

High Blood Cholesterol

National Heart, Lung and Blood Institute

■ ABSTRACT

Research has shown that high levels of low-density lipoprotein (LDL), "bad cholesterol," is a risk factor for cardiac disease. This article provides an overview of "good" cholesterol (high-density lipoprotein, HDL) and "bad" (LDL) cholesterol, assesses the role of triglycerides in heart disease, and offers strategies for cholesterol lowering and heart disease prevention. *Nutr Clin Care*. 2003;6:108-114 ■

KEY WORDS: cholesterol, triglycerides, metabolic syndrome, overweight, heart disease

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High blood cholesterol is an important risk factor for heart disease that can be remedied. All women should keep their cholesterol levels down to lessen the chances of developing heart disease or having a heart attack. If a patient already has heart disease, it is particularly important to lower an elevated blood cholesterol level in order to reduce your high risk for a heart attack. Women with diabetes also are at especially high risk for a heart attack. If a patient has diabetes, steps will need to be taken to keep both cholesterol and diabetes under control. Although young women tend to have lower cholesterol levels than young men, between the ages of 45 and 55, women's levels begin to rise higher than men's. After age 55, this "cholesterol gap" between women and men becomes still wider. Although at older ages, women's overall risk of heart disease continues to be somewhat lower than that of men, the higher a woman's blood cholesterol level, the greater her chances of developing heart disease.

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Nutrition in Clinical Care, Volume 6, Number 3, 2003 108-114

CHOLESTEROL AND YOUR HEART

The body needs cholesterol to function normally. However, the body makes all the cholesterol it needs. Over a period of years, extra cholesterol and fat circulating in the blood build up in the walls of the arteries that supply blood to the heart. This buildup makes the arteries narrower and narrower. As a result, less blood gets to the heart. Blood carries oxygen to the heart, and if enough oxygen-rich blood cannot reach your heart, a patient may suffer chest pain. If the blood supply to a portion of the heart is completely cut off, the result is a heart attack. Cholesterol travels in the blood in packages called lipoproteins. Low-density lipoprotein (LDL) carries most of the cholesterol in the blood. Cholesterol packaged in LDL is often called "bad" cholesterol, because too much LDL in the blood can lead to cholesterol buildup and blockage in the arteries. Another type of cholesterol is high-density lipoprotein (HDL), known as "good" cholesterol. That's because HDL helps remove cholesterol from the blood, preventing it from building up in the arteries.

GETTING TESTED

All women age 20 and older should have their cholesterol levels checked by means of a blood test called a "lipoprotein profile." Be sure to ask for the test results, so you will know whether or not you need to lower your cholesterol. Total cholesterol is a measure of the cholesterol in all of your lipoproteins, including LDL and HDL. An LDL level below 100 mg/dL is considered "optimal," or ideal (Table 1). However, not every woman needs to aim for so low a level. The higher your LDL number, the higher your risk of heart disease. Knowing your LDL number is especially important because it will determine the kind of treatment needed. The HDL number tells a

Table 1. Blood Cholesterol Levels and Heart Disease Risk

Total Cholesterol Level	Category
Less than 200 mg/dL	Desirable
200–239 mg/dL	Borderline high
240 mg/dL and above	High
LDL Cholesterol Level	Category
Less than 100 mg/dL	Optimal (ideal)
100–129 mg/dL	Near optimal/above optimal
130–159 mg/dL	Borderline high
160–189 mg/dL	High
190 mg/dL and above	Very high

different story. The *lower* the HDL level, the higher your heart disease risk. The lipoprotein profile test will also measure levels of triglycerides, which is another fatty substance in the blood.

HDL Cholesterol Level

An HDL cholesterol level of less than 40 mg/dL is a major risk factor for heart disease. An HDL level of 60 mg/dL or higher is protective.

What Are Triglycerides?

