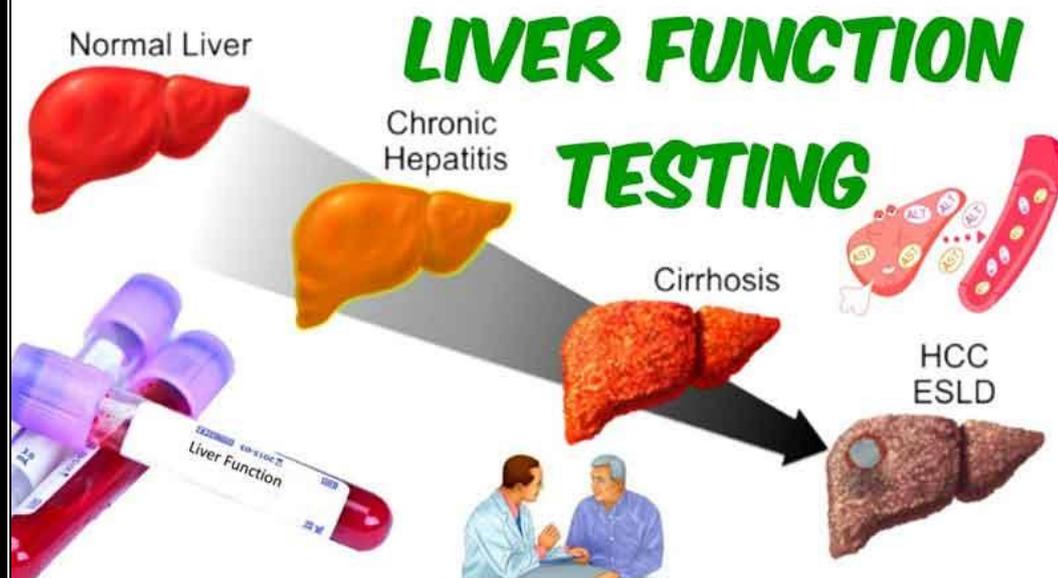


# *PRACTICAL* *BIOCHEMISTRY*

## **lab 7**

### ***Aspartate transaminase*** ***Alanine aminotransferase***



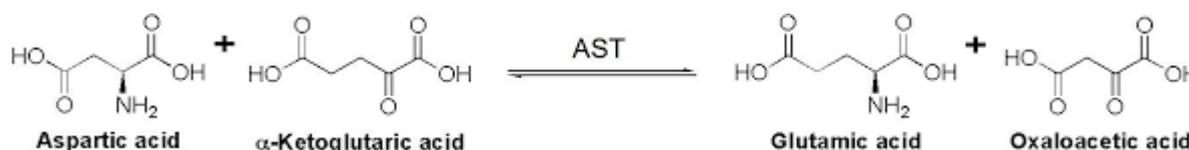
## Aspartate transaminase (AST or GOT)

Liver blood tests are some of the most commonly performed blood tests. These tests can be used to assess liver functions or liver injury. An initial step in detecting liver damage is a simple blood test to determine the level of certain liver enzymes (proteins) in the blood. Under normal circumstances, these enzymes mostly reside within the cells of the liver. But when the liver is injured for any reason, these enzymes are spilled into the blood stream.

Among the most sensitive and widely used liver enzymes are the aminotransferases. They include aspartate aminotransferase (AST or GOT) and alanine aminotransferase (ALT or GPT). These enzymes are normally present in liver and heart cells. If the liver is injured or damaged, the liver cells spill these enzymes into the blood, raising the AST and ALT enzyme blood levels and signaling liver disease.

Aspartate transaminase (AST or GOT): is an enzyme present in tissues of high metabolic activity (heart, liver, skeletal muscle, kidney, brain, pancreas and red blood cells lungs).

Glutamic Oxaloacetic transaminase (GOT), is a pyridoxal phosphate (PLP)-dependent transaminase enzyme. AST catalyzes the reversible transfer of an  $\alpha$ -amino group between aspartate and glutamate and, as such, is an important enzyme in amino acid metabolism.



The amount of AST in the blood is directly related to the number of damaged cells and the amount of time that passes between the injury to the tissue and the test.

*Two isoenzymes are present in a wide variety of eukaryotes. In humans:*

- GOT1/cAST, the cytosolic isoenzyme derives mainly from red blood cells and heart.
- GOT2/mAST, the mitochondrial isoenzyme is present predominantly in the liver.



Almost all serum AST activity is due to the cytosol isoenzyme, even after damage to tissues with substantial mitochondrial isoenzyme content. Since the mitochondrial isoenzyme has such a short circulating lifetime, its activity is rapidly eliminated.

