# Role of Salivary Glands and Stomach in Digestion

# Objectives:

- Understand the principle and importance of digestion of dietary foodstuffs
- Understand the role of salivary glands in digestion
- Understand the role of stomach in digestion

# Background:

- **Most of dietary foodstuffs are ingested in the form that cannot be readily absorbed from the digestive tract**
- **Digestion: The breakdown of the naturally occurring foodstuffs into smaller, easily absorbable forms**

# Digestion:

- **Mechanical effects:**

  **e.g., mastication**

- **Enzymatic effects:**

  **Digestive enzymes (hydrolases)**

# End Products of Digestion:

- **Carbohydrates ⟶ Monosaccharides**
- **Triacylglycerols (TAG) ⟶ Fatty acids & monoacylglycerols**
- **Proteins ⟶ Amino acids**

# Role of Salivary Glands in Digestion

- They secrete saliva
- Saliva:

  Acts as lubricant

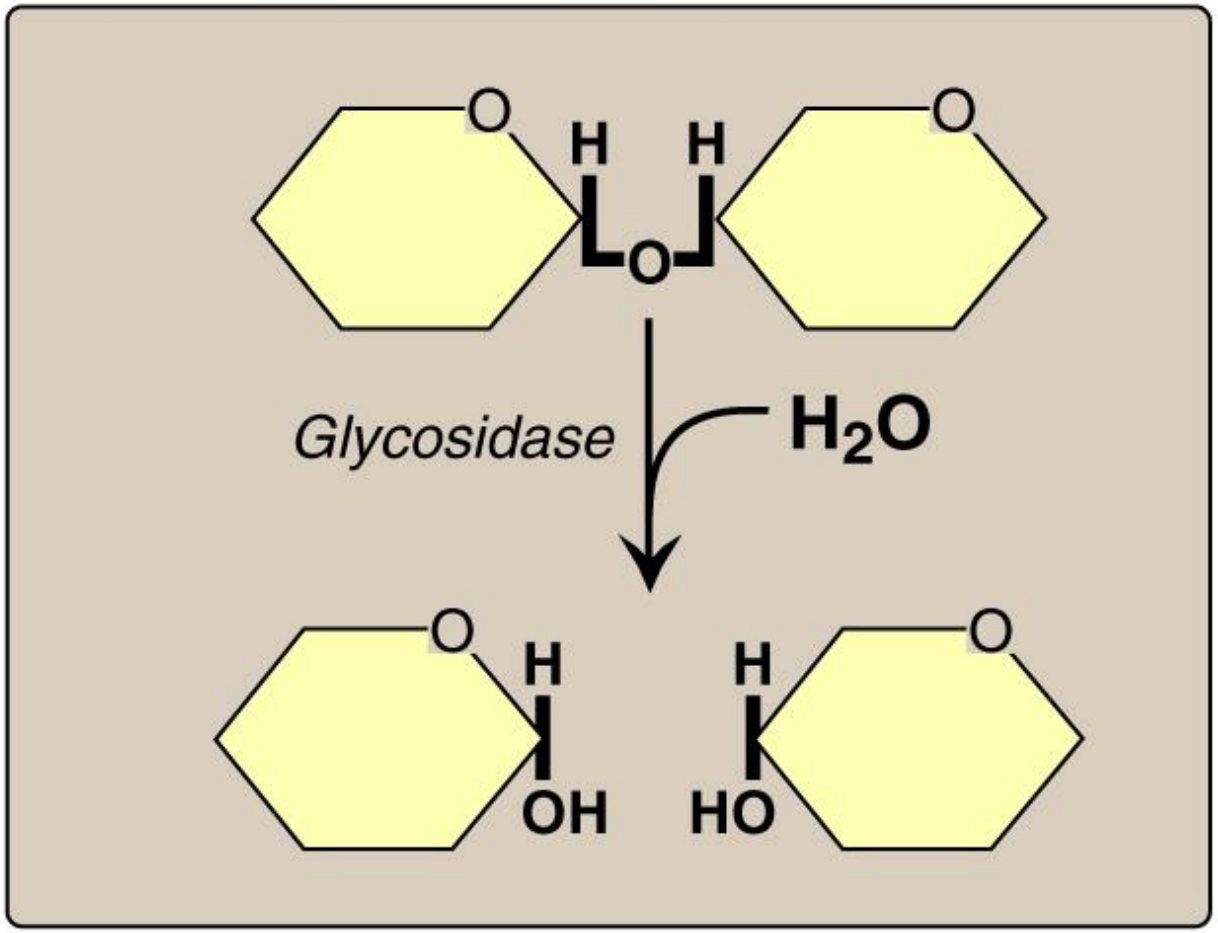
  Contains salivary α-amylase

  Contains lingual lipase

# Salivary α-Amylase

- **Secreted by:** Parotid glands
- **Optimum pH:** 6.6 – 6.8
- **Substrate:** Starch and glycogen
- **Action:** Hydrolysis of α(1,4) glycosidic bonds
- **Products:** Short oligosaccharides

