LIPID PROFILE

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* Is a group of tests that are often ordered together to determine risk of :
* coronary heart disease (CHD)
* acute pancreatitis
* failure to thrive and weakness
* cataracts.
* coronary heart disease (CHD)
* They are tests that have been shown to be good indicators of whether someone is likely to have a heart attack or stroke caused by blockage of blood vessels or hardening of the arteries (atherosclerosis).
* The lipid profile typically includes:

1. Triglycerides 2. Total cholesterol

3. High density lipoprotein cholesterol (HDL-C)often called good cholesterol

4. Low density lipoprotein cholesterol (LDL-C)-often called bad cholesterol

5. Very low density lipoprotein cholesterol (VLDL-C)

1-Determination of Total cholesterol : Cholesterol is the most abundant steroid in animal tissues. The measurement of serum cholesterol is one of the most common tests performed in the clinical laboratory. Hypercholesterolemia (high blood cholesterol levels) can be the result of a variety of medical conditions.

Cholesterol levels are increased in:

1) Cardiovascular diseases and atherosclerosis

2) Type II familial hypercholesterolemia

3) Obstructive jaundice

5) Hypothyroidism

4) Diabetes Miletus

7) Nephrosis

6) Obesity

High blood cholesterol levels do not point to a specific disease; determination of cholesterol is used in conjunction with other clinical measurements mainly for confirmation of a particular diseased condition, rather than for diagnosis of a specific ailment.

High serum levels of cholesterol-bearing LDLs are positively correlated with the development of atherosclerosis. In contrast, high levels of HDL cholesterol are inversely related to a predisposition to coronary artery disease. In general, the higher the ratio of HDL-cholesterol to LDL-cholesterol, the lower the incidence of heart disease.

Risk Level	LDL/HDL Ratio	HDL/LDL Ratio
Low	3.3 - 4.4	0.22 - 0.30
Average	4.4 - 7.1	0.14 - 0.22
Moderate	7.1- 11.0	0.09 - 0.14
High	> 11.0	> 0.09

Cholesterol levels are lowered in:

1- condition like :

a) Liver disease b) Anaemia c) Stress

d) Sepsis e) Antibiotic therapy in which there is impairment of absorption from G.I.T.

2) Pernicious anaemia 3) Haemolytic jaundice

4) Hyperthyroidism. 5) Final stages of cancer

6) Hypolipoproteinaemias 7) Severe infection

Instructions to the patients:

1) 12 hours fasting before test.
2) Normal dieting for 7 days prior to testing.
3) Non consumption of alcohol for 24 hours prior to testing.
4) Avoiding lipid lowering drugs as Estrogen, Oral contraceptive pills, Salicylates etc.

TEST PRINCIPLE :

- Clinical measurements of total cholesterol in serum or plasma detect cholesterol esters in addition to cholesterol . Between 60 and 70 % of the cholesterol transported in blood is in an esterified form, where the β-3 OH group on the steroid-skeleton is covalently linked to a naturally occurring fatty acid.
- Testing methods for total cholesterol use cholesterol oxidase reactions along with cholesterol esterase and usually a peroxidase reaction for the "colour" or final determination reaction.
- The cholesterol esters are hydrolized to free cholesterol by cholesterol esterase (CE). The free cholesterol is then oxidized by cholesterol oxidase (Co) to cholest-3-ene-4-one with the simultaneous production of hydrogen peroxide.

- The hydrogen peroxide produced couples with 4-aminoantipyrine and phenol, in the presence of peroxidase, to yield a chromogen with maximum absorbance at 505 nm.
- The intensity of the color produced is directly proportional to the concentration of total cholesterol in the sample.

Cholesterol esters $\xrightarrow{\text{Cholesterol Esterase}}$ cholesterol+ free fatty acid

Cholesterol + 02 $\xrightarrow{\text{Cholesterol Oxidase}}$ cholest-3-ene-4-one+H202

$2\ H_2O_2$ + 4-aminoantipyrine $\xrightarrow{\text{Peroxidase}}$ PhenolQuinoneimine $+4H_2O$

Interference :

Remove sample from red cells after blood clots or plasma has been spun down. The peroxidise assay can be susceptible to increases in uric acid, ascorbic acid, bilirubin, haemoglobin,

or other reducing substances. Samples should have only the normal amount of these substances present.

The Specimen Non-hemolyzed serum or plasma, free from clots. The patient need not be fasting if this is the only lipid test requested. However, if total cholesterol is requested as part of a lipid panel, the patient must be fasting for 10 to 12 hours.

Reference Ranges (Age-Specific)

Male (25-29 year old) 130-234 mg/dL

Female (25-29 years old) 130-231 mg/dL

2. Triglycerides (TG) Triglycerides are measured enzymatically in serum or plasma using a series of coupled reactions in which triglycerides are hydrolyzed to produce glycerol. Glycerol is then oxidized using glycerol oxidase, and H_2O_2.

one of the reaction products, is measured as described above for cholesterol. Absorbance is measured at 500 nm.

The reaction sequence is as follows:

Triglycerides+3H_2O —(lipase)→ glycerol + fatty acids Glycerol +

ATP + glycerol —(glycerokinase)→ glycerol-3-phosphate + ADP

Glycerol-3-phosphate+0_2 —(glycerophosphate oxidase)→ dihydroxyacetone phosphate + H_2O_2

H202 +4-aminophenazone+ 4-chlorophenol —(Peroxidase)→ 4-(p-benzoquinone- monoimino)- phenazone +2H_2O +HCL

High levels of serum triglycerides help mark conditions that are associated with increased risk for CHD and peripheral atherosclerosis. High triglycerides are associated with increased risk for CAD in patients with other risk factors, such as low HDL-cholesterol, some patient groups with elevated apolipoprotein B concentrations,

and patients with forms of LDL that may be particularly atherogenic. Desirable fasting triglyceride levels are considered to be those below 200 mg/dL, and are further categorized as Borderline, 200-400 mg/dL: High, 400-1,000 mg/dL; and Very High >1000 mg/dL). Very high triglycerides can result in pancreatitis and should be promptly evaluated and treated. Triglycerides are also measured because the value is used to calculate very low density lipoprotein (VLDL)-cholesterol concentrations

VLDL = TG/5

3. HDL CHOLESTEROL :

The Precipitation Reaction

The precipitation methods use either dextran sulfate, polyethylene glycol G(PEG), or phosphotungstic acid with magnesium chloride ($MgCl_2$) to precipfate LDL and VLDL

lipoproteins from a fasting serum sample, leaving HDL in the supernatant. This HDL supernatant is then assayed for cholesterol. The resulting answer (in mg/dL) represents the amount of HDL in the serum sample.

4. LDL-cholesterol:

Most of the circulating cholesterol is found in three major lipoprotein fractions: very low density lipoproteins (VLDL), LDL and HDL

Total chol.= [VLDLchol]+ [LDLchol]+ [HDLchol]

LDL-cholesterol: is calculated from measured values of total cholesterol, triglycerides and HDL-cholesterol according to the relationship:

[LDL chol] = [total chol] – ([HDL chol]-[TG/5]

all values are expressed in mg/dL

LDL carries most of the circulating cholesterol in man and when elevated contributes to the development of coronary atherosclerosis. LDL-cholesterol is measured to assess risk for CHD and to follow the progress of patients being treated to lower LDL-cholesterol concentrations.

Desirable levels of LDL-chol are those below 130 mg/dL in adults and 110 mg/dL in children.