

High-density lipoprotein (HDL) is the cholesterol carried by the alpha lipoproteins. A high level of HDL is an indication of a healthy metabolic system if there is no sign of liver disease or intoxication. HDL offers protection against chronic heart disease because it:

- inhibits cellular uptake of LDL
- serves as a carrier to remove cholesterol from the peripheral tissues and transport it back to the liver for catabolism and excretion.

Very high triglyceride levels can falsely elevate the measured HDL level.⁹

Low-density lipoprotein

.....2.0–3.4 mmol/L
Target goal with increased CV risk..... < 2 mmol/L

Low-density lipoprotein (LDL) is the cholesterol-rich remnant of the lipid transport vehicle, VLDL (very low density lipoprotein). There have been many studies to correlate the association between high levels of LDL and arterial atherosclerosis.

LDL is calculated using the Friedewald formula:

$$\text{LDL} = \text{total cholesterol} - \text{HDL} - \frac{\text{triglyceride}}{2.2}$$

Ratio: total cholesterol/HDL cholesterol

The ratio of total cholesterol to HDL is used as a marker of cardiovascular risk (e.g. NZ Cardiovascular Risk Calculator).¹⁰

Total cholesterol

Desirable goal <5.5 mmol/L
At increased CV risk..... <4 mmol/L

Cholesterol is a structural component of cell membrane and plasma lipoproteins and is important in the synthesis of steroid hormones, glucocorticoids and bile acids. Most cholesterol is synthesised in the liver, but some is absorbed through the diet, especially one high in saturated fats. HDL is cardioprotective. LDL and VLDL are involved in the pathogenesis of atherosclerotic plaques. Elevated cholesterol levels are associated with polygenic hypercholesterolaemia, familial hyperlipoproteinaemia, a high-fat diet, diabetes mellitus, hypothyroidism, nephrotic syndrome and the use of various drugs (e.g. cyclosporin, isotretinoin).

Low cholesterol levels may be seen in depression, malnutrition, liver insufficiency, malignancies, anaemia and infection.

Total triglycerides

Fasting <1.7 mmol/L
Target goal with increased CV risk..... <1.5 mmol/L

Triglycerides, stored in adipose tissue as glycerol, fatty acids and monoglycerides, are reconverted to triglycerides by the liver. 90% of the dietary intake and 95% of the fat stored in tissues consists of triglycerides.

Accurate triglyceride levels depend on prolonged fasting and are sensitive to weight change and many medications (e.g. diuretics and oral contraceptives).³ Increased levels may be present in metabolic syndrome, uncontrolled diabetes, alcohol excess, atherosclerosis, hypothyroidism, liver disease, pancreatitis, myocardial infarction, metabolic disorders, toxemia, and nephrotic syndrome. Decreased levels may be present in chronic obstructive pulmonary disease, brain infarction, hyperthyroidism, malnutrition and malabsorption.

Liver function tests

Liver function tests (LFTs) are used to detect liver damage or disease.⁶ The term 'liver function tests' can be misleading as only bilirubin and albumin levels reflect liver function; bilirubin levels are indicative of the excretory function and albumin the synthetic function. Only gamma glutamyltransferase is specific for the liver. Aspartate aminotransferase is also found in muscle; lactate dehydrogenase has many sources, including red blood cells and cardiac and skeletal muscle; and alkaline phosphatase is found in bone and intestine as well as liver.

Because of this, although elevated LFT results are associated with liver inflammation, chronic liver disease is frequently associated with only mild to moderate enzyme elevations.

Alkaline phosphatase

Adult (non-pregnant)..... 25–100 U/L
Growing child..... 70–350 U/L

The highest concentrations of alkaline phosphatase (ALP) are found in the bone, liver, placenta and biliary tract epithelium. Elevations seen in liver disease are primarily due to hepatobiliary obstruction but also occur in many other types of liver disease. Another source of raised ALP is bone (e.g. in Paget's Disease). Growing children normally have higher levels of this enzyme, as do pregnant females and people aged over 50.

A simultaneous elevation of 5-nucleotidase establishes liver disease as the cause of an elevated ALP.

ALP levels may be low in vitamin D excess, milk-alkali syndrome, scurvy, hypophosphatasaemia and hypothyroidism.

Aminotransferases

Alanine aminotransferase (ALT) <35 U/L
(formerly called serum glutamic-pyruvic transaminase, or SGPT)

Aspartate aminotransferase (AST)..... <40 U/L
(formerly called serum glutamic-oxaloacetic transaminase, or SGOT)