**Normal Range:**

S.GOT (AST) = 8-40 Umol/min/L = 2-20 I.U/L

**Explanation of Test:**

It is used to diagnose liver disease and to monitor the course of treatment for hepatitis, cirrhosis and effects of drug therapy. Also, to differentiate between hemolytic Jaundice and hepatic Jaundice

**Clinical implications:**

1. Increased AST levels: in heart disease. In Myocardial Infarction, its level reaches a peak in 24 hours and returns to normal by day 3 or 4 post MI. the level increased 4-10 times the normal values.
2. Increased AST levels in liver diseases. (10 – 100 times normal)
  - a) Acute and chronic hepatitis
  - b) Active cirrhosis
  - c) Infectious mononucleosis
  - d) Hepatic necrosis and metastasis
  - e) Alcoholic hepatitis
3. Other diseases associated with increased AST levels include:  
Acute pancreatitis, Trauma, Dermatomyositis, Muscular dystrophy, Hemolytic anemia, Exhaustion and heat stroke.
4. Decreased AST levels occur in:
  - a. Azotemia
  - b. Chronic renal dialysis



## ***Alanine aminotransferase (ALT or GPT)***

Alanine aminotransferase (ALT or GPT): Is an enzyme with high concentrations occur in the liver, and relatively low concentrations are found in the heart, muscle, and kidney.

An alanine aminotransferase (ALT) test measures the amount of this enzyme in the blood. ALT is measured to see if the liver is damaged or diseased. Normally Low levels of ALT are found in the blood, but when the liver is damaged or diseased, it releases ALT into the bloodstream, which makes ALT levels go up. Most increases in ALT levels are caused by liver damage.

AST/ALT ratio is commonly measured clinically as biomarkers for liver health. *Using the AST/ALT ratio in the differentiation of alcoholic liver disease (ALD) from other forms of liver disease, particularly the Non-alcoholic Fatty Liver Disease (NAFLD) spectrum.*

Both AST and ALT enzymes require pyridoxal-5'-phosphate (vitamin B6) to function properly. Its absence in nutritionally-deficient heavy-drinkers has a much larger effect on the production of ALT than that of AST, causing the AST/ALT ratio to rise.

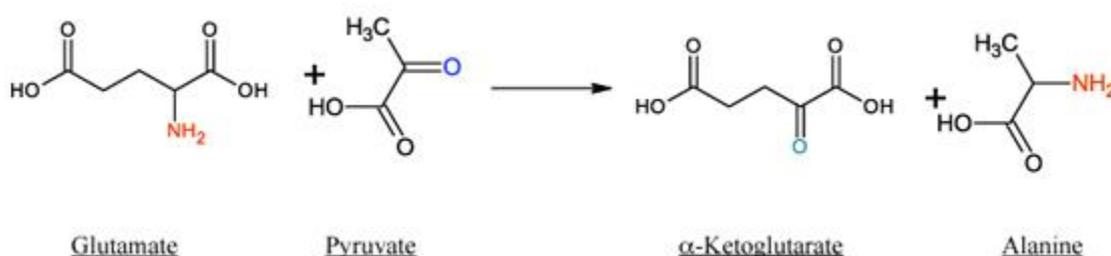
A normal AST/ALT ratio should be  $<1$ .

- ☒ When AST/ALT  $>1$  but  $<2$ , it is likely to be associated with ***cirrhosis***.
- ☒ When AST/ALT  $>2$ , it is likely to be associated with ***alcoholic hepatitis***.

*The alanine aminotransferase (ALT) test is done to:*

- Identify liver disease, especially cirrhosis and hepatitis caused by alcohol, drugs, or viruses.
- Help check for liver damage.
- Find out whether jaundice was caused by a blood disorder or liver disease.
- Keep track of the effects of medicines that can damage the liver.

ALT catalyzes the transfer of an amino group from L-alanine to  $\alpha$ -ketoglutarate, the products of this reversible transamination reaction being pyruvate and L-glutamate.



ALT (and all transaminases) requires the coenzyme Pyridoxal phosphate, which is converted into pyridoxamine in the first phase of the reaction, when an amino acid is converted into a keto acid.

The reaction catalyzed by ALT requires the cofactor pyridoxal-5-phosphate (P5P), which is the active form of vitamin B6.

- ✓ Vitamin B6 important requirement for AST and ALT assays.

Under normal conditions ALT is found in most tissues and fluids of the body except urine. The most important source of ALT is the liver.

### **Normal Results**

A normal ALT test result is :

- ✓ < 45 U/L (male)
- ✓ < 34 U/L (female)
- ☒ The normal range can be affected by different factors, such as *gender* and *age*.

### **Abnormal Results**

Higher than normal amounts of ALT can be a sign of liver damage.

Increased levels of ALT may be a result of: hepatitis, cirrhosis, liver tissue death (necrosis), tumor or cancer in the liver, toxic medications, hemochromatosis, mononucleosis, pancreatitis (inflamed and swollen pancreas), lack of blood flow to the liver (liver ischemia).



***Clinical implications:***

1. Increased ALT levels are found in:
  - a. Hepatocellular disease (high increase).
  - b. Viral, infectious or toxic hepatitis (50 times normal).
  - c. Obstructive Jaundice (moderate increase).
  - d. Cirrhosis (mild increase).
  - e. Metastatic liver tumor (mild increase).
  - f. Myocardial Infarction.
  - g. Trauma, shock and burns.
  
2. Decreased ALT levels occur in:
  - a- Malnutrition.
  - b- Urinary tract infection.