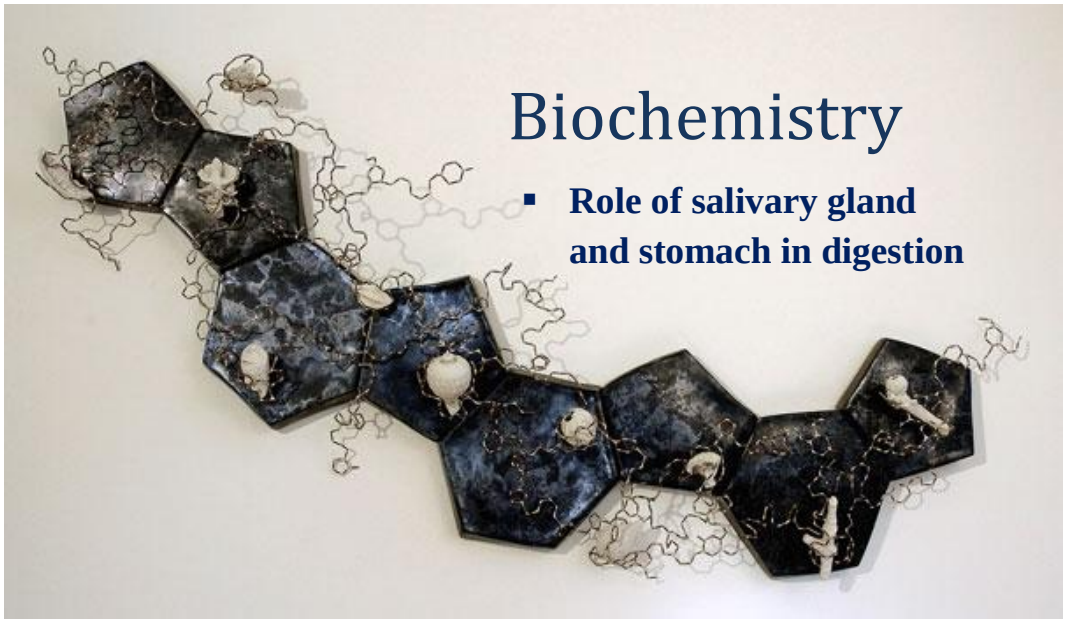

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Meshal Al-Otaibi	Deema Jomar

-Notes are in green or in boxes. Important notes are in red.

▪ Role of salivary gland and stomach in digestion

- **Mechanical effects**: e.g. mastication
- **Enzymatic effects:** e.g. Digestive enzymes (hydrolysis)

TAG: 3fatty acids+ Glycerol
when it is digested, it gives 2 free fatty acids + monoacylglycerol (fatty acids bound to glycerol

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

The salivary α-amylase acts in the mouth and then the pancreatic α-amylase in the duodenum completes the digestion of the carbohydrates

Salivary α-Amylase

- Secreted by: Parotid glands
- Optimum pH: 6.6 – 6.8

It means that enzyme works best in this pH therefore it doesn't work in the stomach (in other words **start** in mouth **stop** in stomach)

- Substrate: Starch **(carbohydrate from plants)** and glycogen **(carbohydrate from animals)**
- Hydrolyzes: α(1,4) glycosidic bonds
- Produces: Short oligosaccharides (dextrins)

α (1-4) = bond between glucose carbon number one with other glucose carbon number 4

Monosaccharides: glucose or fructose or galactose

Disaccharides:

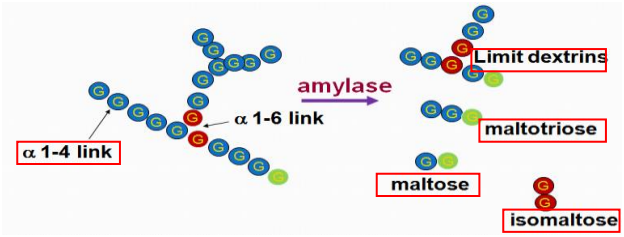
- **Sucrose:** Glucose α 1–2 fructose (table sugar)
- **Lactose:** Galactose β 1-4 glucose (in dairy products) **[we give people with lactose intolerance lactase to digest it]**
- **Maltose:** glucose α 1–4 glucose **(product of the digestion of carbohydrates)**

Structures are for you information no need to memorize them Dr. Rana

What's the difference between α & β?
β (as in fibers cellulose) are indigestible therefore it cannot be absorbed these fibers help with constipation **(This does not apply on lactose)**

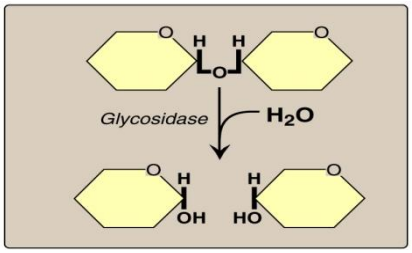
Prefix endo- :It doesn't work on the periphery this is why we get maltose maltotriose and not glucose

Digestion: Pre-stomach – Salivary amylase : **α 1-4 endoglycosidase**



End product

Hydrolysis of α(1,4) Glycosidic



*this happens in the presence of water.