# Hydrolysis of α(1,4) Glycosidic Bonds



# Effect of α-Amylase on Glycogen

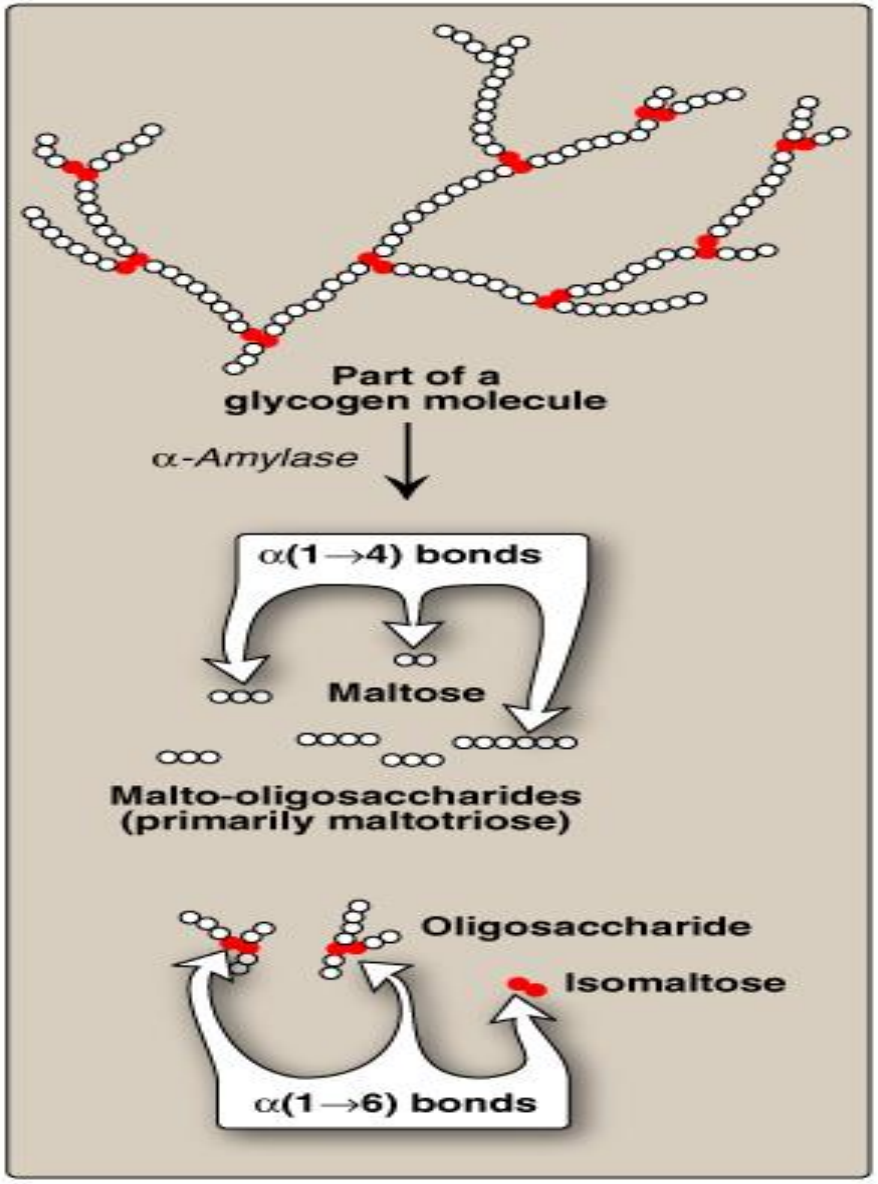
- **Hydrolysis of:**

  **α(1,4) glycosidic bonds**

- **Products:**

  **Mixture of short oligosaccharides (both branched & unbranched)**

  **Disaccharides: Maltose and isomaltose**



# Salivary α-Amylase

CONT'D

- Its digestive action on the polysaccharides is of little significance because of the short time during which the enzyme can act on the food in the mouth
- Salivary amylase is inactivated by the acidity of stomach (The enzyme is inactivated at pH 4.0 or less)

