[lecture 2]

Role of Salivary Glands and Stomach in Digestion

The 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

Red = Import-ant

Blue = explain

Green = addition notes

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Biochemistry Team

Mind Map

digestion of dietary foodstuffs

- Protein → By Pepsin & Rennin
- Lipid → By Lingual and Gastric Lipases
- CHO → By α-Amylase

Introduction

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 can go by two ways:

Mechanical effects: e.g., mastication (convert the food into smaller pieces)

Enzymatic effects: Digestive enzymes (hydrolases) (hydrolases means the breakdown by water).

*To take the benefits we should convert the food to end products

Role of Salivary Glands in Digestion

We start the digestive process in the mouth)

They secrete saliva

Saliva:

- ✓ **Acts as lubricant** (more softy)
- ✓ **Contains salivary α-amylase**
- ✓ **Contains lingual lipase**

Salivary α-amylase

Secreted by: Parotid glands (it actually secreted from parotid gland but found & work in mouth) (The salivary α-amylase acts in the mouth and then the pancreatic α-amylase in the duodenum completes the digestion of the carbohydrates)

Optimum pH: 6.6 – 6.8 (it digest carbohydrate in the mouth but will stop working in the stomach "acidity of stomach differ , less than 4")

Action: Hydrolysis only α(1,4)** glycosidic bonds (between two glucose), it is α so can not break β(1,4) glycosidic bonds of cellulose.

Substrate * : two origin of carbohydrate **Starch (plant) and glycogen (animal).**

* **Substrate + enzyme = product.**

Produces: Short oligosaccharides. (dextrins)

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.(we eat quickly. so, amylase doesn't take its time in mouth to digest the CHO completely)

Salivary amylase is inactivated by the acidity of stomach (The enzyme is inactivated at pH 4.0 or less)

Effect of α-Amylase on Glycogen

(Hydrolysis of: α(1,4) glycosidic bonds)

products :-

- **Mixture of short oligosaccharides**

- **Disaccharides:** (Maltose and isomaltose)

α 1-4 link

α 1–6 link

oligosaccharide

amylase

maltotriose

(1) α-Amylase can not work on periphery

isomaltose

(2) α-Amylase can not break branch(α 1-6

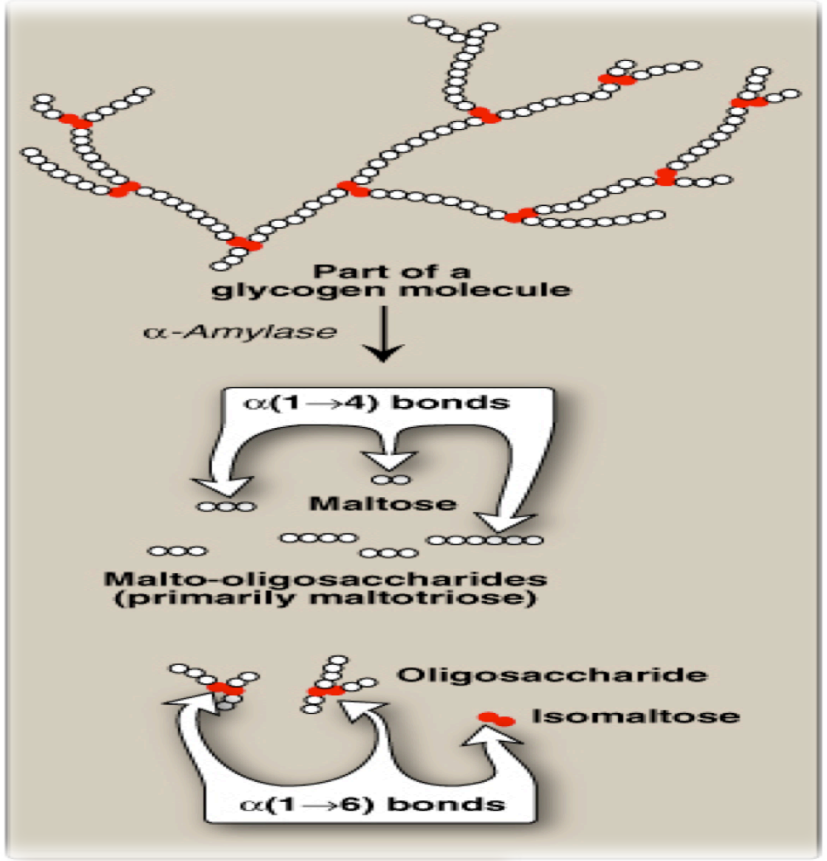
maltose

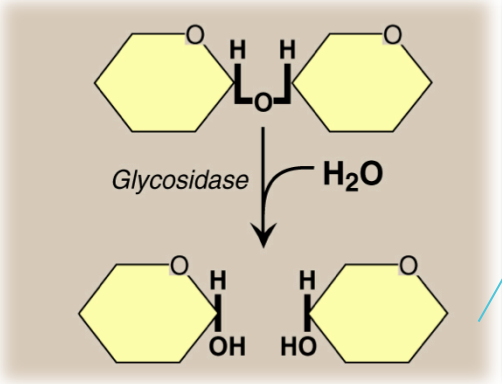
(3) α-Amylase can not break disaccharides

