Practical biochemistry

Malabsorption Analysis of Serum Amylase & Liver Function Tests

Biochemistry Team

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Malabsorption Analysis of Serum Amylase

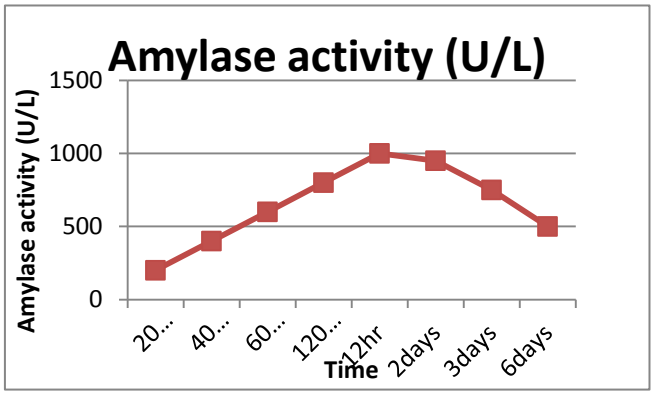
Q.1 What is amylase, and what are its source in human body?
Answer: **Amylase** is a group of proteins found in saliva, pancreatic juice and parts of plants; they help to convert starch into sugar

Q.2 What is the physiological action of amylase?

Answer: **Amylase** hydrolyzes (breakdown) the dietary starch and glycogen into short, branched di and oligosaccharides (maltose, iso-maltose and limit dextrins).

Q.3 Would you expect a high level of amylase in blood under a normal condition?
Answer: **No**

Q.4 –a: What are the uses of amylase measurement in clinical practice?
Answer: Acute Pancreatitis
Q.4 –b: What other diagnostic marker can be use measured in this clinical condition?
Answer: Serum lipase



Q.5 Changes in serum amylase activity during course of an injury (time course)

Amylase levels will be increasing over time, and will reach a peak within 12-72 hours. It will return to normal in few days.

Q.5-a what are the possible factors responsible for these changes in the curve?
Answer:
Acute pancreatitis will result in damage of the exocrine part of the pancreas; this will release the pancreatic enzymes into the circulation.
α-Amylase is one of the pancreatic enzymes released.

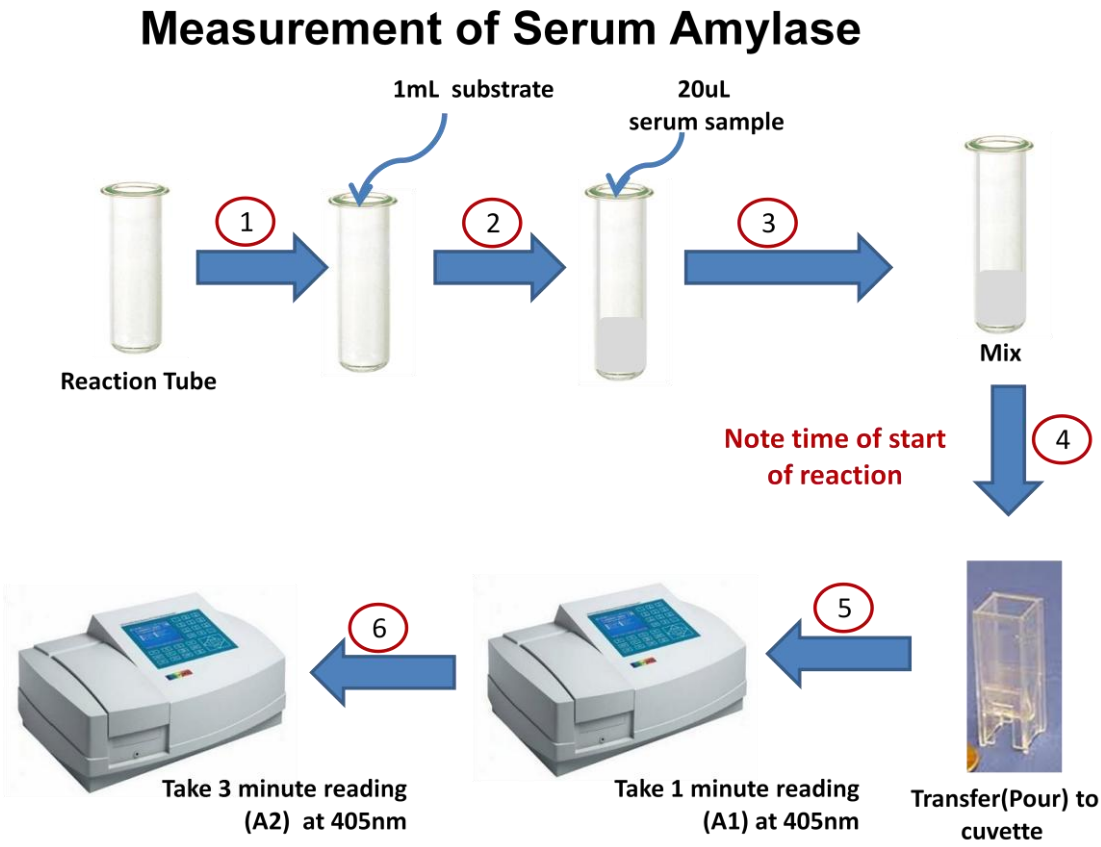
Why does amylase level increase?
Acute pancreatitis → damage of the exocrine part of the pancreas → release of the pancreatic enzymes into the circulation (α-Amylase is one of the pancreatic enzymes released).