Triglycerides are another type of fat found in the blood and in food. Triglycerides are produced in the liver. When you drink alcohol or take in excess calories, your liver produces more triglycerides. Recent research indicates that triglyceride levels that are borderline high (150–199 mg/dL) or high (200 mg/dL or more) increase risk of heart disease. To reduce blood triglyceride levels, doctors recommend a low-saturated fat, low-cholesterol diet that also limits carbohydrates. It is also important to control weight, get more physical activity, and avoid smoking and alcohol. Sometimes, medication is needed.

Heart Disease Risk and Your LDL Goal

In general, the higher the LDL level and the more other risk factors that are present, the greater the chances of developing heart disease or having a heart attack. The higher the risk, the lower the LDL “goal” level will be. Here is how to determine the LDL goal:

Step 1: Count Risk Factors. Below are risk factors for heart disease that will affect a LDL goal. Although overweight and physical inactivity are not on this list of risk factors to be counted, they are conditions that

raise your risk for heart disease and need to be corrected. Also, if your HDL cholesterol is 60 mg/dL or higher, subtract 1 from your total:

- Cigarette smoking.
- High blood pressure (140/90 mmHg or higher, or if you are on blood pressure medication).
- Low HDL cholesterol (less than 40 mg/dL).
- Family history of early heart disease (father or brother before age 55, or mother or sister before age 65).
- Age (55 or older).

Step 2: Find Out Risk Score. If two or more risk factors from the list above are present, a “risk score” needs to be calculated. This score will show the chances of having a heart attack in the next 10 years. To find out a risk score, see “How to Estimate Your Risk” in Appendix A.

Step 3: Find Out Your Risk Category. Use the number of risk factors, risk score, and medical history in Table 2 to find out the category of risk for heart disease or heart attack.

A Special Type of Risk

Some women have a group of risk factors known as “metabolic syndrome,” which is often connected to overweight/obesity and physical inactivity. This cluster of risk factors increases the risk of heart disease, no matter what the LDL cholesterol level. Women have metabolic syndrome if they have three or more of the following conditions:

- A waist measurement of more than 35 inches.
- Triglycerides of 150 or more.
- An HDL level of less than 50.
- Blood pressure of 130/85 or more (either number counts).
- Blood sugar of 110 or more.

Table 2. Risk Categories

Risk factor	Your category is
Heart disease, diabetes, or a risk score of more than 20%*	Highest risk
2 or more risk factors and a risk score of 10–20%	Next highest risk
2 or more risk factors and a risk score of less than 10%	Moderate risk
0 to 1 risk factor	Low-to-moderate risk

*Means that more than 20 of 100 people in this category will have a heart attack within 10 years.

People with metabolic syndrome, should calculate their risk score and risk category as above. But because having metabolic syndrome adds additional risk, a particularly strong effort should be made to reach and maintain the LDL goal. Emphasis should be placed on weight control and physical activity to correct the risk factors of the metabolic syndrome.

LDL Goal

The main goal of cholesterol-lowering treatment is to lower the LDL level enough to reduce the risk of heart disease or heart attack. The higher the risk category, the lower the LDL goal will be. Particular LDL goals, can be found in Table 3.

How to Lower LDL

There are two main ways to lower LDL cholesterol—through lifestyle changes alone, or through medication combined with lifestyle changes. Depending on the risk category, the use of these treatments will differ. For information on the best treatment plan for a particular risk category, see the fact sheet, “High Blood Cholesterol: What You Need to Know,” available from NHLBI’s Web site or Health Information Center. (See Appendix B.)

Lifestyle Changes. One important treatment approach is called “TLC,” which stands for “Therapeutic Lifestyle Changes.” This treatment includes a cholesterol-lowering diet, regular physical activity, and weight management. Every woman who needs to lower her LDL cholesterol should use this TLC program. (For more on the TLC approach, see Appendix C.) Losing extra weight and getting regular physical activity are especially important for women who have metabolic syndrome.

