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Perspective

# Liver Function Assessment and Factors Affecting of Alanine Aminotransferase

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## ABOUT THE STUDY

Alanine aminotransferase (ALT), also known as Serum Glutamate-Pyruvate Transaminase (SGPT), is an important enzyme primarily found in liver cells (hepatocytes) and, to a lesser extent, in the kidneys and heart. It plays a fundamental role in amino acid metabolism, specifically in the reversible transfer of an amino group between alanine and α-ketoglutarate to form pyruvate and glutamate. This enzymatic process is essential for maintaining cellular energy production and is a key component of Liver Function Tests (LFTs) used to assess liver health.

ALT is a pyridoxal phosphate-dependent enzyme, meaning it requires vitamin B6 as a coenzyme to catalyze its biochemical reactions. Its primary function involves the transamination reaction between alanine and α-ketoglutarate, resulting in the formation of pyruvate and glutamate. This reaction is essential for gluconeogenesis, the process by which glucose is synthesized from non-carbohydrate precursors like amino acids, during fasting or periods of increased metabolic demand.

In terms of structure, ALT is a homodimeric enzyme, meaning it consists of two identical subunits. Each subunit contains a binding site for the coenzyme Pyridoxal Phosphate (PLP) and a catalytic site where the transamination reaction takes place. The PLP molecule plays a vital role in facilitating the transfer of the amino group between substrates, allowing ALT to function as a catalyst in the conversion of alanine and α-ketoglutarate.

### Factors affecting ALT levels

Several factors can influence Alanine aminotransferase (ALT) levels, which serve as a significant marker of liver health and function. Age and sex play a role, with ALT levels generally higher in males and varying with age due to physiological changes. Body Mass Index (BMI) is closely linked; obesity and higher BMI are associated with elevated ALT levels, often indicative of fatty liver disease or metabolic syndrome. Medications, particularly those known to cause hepatotoxicity (such as certain antibiotics, statins, and anti-seizure medications), can increase ALT levels as a result of liver cell damage. Alcohol consumption, especially chronic and excessive, can significantly elevate ALT due to alcohol direct toxic effects on hepatocytes.

Various medical conditions also impact ALT levels. Viral hepatitis infections, including hepatitis B and C, cause liver inflammation and elevate ALT. Autoimmune hepatitis and Non-Alcoholic Fatty Liver Disease (NAFLD) are other conditions where ALT levels are frequently elevated due to ongoing liver inflammation or fat accumulation. Liver cirrhosis, a consequence of chronic liver disease, typically results in elevated ALT as liver function declines. Genetic factors may also influence baseline ALT levels, contributing to individual variations in enzyme activity. These factors is essential for interpreting ALT levels accurately in clinical practice and managing patients with liver-related disorders.

### Liver function assessment

The liver plays a central and essential role in the assessment of overall health and various metabolic functions within the body. Here are the key aspects of the liver role in liver function assessment.

**Metabolic functions:** The liver is essential for metabolism, playing a role in the breakdown, synthesis, and storage of carbohydrates, fats, and proteins. It metabolizes nutrients absorbed from the digestive tract, regulating blood glucose levels, and converting excess glucose into glycogen for storage.

**Detoxification:** The liver filters and detoxifies harmful substances such as drugs, alcohol, and metabolic by-products. It converts toxins into less harmful forms for excretion by the kidneys or bile secretion into the intestines.

**Synthesis of proteins:** The liver synthesizes important proteins such as albumin, which helps maintain oncotic pressure in blood vessels, and clotting factors (e.g., fibrinogen, prothrombin) necessary for blood clotting.

**Bile production:** Hepatocytes in the liver produce bile, which is essential for the digestion and absorption of fats and fat-soluble vitamins in the intestines. Additionally, bile facilitates the excretion of wastes, such as bilirubin.

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**Storage of nutrients:** The liver stores vitamins (e.g., vitamin A, D, K, B12) and minerals (e.g., iron, copper) for future use. It also stores glycogen, releasing glucose into the bloodstream when needed to maintain blood sugar levels.

**Regulation of cholesterol levels:** The liver synthesizes cholesterol and regulates its levels in the bloodstream. It converts excess cholesterol into bile acids, which are then excreted in bile.