Why does it decrease?
1. The condition is self-limited
2. The circulating amylase will be excreted in urine
3. The circulating amylase will be degraded (protein turnover)

Q.5-b with knowledge about amylase activity overtime, what is the clinical application?

Answer: Three points can be derived from such a curve:

1. Measurement of α-amylase in the serum is limited by the time elapsed since the initiation of acute inflammation of the pancreas. If the patient presented late, and the condition was self limited, the diagnosis of acute pancreatitis based on the enzyme level at time of presentation could be missed.
2. The measurement of α-amylase in serum should not be interpreted on its own; it has to be evaluated in association with the clinical picture (e.g. the nature of the abdominal pain).
3. The rising trend of the levels of serum α-amylase as the acute inflammation is taking place is more clinically significant than one single high reading.



Calculation & Interpretation

$$\Delta A = \frac{A2 - A1}{3\ *}$$

Serum Amylase (U/L) = 5544 × Δ A

Results:…… U/L

Normal reference values:

Serum: up to 125 U/L (at room temperature)

Normal **range** 25-125 U/L

* the time between the first reading and the second reading = 3 minutes

U/L = Average Abs/min

1. Put 1 mL of the substrate (polysaccharide) in the beaker (use measurements by pipette)
2. put 20 μL of serum reagent (T1 or T2) (use measurements by a pipette)
3. mix and wait 1 minute
4. place the mixture in a cuvette
5. read the average change in absorbance using an automated analyzer at 405 nm (A1)
6. wait another 3 minutes then read it again (A2)

Liver Function Tests

Q1. What are the liver function tests (LFTs)?

Answer: Serum Bilirubin – Urinary urobilinogen and bile salts – ALT – AST – PT – ALP – Albumin and globulin - GGT

Liver chemistry test	Clinical implication of abnormality
Alanine aminotransferase	Hepatocellular damage
Aspartate aminotransferase	Hepatocellular damage
Bilirubin	Cholestasis, impaired conjugation, or biliary obstruction
Alkaline phosphatase	Cholestasis, infiltrative disease, or biliary obstruction
Prothrombin time	Synthetic function
Albumin	Synthetic function
γ-glutamyltransferase	Cholestasis or biliary obstruction
Bile acids	Cholestasis or biliary obstruction

e.g. Viral hepatitis

Q.2 What is bilirubin and how is it produced in the body?

Answer: Bilirubin is a yellow bile pigment.
It is produced from the degradation of heme; which is one of the breakdown products of red blood cells.

Q.3 Which form of bilirubin is carried to the liver and how?

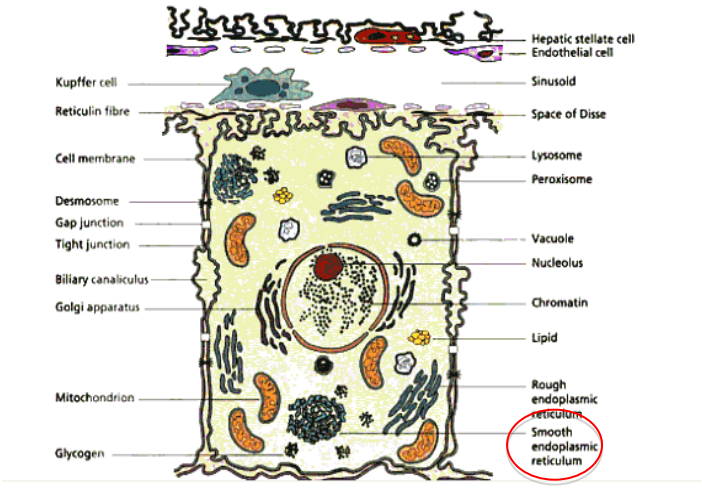
Answer: The unconjugated form of bilirubin is carried to the liver
Unconjugated bilirubin forms a complex with albumin to be transported

Q.4 How & why is bilirubin conjugated?

