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Lipid Profile

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Also known as: Lipid Panel; Coronary Risk Panel

Formal name: Lipid Profile

Related tests: [Cholesterol](#); [HDL Cholesterol](#); [LDL Cholesterol](#); [Triglycerides](#); [Direct LDL Cholesterol](#); [VLDL Cholesterol](#); [Cardiac Risk Assessment](#); [Lp-PLA2](#); [Apo A-I](#); [Apo B](#); [Lp\(a\)](#); [LDL Particle Testing](#)



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At a Glance

Why Get Tested?

To assess your risk of developing [cardiovascular disease \(CVD\)](#); to monitor treatment

When to Get Tested?

Screening when no risk factors present: for adults, every four to six years; for youths, once between the ages of 9 and 11 and again between ages 17 and 21

Monitoring: at regular intervals when risk factors are present, when prior results showed high risk levels, and/or to monitor effectiveness of treatment

Sample Required?

A blood sample obtained by inserting a needle into a vein in your arm or from a fingerstick

Test Preparation Needed?

Typically, fasting for 9-12 hours (water only) before having your blood drawn is required, but some labs offer non-fasting lipid testing. Follow any instructions you are given and tell the person drawing your blood whether or not you have fasted. For youths without risk factors, testing may be done without fasting.

The Test Sample

What is being tested?

Lipids are a group of fats and fat-like substances that are important constituents of cells and sources of energy. A lipid profile measures the level of specific lipids in the blood.

Two important lipids, cholesterol and triglycerides, are transported in the blood by lipoprotein particles. Each particle contains a combination of protein, cholesterol, triglyceride, and phospholipid molecules. The particles measured with a lipid profile are classified by their density into high-density lipoproteins (HDL), low-density lipoproteins (LDL), and very low-density lipoproteins (VLDL).

Monitoring and maintaining healthy levels of these lipids is important in staying healthy. While the body produces the cholesterol needed to function properly, the source for some cholesterol is the diet. Eating too much of foods that are high in saturated fats and trans unsaturated fats (trans fats) or having an inherited predisposition can result in a high level of cholesterol in the blood. The extra cholesterol may be deposited in [plaques](#) on the walls of blood vessels. Plaques can narrow or eventually block the opening of blood vessels, leading to hardening of the arteries ([atherosclerosis](#)) and increasing the risk of numerous health problems, including [heart disease](#) and [stroke](#). A high level of triglycerides in the blood is also associated with an increased risk of developing [cardiovascular disease \(CVD\)](#), although the reason for this is not well understood.

A lipid profile typically includes:

- [Total cholesterol](#)
- [High-density lipoprotein cholesterol \(HDL-C\)](#) — often called "good cholesterol" because it removes excess cholesterol and carries it to the liver for removal.

- **Low-density lipoprotein cholesterol (LDL-C)** — often called "bad cholesterol" because it deposits excess cholesterol in walls of blood vessels, which can contribute to atherosclerosis.
- **Triglycerides**

For more about these, see the ["The Test"](#) tab.

How is the sample collected for testing?

A blood sample is obtained by inserting a needle into a vein in the arm. Sometimes a drop of blood is collected by puncturing the skin on a fingertip. This fingerstick sample is typically used when a lipid profile is being measured on a portable testing device, for example, at a health fair.

Is any test preparation needed to ensure the quality of the sample?

Typically, fasting for 9-12 hours before having the blood sample drawn is required; only water is permitted. However, some laboratories offer non-fasting lipid profiles. In particular, children and teens may have testing done without fasting. Follow any instructions you are given and be sure to tell the person drawing your blood whether or not you have fasted.

The Test

How is it used?

The lipid profile is used as part of a **cardiac risk assessment** to help determine an individual's risk of **heart disease** and to help make decisions about what treatment may be best if there is borderline or high risk.

Lipids are a group of fats and fat-like substances that are important constituents of cells and sources of energy. Monitoring and maintaining healthy levels of these lipids is important in staying healthy. (For more on lipids, see the ["What is being tested?"](#) section.)

The results of the lipid profile are considered along with other known risk factors of heart disease to develop a plan of treatment and follow-up. Depending on the results and other risk factors, treatment options may involve lifestyle changes such as diet and exercise or lipid-lowering medications such as **statins**.