Medication. If the LDL level stays too high even after making lifestyle changes, medicine may need to be taken. If medication is needed, be sure to use it along with the TLC approach. This will keep the dose of medicine as low as possible, and lower the risk in other ways as well. Control will also be needed over all of other heart disease risk fac-

tors, including high blood pressure, diabetes, and smoking.

CHOLESTEROL-LOWERING

Doctors may recommend medication as part of your cholesterol-lowering treatment plan. Following are the most commonly used medicines:

Statins. These are the drugs most often prescribed for people who need a cholesterol-lowering medicine. Of all available medications, statins lower LDL cholesterol the most, usually by 20 to 60 percent. Side effects are usually mild, although liver and muscle problems occur rarely.

Bile Acid Sequestrants. These medications lower LDL cholesterol by about 10 to 20 percent. Bile acid sequestrants are often prescribed along with a statin to further decrease cholesterol levels. Side effects may include constipation, bloating, nausea, and gas. However, long-term use of these medicines is considered safe.

Nicotinic Acid. Nicotinic acid, or niacin, lowers total cholesterol, LDL cholesterol, and triglyceride levels, while also raising HDL cholesterol. While nicotinic acid is available without a prescription, use it under a doctor’s care because of possibly serious side effects. In some people, it may inflame peptic ulcers or cause liver problems, gout, or high blood sugar.

Fibrates. These drugs can reduce triglyceride levels by 20 to 50 percent, while increasing HDL cholesterol by 10 to 15 percent. They are not very effective for lowering LDL cholesterol. While the drugs usually cause only mild side effects, they can increase the chances of developing gallstones and heighten the effects of blood-thinning drugs.

Ezetimibe. This is the first in a new class of cholesterol-lowering agents that interfere with the absorption of cholesterol in the intestine. It can be used alone or in combination with a statin. Side effects may include back and joint pain.

Postmenopausal Hormone Therapy. Until recently, many postmenopausal women were prescribed an estrogen plus progestin medication to lower their cholesterol. But recent studies indicate that this type of hormone therapy actually increases the chances of developing heart disease, breast cancer, and other serious conditions. If you need cholesterol-lowering drugs to reduce your risk of heart attack or heart disease, do not use an estrogen plus progestin medication. Furthermore, estrogen-only

Table 3. LDL Goals

Risk Category	LDL Goal Is
Highest risk	Less than 100 mg/dL
Next highest risk	Less than 130 mg/dL
Moderate risk	Less than 130 mg/dL
Low-to-moderate risk	Less than 160 mg/dL

medications should not be used for cholesterol lowering. (For more information, see Appendix D.)

OVERWEIGHT

A healthy weight is important for a long, vigorous life. Yet about 62 percent of all American women age 20 and older are overweight—about 33 percent of them are obese (extremely overweight). The more overweight a woman is, the higher her risk for heart disease. Overweight also increases the risks for stroke, congestive heart failure, gallbladder disease, arthritis, and breathing problems, as well as breast, colon, and other cancers. If you are overweight, you are more likely to develop heart disease even if you have no other risk factors. Being overweight also appears to contribute to heart disease by increasing the chances of developing other major risk factors, such as diabetes, high blood pressure, and high blood cholesterol. Maintaining a healthy weight is an extremely important part of heart disease prevention.

Choose To Lose?

Is weight loss necessary to reduce the risk of heart disease? Three simple steps can help determine if it is necessary. First, determine weight in relation to your height to obtain “body mass index” (BMI) (Table 4). A BMI from 18.5 to 24.9 indicates a normal weight. A person with a BMI from 25 to 29.9 is overweight,