Limit dextrins

•(4)Salivary α-amylase cannot act on: β(1,4) glycosidic bonds

Effect of α-Amylase on Glycogen





Hydrolysis of α(1,4) Glycosidic Bonds

** we don't have to memorize the structures

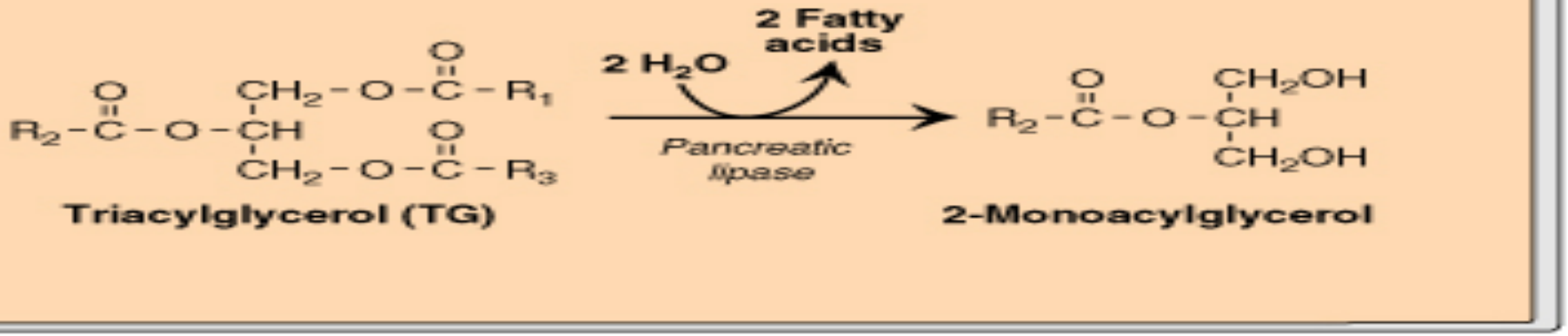
enzyme	(Acid-Stable Lipases) Lingual and Gastric Lipases
Substrate	TAG molecules, containing medium- and short-chain fatty acids; ex(found in milk fat)
End products	2-monoacylglycerols (2 is just means> on carbon no. 2) and fatty acids
They are important in	1)neonates and infants for the digestion of TAG of milk (because it has short- or medium-chain fatty acids 2) patients with pancreatic insufficiency where there is an absence of pancreatic lipase
The role is little significance	In adult human (because of lack of emulsification that occurs in duodenum) we will take it in the next lecture. Emulsification: The breakdown of large fat globules into smaller, uniformly distributed particles. It is accomplished mainly by bile acids in the small intestine.

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 Lipase

- Secreted by the dorsal surface of the tongue (**Ebner's glands**)

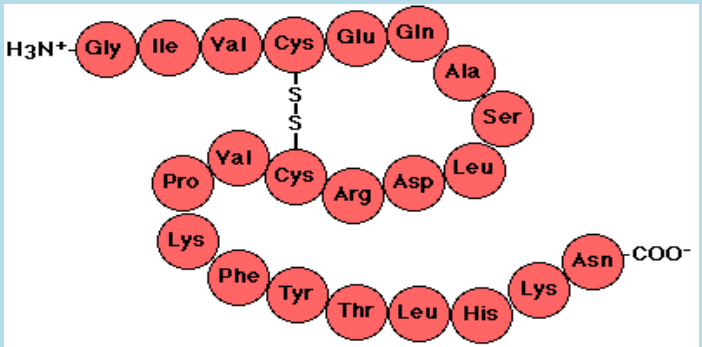


Salivary α-amylase

Protein digestion through 2 enzymes:

Pepsin

- Secreted by chief cells of stomach as inactive proenzyme, pepsinogen.
- Activated by HCl and autocatalytically by pepsin.
- Acid-stable and 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

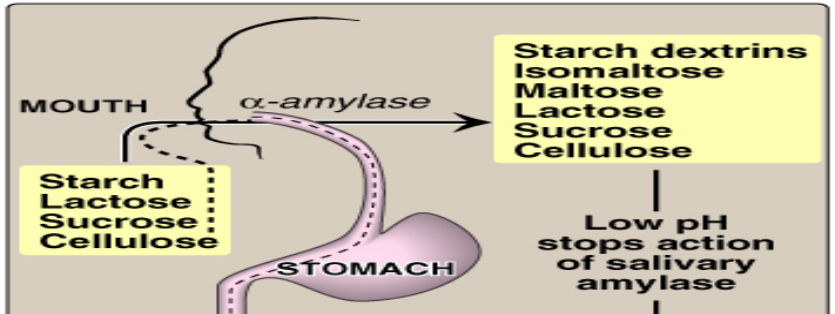
#Rennin:
(Imp just for baby to convert milk from liquid to sold form via
Converting the casein> جبنينto paracasein to take time inside the baby &after that it will disappear)

Summary

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 into short, branched 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

- 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
- Salivary α-amylase does not hydrolyze **disaccharides**
- Salivary α-amylase does **not work on the periphery** (maltotrise).



Test your knowledge ..!

Questions

1) Carbohydrates digestion starts in:
A) Mouth B) stomach C) intestine

2) Protein & lipids digestion start in:
A) Mouth B) stomach C) intestine

3)Enzyme important just for infants for milk clot:
A) Rennin B) renin C) pepsin

4) Enzyme inactivated in stomach:
A) Rennin B) pepsin C) α-Amylase

5)Lipase acts on which type of fatty acids:
A) Short B) long C) short or medium

6) Which of the following is responsible for Pepsinogen activation:
A. HCL B. Rennin C. Lingual lipase D. Gastric Lipase

7) Salivary α-amylase is able to hydrolyze which of the following:

A. α(1,6) glycosidic bonds
B. β(1,4) glycosidic bonds of cellulose
C. α(1,4) glycosidic bonds
D. Disacharride

Answers: 1. A 2. B 3. A 4. C 5. C 6. A 7. C

Biochemistry
Team

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Thank you