

Lipid Profile Tests

Lipid Profile Tests

What is a Lipid Profile Test?

- A **lipid profile test**, also known as a **lipid panel**, is a **blood test** that measures the levels of various **lipids (fats)** in the bloodstream.
- This test is essential for assessing the risk of **cardiovascular diseases** such as **atherosclerosis**, **coronary artery disease**, **stroke**, and **heart attack**.

Why Is It Done?

- The lipid profile test is primarily used to:
 - Screen for **abnormal lipid levels**.
 - Evaluate **risk of heart disease**.
 - Monitor the **effectiveness of lipid-lowering treatments** (e.g., statins, lifestyle changes).
 - Diagnose **hyperlipidemia** (high levels of lipids in the blood).

What Parameters Are Typically Included in a Lipid Profile?

1. **Total Cholesterol**
2. **High-Density Lipoprotein (HDL) Cholesterol** – "good" cholesterol
3. **Low-Density Lipoprotein (LDL) Cholesterol** – "bad" cholesterol
4. **Triglycerides**
5. **Very Low-Density Lipoprotein (VLDL)** – sometimes calculated or included
6. **Total Cholesterol/HDL ratio**
7. **Non-HDL Cholesterol**

Lipoproteins: Composition and Functions

- Lipids (like cholesterol and triglycerides) are **not water-soluble**, so they cannot travel freely in the blood.
- To be transported in the bloodstream, they are combined with **proteins** to form **lipoproteins**.

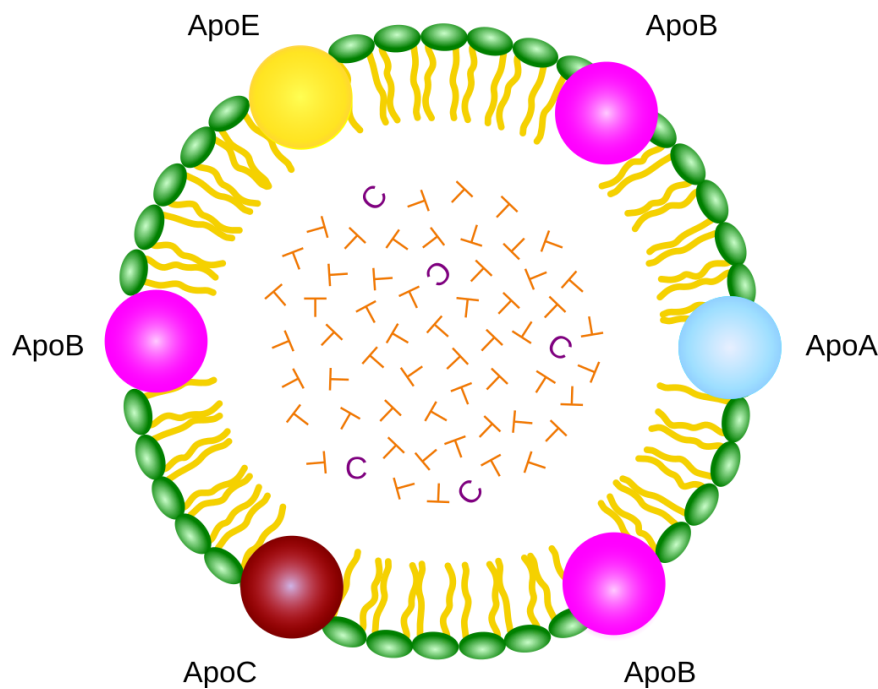
Types of Lipoproteins

There are **five major classes**, based on their **density**, which is influenced by their **lipid-to-protein ratio**:

Lipoprotein	Major Component	Density	Function
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Chylomicrons	Triglycerides	Least dense (most lipid, least protein)	Transport dietary TGs from intestine to tissues
VLDL (Very Low-Density Lipoprotein)	Triglycerides	Very low	Transport TGs synthesized by liver to tissues
IDL (Intermediate-Density Lipoprotein)	Cholesterol, TGs	Intermediate	Transition between VLDL and LDL
LDL (Low-Density Lipoprotein)	Cholesterol	Low	Delivers cholesterol to peripheral tissues
HDL (High-Density Lipoprotein)	Protein	Most dense (least lipid, most protein)	Removes excess cholesterol and transports it to liver

Structure of Lipoproteins



Structure of a chylomicron (the largest lipoprotein).

