

## Alkaline Phosphatase (ALP)

### WHAT IS ALKALINE PHOSPHATASE?

Alkaline phosphatase (ALP) is an enzyme found in several different tissues. It helps break down proteins by catalyzing the hydrolysis of organic phosphate esters. More than 80% of the ALP that is detected in blood is from the liver and bones. Other sources include the intestine, pancreas, kidneys, and placenta (during pregnancy) (1). This assay measures the levels of total ALP in blood. Additional testing can determine the source of ALP, as each of the tissue types produce distinct forms (isoenzymes) of ALP (2).

### PURPOSE OF AN ALKALINE PHOSPHATASE TEST

ALP blood levels are significantly elevated in most people affected by serious liver disease, and moderately elevated in milder forms of liver disease. This test can detect those ALP increases from just a simple blood sample. Early diagnosis of liver issues is essential as the liver is very good at repairing and regenerating itself, but only in the early stages of liver damage (hepatitis and fibrosis). However, often people do not show any symptoms until the scarring gets worse and becomes irreversible cirrhosis (severe scarring). Cirrhosis is associated with a very high risk of developing liver cancer and liver failure.

ALP levels are also elevated in other health conditions, particularly related to bone problems such as rickets, bone tumors, and Paget's disease. This ALP test may be required to check for these bone problems and to monitor how well treatment is working.

### ALKALINE PHOSPHATASE REFERENCE RANGES

ALP levels vary with age, with high levels occurring during childhood and puberty due to bone growth and development. Variations between individuals of different genders and blood types also occur. In addition, an influx of placental alkaline phosphatase causes an increase during the third trimester in pregnant women (2).

Normal ALP levels are 55–167 U/L (males, 16–21 years), 44–107 U/L (females, 16–29 years), 50–116 U/L (males, 22–79 years), and 46–122 U/L (females, 30–79 years) (3).

### ELEVATED ALKALINE PHOSPHATASE

Up to 75% of individuals with cholestatic liver disease have elevated ALP that is at least 4-fold higher than the normal upper limit. High elevations also occur in bile duct obstruction (due to gallbladder inflammation, gallstones, or cancer), infiltrative liver disease, severe alcoholic hepatitis, and drug-induced liver injury. AIDS patients may also have similar ALP elevations, either due to opportunistic infections or tuberculosis complications (2).

Moderate ALP elevations (up to 4-fold increase) can occur in a variety of situations, including cirrhosis of the liver, chronic and viral hepatitis, congestive heart failure, Hodgkin lymphoma, myeloid metaplasia, kidney cancer, and bacterial infection. Bone disorders that cause excessive bone formation (e.g. Paget's disease) can also increase ALP levels in the blood (2).

### REDUCED ALKALINE PHOSPHATASE

Lower-than-normal ALP levels are rare, but may occur in cases of malnutrition, or a deficiency in certain vitamins and minerals. Celiac disease is one disorder that can contribute to a malnourished state. Wilson's disease, a disorder of copper overload, can lead to reduced ALP levels due to the displacement of zinc (a cofactor of ALP) by excess copper (4).

### TEST PROCEDURE

Correct specimen collection and handling is required for optimal assay performance.

This test requires a blood sample from a finger prick. All supplies for sample collection are provided in this kit. First wash and dry hands. Warm hands aid in blood collection. Clean the finger prick site with the alcohol swab and allow to air dry. Use the provided lancet to puncture the skin in one quick, continuous and deliberate stroke. Wipe away the first drop of blood (as it may be contaminated with tissue fluid or skin debris). Massage finger to increase blood flow at the puncture site and hold in a position that gravity facilitates the collection of blood on the fingertip. Transfer the blood to the blood collection card or blood collection tube (microtainer).

Avoid squeezing or 'milking' the finger excessively. If blood flow stops, perform a second skin puncture on another finger if more blood is required.

Dispose of all sharps safely and return sample to the laboratory in the provided prepaid return shipping envelope.

Upon receipt at the laboratory, the blood sample is analyzed by the fully automated Alinity c Alkaline Phosphatase assay on the Alinity ci series analyzer. This assay determines alkaline phosphatase levels using the para-nitrophenyl phosphate methodology, where alkaline phosphatase in the blood specimen catalyzes the hydrolysis of colorless p-nitrophenyl phosphate to give p-nitrophenol and inorganic phosphate. This results in an absorbance increase at 404 nm, which is directly proportional to the amount of alkaline phosphatase activity in the specimen.

### SPECIAL INSTRUCTIONS

In individuals with blood groups O and B, ALP levels increase in the blood for up to 12 hours after consumption of a fatty meal (5). For this reason, collection of a blood sample for this assay should occur in a fasting state (10-12 hours).

Values obtained with different assay methods should not be used interchangeably in serial testing. It is recommended that only one assay method be used consistently to monitor each patient's course of therapy.

### TEST INTERPRETATION

This assay will provide an accurate ALP level for the tested blood specimen. Typical ALP levels in serum are 40 – 150 U/L for adults (3). Additional testing can determine the source of ALP, as each of the tissue types produce distinct forms (isoenzymes) of ALP (2).

### DISCLAIMERS/LIMITATIONS

Certain medications (e.g., long-term aspirin use, some antibiotics, and birth control pills), going through menopause, and drinking lots of alcohol may affect ALP test results.

These results should be interpreted in conjunction with other laboratory and clinical information.

Additional testing is recommended if alkaline phosphatase levels are inconsistent with clinical evidence.

Correct specimen collection and handling is required for optimal assay performance.

## REFERENCES

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