A lipid profile typically includes:

- **Total cholesterol** — this test measures all of the cholesterol in all the lipoprotein particles.
- **High-density lipoprotein cholesterol (HDL-C)** — measures the cholesterol in HDL particles; often called "good cholesterol" because it removes excess cholesterol and carries it to the liver for removal.
- **Low-density lipoprotein cholesterol (LDL-C)** — calculates the cholesterol in LDL particles; often called "bad cholesterol" because it deposits excess cholesterol in walls of blood vessels, which can contribute to **atherosclerosis**. Usually, the amount of LDL-C is calculated using the results of total cholesterol, HDL-C, and triglycerides.
- **Triglycerides** — measures all the triglycerides in all the lipoprotein particles; most is in the very low-density lipoproteins (VLDL).

Some other information may be reported as part of the lipid profile. These parameters are calculated from the results of the tests identified above.

- **Very low-density lipoprotein cholesterol (VLDL-C)** — calculated from triglycerides/5; this formula is based on the typical composition of VLDL particles.
- **Non-HDL-C** — calculated from total cholesterol minus HDL-C.
- **Cholesterol/HDL ratio** — calculated ratio of total cholesterol to HDL-C.

An extended profile (or advanced lipid testing) may also include low-density lipoprotein particle number/concentration (LDL-P). This test measures the number of LDL particles, rather than measuring the amount of LDL-cholesterol. It is thought that this value may more accurately reflect heart disease risk in certain people. For more, see [Common Questions #5](#) or the article on [LDL Particle Testing](#).

When is it ordered?

Adults

It is recommended that healthy adults with no other risk factors for **heart disease** be tested with a fasting lipid profile once every four to six years. Initial screening may involve only a single test for **total cholesterol** and not a full lipid profile. However, if the screening cholesterol test result is high, it will likely be followed by testing with a lipid profile.

If other risk factors are present or if previous testing revealed a high cholesterol level in the past, more frequent testing with a full lipid profile is recommended.

Risk factors other than high **low-density lipoprotein cholesterol (LDL-C)** include:

- Cigarette smoking
- Being overweight or obese
- Unhealthy diet
- Being physically inactive—not getting enough exercise
- Age (if you are a male 45 years or older or a female 50-55 years or older)
- **Hypertension** (blood pressure of 140/90 or higher or taking high blood pressure medications)
- Family history of premature heart disease (heart disease in a first degree male relative under age 55 or a first degree female relative under age 65)
- Pre-existing heart disease or already having had a **heart attack**
- **Diabetes** or prediabetes

Note: High **HDL** (60 mg/dL or above) is considered a "negative risk factor" and its presence allows the removal of one risk factor from the total.

Youths

For children and adolescents, routine lipid testing is recommended by the American Academy of Pediatrics (AAP) in all children once between the ages of 9 and 11 and again between 17 and 21. Earlier and more frequent screening with a lipid profile is recommended for children and youths who are at an increased risk of developing heart disease as adults. Some of the risk factors are similar to those in adults and include a family history of heart disease or health problems such as diabetes, high blood pressure, or being overweight. High-risk children should be tested between 2 and 8 years old with a fasting lipid profile, according to the AAP.

Children younger than 2 years old are too young to be tested.

For additional details on this, see the screening articles for [Children](#), [Teens](#), [Young Adults](#), [Adults](#), and [Adults 50 and Up](#).

Monitoring

A lipid profile may also be ordered at regular intervals to evaluate the success of lipid-lowering lifestyle changes such as diet and exercise or to determine the effectiveness of drug therapy such as **statins**.

What does the test result mean?

Adults

In general, healthy lipid levels help to maintain a healthy heart and lower the risk of **heart attack** or **stroke**. A health practitioner will take into consideration the results of each component of a lipid profile plus other risk factors to help determine a person's overall risk of coronary heart disease, whether treatment is necessary and, if so, which treatment will best help to lower the person's risk of **heart disease**.

In 2002, the National Cholesterol Education Program (NCEP) Adult Treatment Panel III provided the guidelines for evaluating lipid levels and determining treatment. However, in 2013, the American College of Cardiology (ACC) and the American Heart Association (AHA) published new guidelines on treatment of cholesterol to reduce **cardiovascular disease** risk in adults. These guidelines recommend a treatment strategy different than those from NCEP. Decisions about cholesterol-lowering therapies are no longer focused on LDL-C or non-HDL-C targets, but are based on the 10-year risk of atherosclerotic cardiovascular disease (ASCVD) and other factors.