# Salivary α-Amylase

CONT'D

- **Salivary α-amylase does not hydrolyze:**

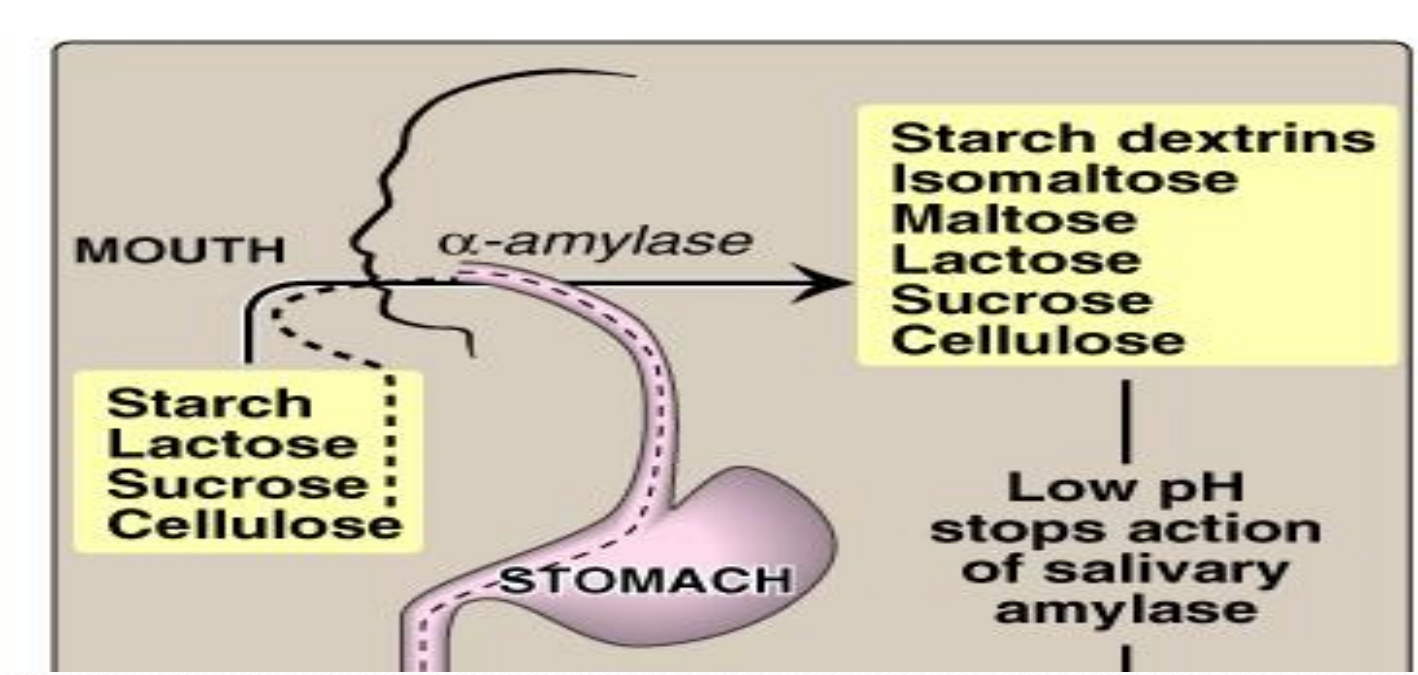
  **α(1,6) glycosidic bonds**

  **(The branch points of starch and glycogen)**

- **Salivary α-amylase cannot act on:**

  **β(1,4) glycosidic bonds of cellulose**

# Digestion of Carbohydrates in the Mouth



# Lingual Lipase

- Secreted by the dorsal surface of the tongue (Ebner's glands)
- Acts in the stomach for the digestion of TAG
- Produces fatty acids and monoacylglycerols