Answer: Bilirubin is conjugated by binding to glucuronic acid in hepatocytes
The conjugated-bilirubin is water soluble and can be excreted in the urine and feces
This prevents precipitation and deposition in tissues.

Q.5: On the picture below, mark the intracellular location for the process of conjugation.

Answer: the smooth endoplasmic Reticulum of hepatocytes



Q.6 Mention 2 syndromes due to congenital deficiency of the conjugating enzyme (bilirubin glucuronyl-transferase).

Answer: Crigler-Najjar syndrome and Gilbert syndrome

Q.7-a How is bilirubin eliminated from the body?

Q.7-b What are the fates of bilirubin in the intestine?

Answer:

After the production of Bilirubin from the breakdown of RBCs, it attaches to Albumin to be carried to the liver. In the liver Bilirubin detaches from Albumin and enters hepatocytes where it is conjugated with glucuronic acid by enzyme UDP- glucuronyl transferase. The soluble conjugated bilirubin glucuronide is excreted to the intestine.

bacteria removes the glucoronic acid and converts bilrubin into urobilinogen. Urobilinogen mostly is oxidized by gut bacteria to form (strecobilin) which leaves the body by the feces (gives it its brown appearance)

some urobilinogen get reabsorbed into portal circulation, where some get recycled in the liver and some go to the kidneys and convert urobiligen into urobilin which give the urine its yellow color and it gets excreted with the urine.

