter, 2009
SALIVARY GLANDS

1. Saliva produced by three major and a number of minor glands

2. Glands are acinar-ductal in structure

3. Made up of Serous and Mucus Acinar Cells, Duct Cells, and Myoepithelial Cells
Histology of a Generic Salivary Gland

Contents of Saliva

H₂O
Ions (HCO₃⁻)
Enzymes
  Amylase
Antibacterial Compounds
  Lysozyme
  Lactoferrin
IGA
Mucus
Function of Saliva

1. Lubrication of food - mucins

2. Partial digestion of polysaccharides - amylase

3. Moisten mouth and wash away dissolved food (necessary for taste)

4. Mild antibacterial - lysozyme, lactoferrin

5. Neutralize acids in food and regurgitated stomach acid

6. Maintenance of teeth - Ca$^{2+}$, fluoride
**SALIVARY GLANDS**

- **Parotid**
  - Serous
  - 25%

- **Sub-mandibular**
  - Mixed
  - 70%

- **Sub-lingual**
  - Mostly mucous
  - 5%

**Saliva**

- Rate:
  - Basal: 0.25 ml/min
  - Max: 5 - 10 ml/min
  - Typical: 1.0 - 1.5 liters/day

- Osmolarity: Hyptonic
- pH: Alkaline
- Major Proteins: Alpha amylase (ptyalin), Mucins

John Williams
Inhibited by sleep, fear, fatigue

(Salivatory Nuclei)
Fluid Flow Model for Production of Saliva

low water permeability

lead, mercury iodide, fluoride

hypotonic, alkaline solution, with high K
SALIVARY PATHOPHYSIOLOGY

**Xerostomia** - the condition of dry mouth resulting from the absence of saliva

Can be due to Sjogrens Syndrome, radiation damage or as a side effect of certain drugs

Absence of saliva leads to tooth decay, infections and discomfort
CHEWING AND SWALLOWING

Esophageal Pressures Measured by a Catheter

[Diagram showing the esophagus, pharynx, UES, LES, and stomach with pressure measurements in mm Hg.]
Pressure Changes During a Primary Peristaltic Wave

Neural Innervation of the Esophagus

Fig. 3-4 Johnson, L. *Gastrointestinal Physiology*, 6th ed. Mosby Elsevier, St. Louis, MO; 2001: 32.
REGULATION OF THE LOWER ESOPHAGEAL SPHINCTER

1. LES contraction regulated by intrinsic properties of smooth muscle, nerves and hormones

2. Basal tone is myogenic but increased by ACh and Gastrin

3. Transient relaxation mediated by inhibitory neurons that use VIP or NO as a neurotransmitter

4. Sphincter tone lacking in newborns and decreased during pregnancy
ABNORMALITIES OF LES

1. Failure of LES to function as a sphincter leads to reflux esophagitis or “heartburn”

2. GERD – Gastroesophageal Reflux Disease

3. Failure to relax results in “Achalasia”
Slide 5 – Fig. 2-3 Granger, D, et al. Clinical Gastrointestinal Physiology. W.B. Saunders, Philadelphia, PA; 1985:35.
Slide 8 – John Williams
Slide 9 – John Williams
Slide 10 – John Williams
Slide 12 – Fig. 3 Johnson, Leonard, Essential Medical Physiology. Raven Press, New York, NY, 1992: 463.
Slide 13 – Jim Sherman
Slide 14 – Jim Sherman
Slide 16 – Fig. 3-4 Johnson, L. Gastrointestinal Physiology, 6th ed. Mosby Elsevier, St. Louis, MO; 2001: 32.