- Its role is of little significance in adult humans

# Role of Stomach in Digestion

- No further digestion of carbohydrates
- Lipid digestion begins by lingual and gastric lipases
- Protein digestion begins by pepsin and rennin

# Lingual and Gastric Lipases (Acid-Stable Lipases)

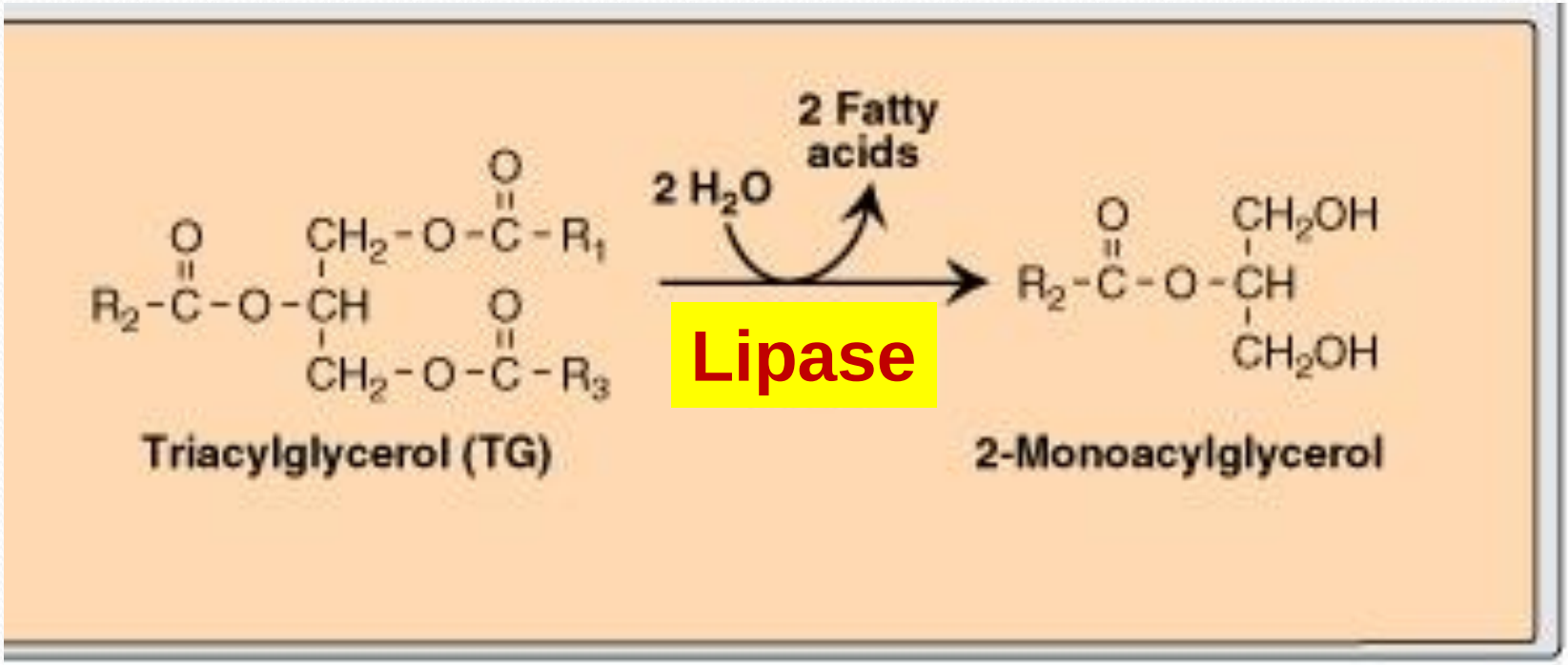
- **Substrate: TAG molecules, containing medium- and short-chain fatty acids; such as found in milk fat**
- **The end products are:**