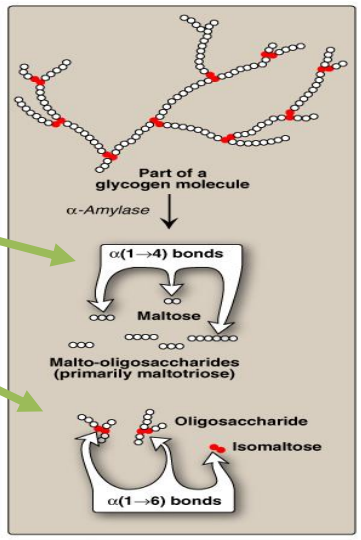
Effect of α-Amylase on Glycogen:

- Hydrolysis of: α(1,4) glycosidic bonds
- Products: **(whatever it can't digest)**

Isomaltose the bond is between c1 and c6 while Maltose is between C1 and C4

Mixture of short oligosaccharides (both branched & unbranched **[maltotrios]**)

Disaccharides: Maltose and isomaltose

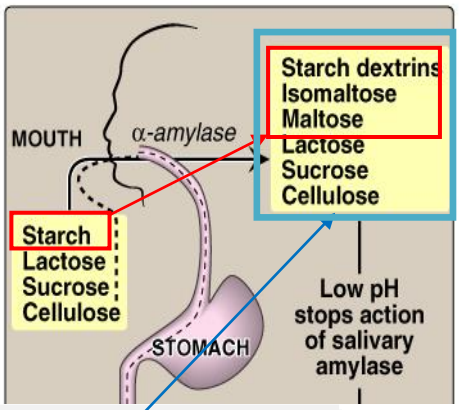


Salivary α-Amylase: **"only work on polysaccharides"**

- 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 **does not hydrolyze**: **This is very Important- Dr. Rana**
  - **α(1,6)** glycosidic bonds (The branch points of starch and glycogen)
  - **β**(1,4) glycosidic bonds of **cellulose**
  - Disaccharides

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



End products of α-Amylase Are not digested by it

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**

In order to lipase work efficiently, fatty acid, which is attached to glycerol in TAG, must be medium or short chain

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 **(2- means it's on C2)**

- 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)

The breakdown of large fat globules into smaller, uniformly distributed particles. It is accomplished mainly by bile acids in the small intestine

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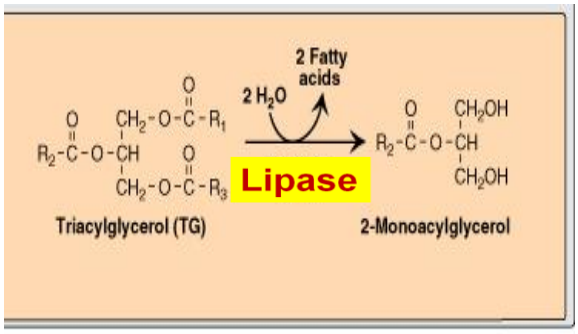
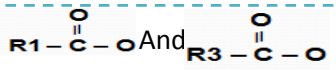


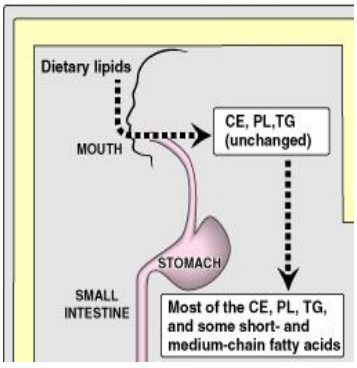
Target substrate for acid-stable lipases is TAG containing:



as short- or medium-chain fatty acids

Lingual and Gastric Lipases:

- 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, **endo**p**e**ptidase
- Substrate: denatured dietary **proteins** (by HCl)
- End product: Smaller polypeptides

Endopeptidase: does not act on the periphery, thus it produces peptide chain, but never amino acid.

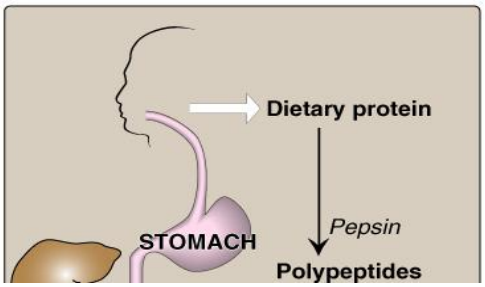
Autocatalytically: the first activated pepsinogen (pepsin) activates the rest.

Rennin:

- Secreted by chief cells of stomach in **neonates and infants**
- Substrate: **Casein of milk** (in the presence of calcium) **liquid**
- End product: Paracasein with the formation of **MILK CLOT** **more solid**
- 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 a amylase is of limited but initial effect on digestion of starch and glycogen in the mouth**
- **Salivary a amylase converts starch and glycogen mainly into short oligosaccharide**
- **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**

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

2. **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**

1=A

2=C

Done by: Jumana Al-Shammari & Khaled Almohaimede