The latest guidelines include a newly developed, evidence-based risk calculator for ASCVD used to identify individuals most likely to benefit from therapy. It is intended for people without heart disease between the ages of 40 and 79. Many factors are considered in the calculation, including age, gender, race, total cholesterol, HDL-C, blood pressure, presence of **diabetes**, and smoking habit. Additionally, the updated guidelines recommend evaluating therapeutic response compared to LDL-C baseline values, with reduction thresholds differing based on the intensity of the lipid-lowering drug therapy. (For more about treatment, see [Common Questions #1](#).)

Use of the updated **risk calculator** and guidelines remains controversial. Many still use the older guidelines from the NCEP Adult Treatment Panel III to evaluate lipid levels and CVD risk:

LDL Cholesterol

Optimal: Less than 100 mg/dL (2.59 mmol/L); for those with known disease (ASCVD or diabetes), less than 70 mg/dL (1.81 mmol/L) is optimal

Near/above optimal: 100-129 mg/dL (2.59-3.34 mmol/L)

Borderline high: 130-159 mg/dL (3.37-4.12 mmol/L)

High: 160-189 mg/dL (4.15-4.90 mmol/L)

Very high: Greater than 190 mg/dL (4.90 mmol/L)

Total Cholesterol

Desirable: Less than 200 mg/dL (5.18 mmol/L)

Borderline high: 200-239 mg/dL (5.18 to 6.18 mmol/L)

High: 240 mg/dL (6.22 mmol/L) or higher

HDL Cholesterol

Low level, increased risk: Less than 40 mg/dL (1.0 mmol/L) for men and less than 50 mg/dL (1.3 mmol/L) for women

Average level, average risk: 40-50 mg/dL (1.0-1.3 mmol/L) for men and between 50-59 mg/dl (1.3-1.5 mmol/L) for women

High level, less than average risk: 60 mg/dL (1.55 mmol/L) or higher for both men and women

Fasting Triglycerides

Desirable: Less than 150 mg/dL (1.70 mmol/L)

Borderline high: 150-199 mg/dL(1.7-2.2 mmol/L)

High: 200-499 mg/dL (2.3-5.6 mmol/L)

Very high: Greater than 500 mg/dL (5.6 mmol/L)

Non-HDL Cholesterol

Optimal: Less than 130 mg/dL (3.37 mmol/L)

Near/above optimal: 130-159 mg/dL (3.37-4.12mmol/L)

Borderline high: 160-189 mg/dL (4.15-4.90 mmol/L)

High: 190-219 mg/dL (4.9-5.7 mmol/L)

Very high: Greater than 220 mg/dL (5.7 mmol/L)

Unhealthy lipid levels and/or the presence of other risk factors such as age, family history, cigarette smoking, diabetes and **high blood pressure**, may mean that the person tested requires treatment.

The NCEP Adult Treatment Panel III guidelines uses the results of lipid tests and these other major risk factors to define target LDL cholesterol levels. According to those guidelines, if individuals have LDL-C above the target values, they will be treated.

The target LDL-C value is:

- Less than 100 mg/dL (2.59 mmol/L) if the person has heart disease or diabetes [and ideally less than 70 mg/dL (1.81 mmol/L)]
- Less than 130 mg/dL (3.37 mmol/L) if the person has 2 or more risk factors
- Less than 160 mg/dL (4.14 mmol/L) if the person has 0 or 1 risk factor

Youths

A full, fasting lipid panel is recommended for screening youths with risk factors for developing heart disease, according to the American Academy of Pediatrics.

Fasting prior to lipid screening in children without risk factors is unnecessary. Non-high-density lipoprotein cholesterol (non-HDL-C) is the recommended test for non-fasting lipid screening. Non-HDL-C-is calculated by testing for total cholesterol and HDL-C and taking the difference between the two levels. Recommended cut-off values include:

	Test	Acceptable (mg/dL)	Borderline (mg/dL)	High (mg/dL)
Children and Adolescents	Total Cholesterol	Less than 170	170-199	Greater than or equal to 200
	Non-HDL Cholesterol	Less than 120	120-144	Greater than or equal to 145
Young Adults	Total Cholesterol	Less than 190	190-224	Greater than or equal to 225
	Non-HDL Cholesterol	Less than 150	150-189	Greater than or equal to 190

*Adapted from "Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents: Summary report." *Pediatrics* 2011; 128.