  **2-monoacylglycerols and fatty acids**
- **The role of both lipases in lipid digestion is of little significance in adult human**

  **(The lipids in the stomach is not yet emulsified. Emulsification occurs in duodenum)**

# Lingual and Gastric Lipases

CONT'D




**Target substrate for acid-stable lipases is TAG containing:**

**R1 – C – O and R3 – C – O as short- or medium-chain fatty acids**

# Lingual and Gastric Lipases

CONT'D

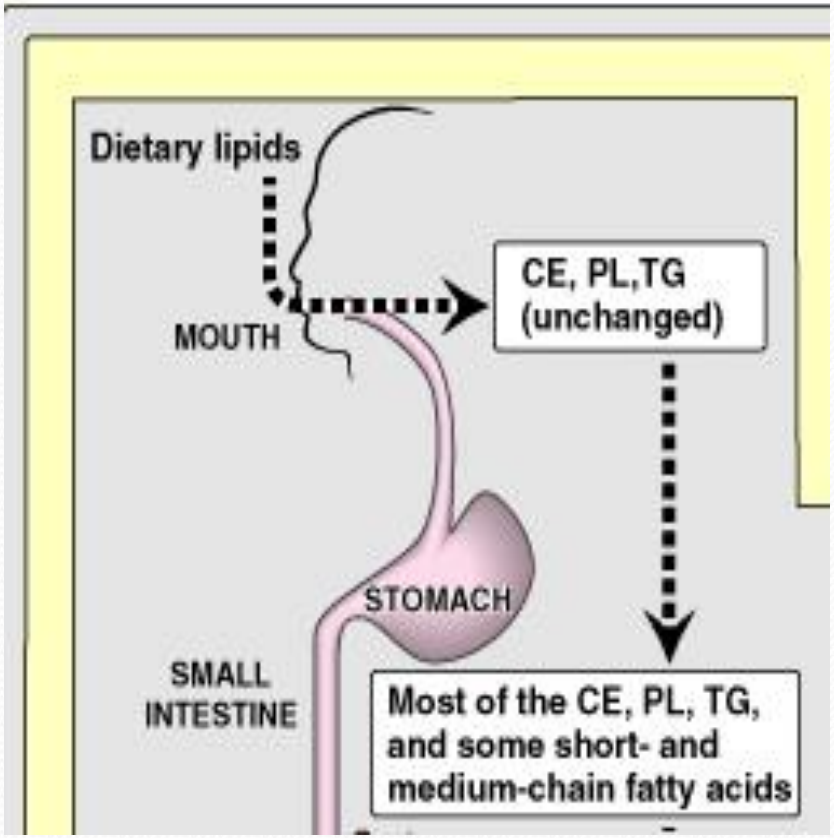
- They are important in neonates and infants for the digestion of TAG of milk

- They are also important in patients with pancreatic insufficiency where there is absence of pancreatic lipase

# Digestion of Lipids in Stomach

**In adults, no significant effects because of lack of emulsification that occurs in duodenum**

**In neonates and infants, digestion of milk TAG and production of short- and medium-chain fatty acids**



# Pepsin

- Secreted by chief cells of stomach as inactive proenzyme, pepsinogen
- Activated by HCl and autocatalytically by pepsin
- Acid-stable, endopeptidase
- Substrate: denatured dietary proteins (by HCl)
- End product: Smaller polypeptides