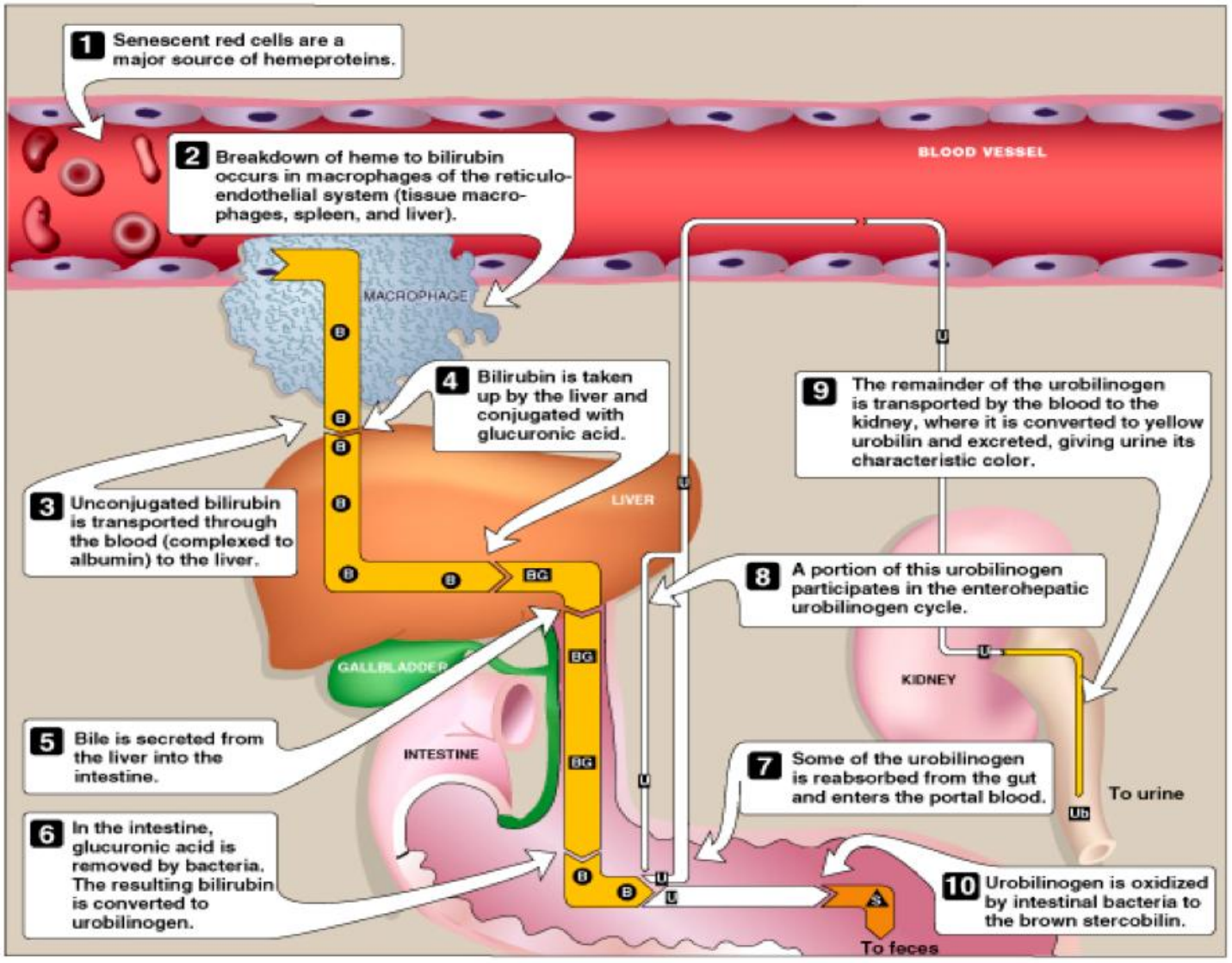
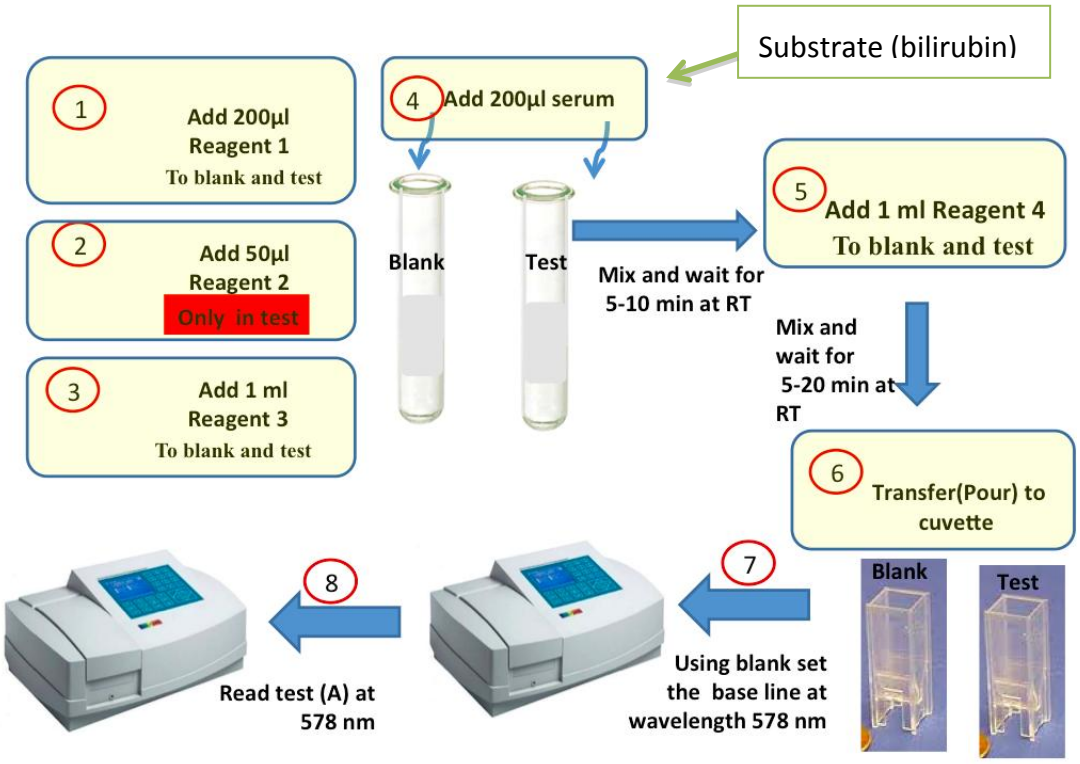


Figure 21.9
Catabolism of heme B = bilirubin; BG = bilirubin diglucuronide; U = urobilinogen; Ub = urobilin; S = stercobilin.

Measurement of Total Bilirubin



Calculation of total bilirubin concentration

Conc. of serum total bilirubin:

A × 185 = …... µmol/L

Note- (Normal range: 2 – 17 µmol/L)