Is there anything else I should know?

There is increasing interest in measuring **triglycerides** in people who have not fasted. The reason is that a non-fasting sample may be more representative of the "usual" circulating level of triglyceride since most of the day, blood lipid levels reflect post-meal (post-prandial) levels rather than fasting levels. However, it is not yet certain how to interpret non-fasting levels for evaluating risk, so at present there is no change in the current recommendations for fasting prior to tests for lipid levels.

A routine cardiac risk assessment typically includes a fasting lipid profile. Beyond that, research continues into the usefulness of other non-traditional markers of cardiac risk, such as **Lp-PLA₂**. A health practitioner may choose to evaluate one or more of these markers to help determine someone's risk, but there is no consensus on their use and they are not widely available. For a more detailed discussion on these, see the article on **Cardiac Risk Assessment**.

Common Questions

1. What treatments are recommended if my lipid levels are unhealthy?

Adherence to a healthy lifestyle is an important part of maintaining heart health and in treating high cholesterol. This may mean you will need to change your lifestyle, specifically by adopting a diet low in saturated fat and trans unsaturated fats (trans fats), avoiding smoking, controlling [high blood pressure](#) and [diabetes](#), and participating in moderate exercise. You may be referred to a dietician for advice in making dietary changes.

Your healthcare provider will talk to you about risks and benefits of drug therapy, based on the results of your [low-density lipoprotein cholesterol \(LDL-C\)](#) and possibly your calculated risk for ASCVD. There are several classes of drugs that are effective in lowering LDL-C. You may be prescribed one of these. Your LDL-C will be checked at regular intervals to assure that the drug is working. If the drug does not result in adequate reduction in your LDL cholesterol, your healthcare provider may increase the amount of drug or possibly add a second drug.

2. I had a screening test for cholesterol. It was less than 200 mg/dL (5.18 mmol/L). Do I need a lipid profile?

If your [total cholesterol](#) is below 200 (5.18 mmol/L) and you have no family history of [heart disease](#) or other risk factors, a full lipid profile may not be necessary. However, an [HDL cholesterol measurement](#) would be advisable to assure that you do not have a low HDL-C. Many screening programs now offer both cholesterol and HDL-C.

3. My lipid profile results came back with high triglycerides and no results for LDL-cholesterol. Why?

In most screening lipid profiles, [LDL cholesterol](#) is calculated from the other lipid measurements. However, the calculation is not valid if [triglycerides](#) are over 400 mg/dL (4.52 mmol/L). To determine LDL-C when triglycerides are over 400 mg/dL (4.52 mmol/L) requires special testing techniques such as a [direct LDL-C test](#) or a lipid ultracentrifugation test (sometimes called a beta-quantification test).

4. What is non-HDL-cholesterol?

Non-HDL-cholesterol (non-HDL-C) is calculated by subtracting your [HDL-C](#) result from your [total cholesterol](#) result. It represents the "atherogenic" cholesterol — the cholesterol that can build up in the arteries, form [plaques](#), and cause narrowing of the vessels and blockages. Unlike calculation of LDL-C (see Question #3 above), this calculation is not affected by high levels of [triglycerides](#). Your non-HDL-C result may be used to assess your risk for [CVD](#), especially if you have high triglycerides, since high non-HDL-C is associated with increased risk. As recommended by the National Cholesterol Education Program, Adult Treatment Panel III, if you have high triglycerides (greater than 200 mg/dL), the non-HDL-C result can be used as a secondary target of treatments such as lifestyle changes and drugs that aim to lower lipid levels.

5. What is a low-density lipoprotein particle number (LDL-P) test?

LDL-P is a test that measures the number of LDL particles, rather than measuring the amount of LDL-cholesterol. For many people, the [LDL-C test](#) is a good indicator of risk of [CVD](#). However, research has found that some people with healthy levels of LDL-C still have increased risk of CVD. Similarly, individuals with some [chronic](#) conditions such as [diabetes](#) may have increased risk though their LDL-C is at a healthy level. For these populations, it has been suggested that the number of LDL particles, and their size, might be an additional factor to consider when determining their CVD risk. For more on this, see the article on [LDL Particle Testing](#).

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Elsewhere On The Web

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Article Sources

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