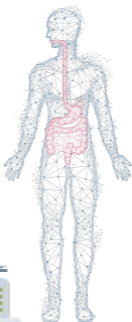




L2:

# Role of salivary glands and stomach in digestion

GNT Block



## Color Index:

- Main text
- Female slides
- Male slides
- Important
- Doctor's notes
- Extra notes

Editing file:





# Objectives:

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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



## Lecture presented by :

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**Dr. Rana Hasanato**

**Dr. Ahmed Mujamammi**



# Background

## Female Slides

### Digestion:

- Mechanical effects:
  - e.g., mastication
- Enzymatic effects:
  - Digestive enzymes (hydrolases)

### Processes of the digestive system:

1. Motility
2. Secretion
3. Absorption
4. Elimination



01

### Dietary foodstuffs :

Most of dietary foodstuffs are ingested in the form that cannot be readily absorbed from the digestive tract.

02

### Digestion :

The breakdown of the naturally occurring foodstuffs into smaller, easily absorbable forms.

03

04

## End product of digestion

Carbohydrates

Monosaccharides

Triacylglycerols (TAG)

Fatty acids & monoacylglycerols


Proteins

Amino acids

# Role of salivary glands In digestion

The salivary glands secrete saliva that act as lubricant and contains:

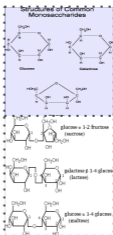
- lingual lipase
- salivary  $\alpha$ -amylase

Salivary $\alpha$ -amylase 	
Secreted by	Parotid glands
Optimum PH	6.6-6.8
Substrate	Starch and glycogen
Hydrolases	$\alpha(1,4)$ glycosidic bonds
Produces	Short oligosaccharides

Types of sugars:

Simple sugars

Disaccharides



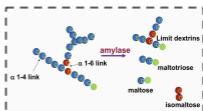
# Role of salivary glands In digestion

## Digestion

Female Slides

Pre-stomach - Salivary amylase :  
a 1-4 endoglycosidase

Female Dr: Salivary Amylase can not work on Disaccharides or  $\alpha(1,6)$  bond (Important question in Exam)



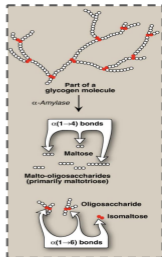
## Effect of $\alpha$ -Amylase on Glycogen

### Hydrolysis of:

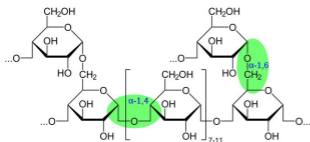
- $\alpha(1,4)$  glycosidic bonds

### Products

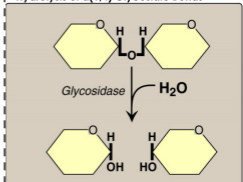
- Mixture of short oligosaccharides (both branched & unbranched).
- Disaccharides: Maltose and isomaltose.



Female Slides



## Hydrolysis of $\alpha(1,4)$ Glycosidic Bonds



# Role of salivary glands In digestion

## Salivary $\alpha$ - amylase :

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  $\alpha$ -amylase does not hydrolyze:  
 $\alpha(1,6)$  glycosidic bonds (The branch points of starch and glycogen)

Salivary  $\alpha$ -amylase cannot act on:  
 $\beta(1,4)$  glycosidic bonds of cellulose  
Salivary  $\alpha$ -amylase does not hydrolyze disaccharides

\*cellulose cannot be digested due to the presence of glycosidic bond  $\beta(1,4)$

Digestion of  
Carbohydrates  
in the Mouth



# Role of Stomach in Digestion

- 1 No further digestion of carbohydrates.
- 2 Protein digestion begins by **pepsin** and **rennin**.
- 3 Lipid digestion begins by **lingual** and **gastric lipases**.  
"Lingual lipase starts its action in the **stomach**"

## Lingual Lipase

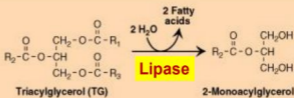
- ◆ Secreted by the dorsal surface of the tongue (**Ebner's glands**)
- ◆ Acts in the **stomach** for the digestion of TAG
- ◆ Produces **fatty acids** and **monoacylglycerols**
- ◆ Its role is of little significance in adult humans

## Lingual and Gastric Lipases (Acid-Stable Lipases)

Substrate	End product	Role
<ul style="list-style-type: none"><li>• <b>TAG</b> molecules, containing medium - and short- chain fatty acids; such as found in milk fat.</li></ul>	<ul style="list-style-type: none"><li>• <u>One molecule of 2-Monoacylglycerols</u> and <u>2 fatty acids</u>.</li></ul> <p><i>Males Dr: "This came in saq multiple times and a lot of students got it incorrect because they wrote 2 molecules of Monoacylglycerols." Correct answer: One molecule of 2-Monoacylglycerol (No.2 means which carbon) and 2 fatty acids.</i></p>	<ul style="list-style-type: none"><li>• Both Lipases role in lipid digestion is of little significance in adult human (<b>the lipid in the stomach is not yet emulsified; Emulsification occurs in duodenum</b>).</li></ul>

### (Acid-Stable Lipases)

Target substrate for acid-stable lipases is TAG containing:  
 $R_1 - \overset{\text{O}}{\parallel} - \text{C} - \text{O}$  and  $R_3 - \overset{\text{O}}{\parallel} - \text{C} - \text{O}$   
as short- or medium-chain fatty acids.