Each lipoprotein particle consists of:

1. Core (Hydrophobic):

- Triglycerides
- Cholesteryl esters

2. Surface (Amphipathic):

- Phospholipids
- Free cholesterol
- **Apolipoproteins (Apos)** – essential proteins that:
 - **Stabilize** the particle

- Act as **ligands for receptors**
- Act as **enzyme cofactors**

Major Apolipoproteins and Their Functions

Apolipoprotein	Found in	Function
Apo A-I	HDL	Activates LCAT, reverse cholesterol transport
Apo B-100	VLDL, IDL, LDL	Binds to LDL receptor
Apo B-48	Chylomicrons	Assembly and secretion of chylomicrons
Apo C-II	Chylomicrons, VLDL	Activates lipoprotein lipase (LPL)
Apo E	Chylomicrons, VLDL, IDL, HDL	Binds to liver receptors, uptake of remnants

Functions of Lipoproteins

Let's look at their **biological roles**:

A. Chylomicrons

- Formed in intestinal cells after fat ingestion.
- Carry **dietary triglycerides** and cholesterol to tissues.
- Triglycerides are hydrolyzed by **lipoprotein lipase (LPL)** in capillaries → free fatty acids enter muscle or adipose tissue.

B. VLDL

- Made by the **liver**.
- Transport **endogenously synthesized triglycerides**.
- As TGs are removed (via LPL), VLDL becomes **IDL**, then **LDL**.

C. IDL

- Intermediate between VLDL and LDL.
- Some is taken up by the liver, some becomes LDL.

D. LDL

- Main transporter of **cholesterol to peripheral tissues**.
- Binds to LDL receptors on cells → cholesterol is used for membrane synthesis, steroid hormones, etc.
- Excess LDL → oxidized LDL → contributes to **atherosclerosis**.

E. HDL

- Synthesized in **liver and intestine**.
- Scavenges **free cholesterol** from tissues and other lipoproteins.

- Enzyme **LCAT** converts free cholesterol to cholesterol esters.
- Transports cholesterol back to the **liver** for excretion → **reverse cholesterol transport**.
- **Protective role** against cardiovascular disease.

Lipoproteins: Composition and Functions

Overview

- **Serum lipid profile** is a laboratory test used to measure different types of **lipids (fats)** in the blood. It includes:
 1. **Total Cholesterol**
 2. **High-Density Lipoprotein (HDL) Cholesterol**
 3. **Low-Density Lipoprotein (LDL) Cholesterol**
 4. **Triglycerides**
- These values help assess the risk for **cardiovascular diseases**, such as **atherosclerosis**, **heart attack**, and **stroke**.

Pre-Analytical Phase

- Before lipid determination:
 - **Fasting requirement:** A 9–12 hour fast is usually required (especially for triglycerides) to avoid postprandial lipemia.
 - **Sample collection:** Venous blood is collected in a plain or serum-separating tube.
 - **Sample processing:** After clotting, serum is separated by centrifugation.
 - **Storage:** Fresh serum is preferred. If delayed, samples should be refrigerated (short term) or frozen (long term).

Analytical Phase

Each lipid component is measured using **enzymatic colorimetric assays**, which rely on specific enzymes reacting with lipids to produce a color change, which is then measured spectrophotometrically.

A. Total Cholesterol Determination

Principle:

- The **cholesterol esters** in serum are hydrolyzed by **cholesterol esterase** to free cholesterol, which is then oxidized by **cholesterol oxidase** to form **cholestenone** and **hydrogen peroxide** (H_2O_2).
- The hydrogen peroxide reacts with a chromogen in the presence of **peroxidase**, forming a colored compound.

Reactions involved:



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