# Rennin

- Secreted by chief cells of stomach in neonates and infants
- Substrate: Casein of milk (in the presence of calcium)
- End product: Paracasein with the formation of milk clot
- Effect: It prevents rapid passage of milk from stomach, allowing more time for action of pepsin on milk proteins

# Digestion of Dietary Proteins in Stomach

**HCl:**

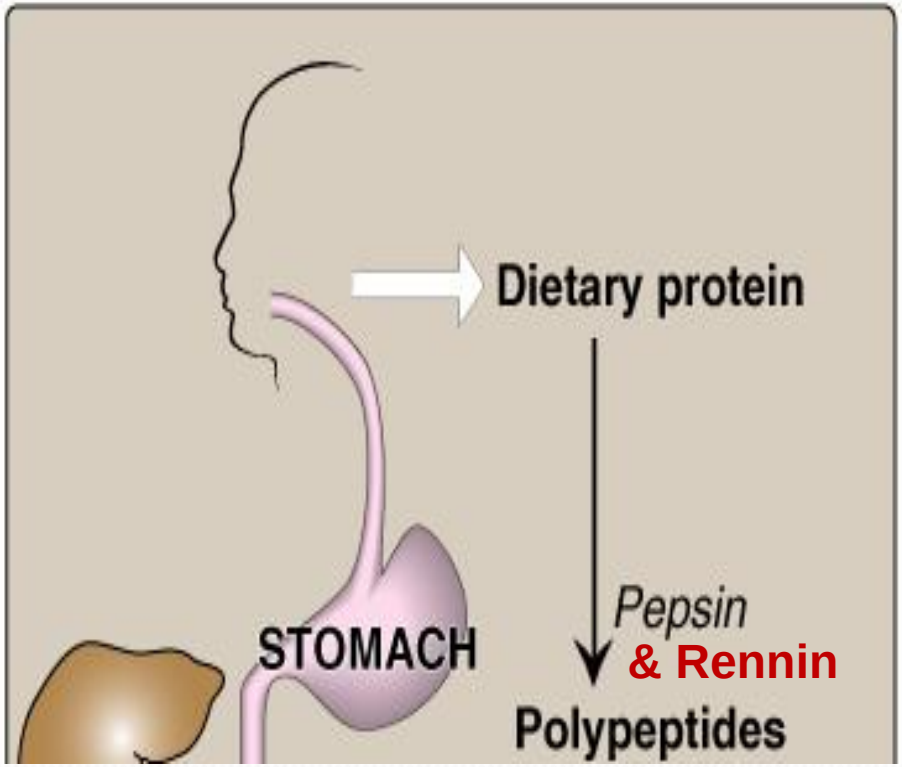
Denatures proteins
Activates pepsin

**Pepsin:**

Cleaves proteins into polypeptides

**Rennin:**

Formation of milk clot



# Take Home Message

- Digestion involves both mechanical and enzymatic processes
- Digestion makes dietary foodstuffs readily absorbable by the digestive tract
- Salivary α-amylase is of limited, but initial effect on digestion of starch and glycogen in the mouth
- Salivary α-amylase converts starch and glycogen mainly into short oligosaccharides

# Take Home Message

CONT'D

- **Limited digestion of TAG begins in the stomach by both lingual and gastric lipases producing 2-monoacylglycerols and fatty acids**
- **Digestion of proteins begins in the stomach by pepsin producing smaller polypeptides**
- **In neonates and infants, digestion of milk occurs in stomach by:**
  - **Acid-stable lipases for digestion of milk fat**
  - **Rennin and pepsin for digestion of milk proteins**

# Reference

**Lippincott's Illustrated reviews: Biochemistry 6th edition, Chapters 7 & 15, Pages 83-90 and 173-180.**