# Lingual and Gastric Lipases Cont.

They are important in:

Patients with pancreatic insufficiency

Neonates and infants

-Because there's **absence** of pancreatic lipase.

-For the digestion of **TAG** of milk.

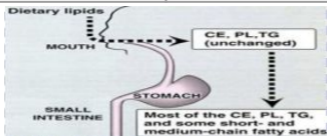
Digestion of Lipids in Stomach

Adults

Neonates and infants

-No significant effects because of lack of **emulsification** that occurs in duodenum

-Digestion of **milk TAG** and production of short- and medium-chain fatty acids



## Digestion of Dietary Proteins in Stomach

**HCL:** Denatures proteins & Activates pepsin

**Pepsin:** Cleaves proteins into polypeptides

**Rennin:** Formation of milk clot



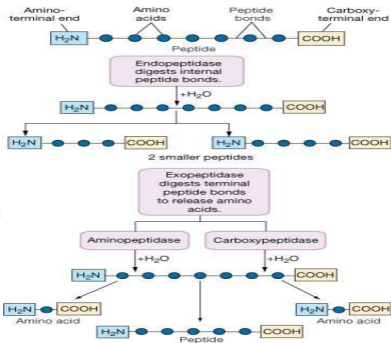


# Digestion of Dietary Proteins in Stomach Cont.

	Rennin (not renin which is in kidney)	Pepsin
Secreted by	Chief cells of stomach in neonates and infants	Chief cells of stomach as inactive proenzyme, <b>pepsinogen</b> "" activated in stomach into pepsin ""
Substrate	Casein of milk (in the presence of calcium)	Denatured dietary proteins (by HCl)
End product	<b>Paracasein</b> with the formation of milk clot	Smaller polypeptides
Additional	Effect: <b>It prevents rapid passage</b> of milk from stomach, allowing more time for action of pepsin on milk proteins	<b>Acid-stable</b> , endopeptidase *. <b>Activated</b> by HCl and autocatalytically by pepsin.

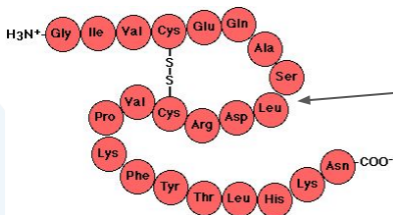
# Doctor's Notes

## Endopeptidases and Exopeptidases



Female Dr:  
Very helpful  
and Important  
Summary

## Polypeptide



Female Dr: Pepsin is  
Endopeptidase which means  
it works in the middle not  
in the Periphery



# Take Home Messages

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Digestion involves both mechanical and enzymatic processes



Digestion makes dietary foodstuffs readily absorbable by the digestive tract



Salivary  $\alpha$ -amylase is of limited, but initial effect on digestion of starch and glycogen in the mouth



Salivary  $\alpha$ -amylase converts starch and glycogen mainly into short oligosaccharides




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
- 

# Quiz

## MCQs

**Q1: Which of the following is responsible for Pepsinogen activation?**

- A- HCl
- B- Rennin
- C- lingual lipase
- D- Gastric lipase

**Q2: Which organ is responsible for the mechanical breakdown of food by churning and mixing?**

- A- Small intestine
- B- Liver
- C- Stomach
- D- Pancreas

**Q3: Proteins & lipid digestion starts in?**

- A- Mouth
- B- Stomach
- C- Intestines
- D- Esophagus

**Q4: Rennin acts on casein in the presence of?**

- A- Calcium
- B- Phosphate
- C- Sodium
- D- Potassium

**Q5: Lingual lipase is secreted by?**

- A- Chief cells of stomach
- B- Ebner's glands
- C- Pituitary gland
- D- Parotid gland

**Q6: What is Salivary  $\alpha$ -Amylase Optimum pH?**

- A- 2.5 - 4
- B- 6.6 - 6.8
- C- 6.8 - 7.0
- D- 8 - 12

Answers: 1-A, 2-C, 3-B, 4-A, 5-B, 6-B

## SAQ

**Q: What is the role of HCL, Pepsin and Rennin in Digestion?**

A:

HCL: Denatures proteins & Activates pepsin

Pepsin: Cleaves proteins into polypeptides

Rennin: Formation of milk clot

**Q: What is the END Product of Lingual and Gastric Lipases (Acid-Stable Lipases)?**

A:

- One molecule of 2-Monoacylglycerols and 2 fatty acids.

# Members board

## Team Leaders



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## Team Members



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Aishah boureggah



Dana A Alkheliwi



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Areej Alquraini



Waad alqahtani

Special Thanks to Aleen Alkulyah for the Design!

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