Table 4. Body Mass Index

Height	BMI										
	21	22	23	24	25	26	27	28	29	30	31
4'10"	100	105	110	115	119	124	129	134	138	143	148
5'0"	107	112	118	123	128	133	138	143	148	153	158
5'1"	111	116	122	127	132	137	143	148	153	158	164
5'3"	118	124	130	135	141	146	152	158	163	169	175
5'5"	126	132	138	144	150	156	162	168	174	180	186
5'7"	134	140	146	153	159	166	172	178	185	191	198
5'9"	142	149	155	162	169	176	182	189	196	203	209
6'0"	150	157	165	172	179	186	193	200	208	215	222
6'1"	159	166	174	182	189	197	204	212	219	227	235
6'3"	168	176	184	192	200	208	216	224	232	240	248

Source: Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults, The Evidence Report, National Heart, Lung, and Blood Institute, in cooperation with the National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, NIH Publication 98-4083, June 1998.

Table depicts BMI for men and women for various heights and weights. Weight is measured with underwear but no shoes.

while someone with a BMI of 30 or higher is obese. Those in the “overweight” or “obese” categories have a higher risk of heart disease.

Table 4 shows a chart for men and women that gives the BMI for various heights and weights; weight is measured with underwear but no shoes.

The second step is to take a waist measurement. For women, a waist measurement of over 35 inches increases the risk of heart disease as well as the risks of high blood pressure, diabetes, and other serious health conditions. To measure a waist correctly, stand and place a tape measure around your middle, just above the hipbones. Measure the waist just after you breathe out.

The third step is to determine other risk factors for heart disease. It is important to know whether these conditions are present: hypertension, high LDL cholesterol, low HDL cholesterol, high triglycerides, high blood glucose (blood sugar), a family history of early heart disease, physical inactivity, or cigarette smoking. Being age 55 or older, or having gone through menopause, also are heart disease risk factors. Patients with the condition known as metabolic syndrome are at high risk of heart disease.

Once these steps have been taken—determine BMI, assess waist measurement, and determine other heart disease risk factors—that information can be used to determine if weight loss is needed. Patients should talk with their physician about whether weight loss is needed and, keep these guidelines in mind:

- Overweight and have two or more other risk factors, or if you are obese, weight loss is needed.
- Overweight, have a waist measurement of over 35 inches, and have two or more other risk factors, weight loss is needed.
- Overweight, but do not have a high waist measurement, and have fewer than two other risk factors, avoid further weight gain.

Small Changes Make a Big Difference

If you need to lose weight, here is some good news: a small weight loss—just 5 to 10 percent of your current weight—will help to lower heart disease risk and other serious medical disorders. The best way to take off pounds is to do so gradually, by getting more physical activity and eating a balanced diet that is lower in calories and fat. (High-fat foods contain more

calories than the same amount of other foods, so they can make it hard for you to avoid excess calories. But be careful—"lowfat" doesn't always mean low in calories. Sometimes extra sugars are added to lowfat desserts, for example.) For some women at very high risk, medication also may be necessary. To develop a weight-loss or weight-maintenance program that works best for you, consult with your doctor, registered dietitian, or qualified nutritionist.

Physical Inactivity

Physical inactivity raises the risk of heart disease—more than you might think. It boosts the chance of developing heart-related problems even if no other risk factors are present. It also increases the likelihood of developing other heart disease risk factors, such as hypertension, diabetes, and overweight. Yet, most women aren't getting enough physical activity. According to the Surgeon General's Report on Physical Activity and Health, 60 percent of women in the U.S. don't get the recommended amount of physical activity. More than 25 percent of women are not active at all during their free time. Physical inactivity is especially common among African American and Hispanic women. Besides raising the risk of heart disease, lack of physical activity leads to more doctor visits, hospitalizations, and use of medicines for a variety of illnesses.

Appendix A: How to Estimate Heart Attack Risk (Framingham Heart Study Point Scores)

Use these risk tables to find your chances of having a heart attack in the next 10 years, given as a percentage.

	Points		Points
Age 20-34	-7	Age 55-59	8
Age 35-39	-3	Age 60-64	10
Age 40-44	0	Age 65-69	12
Age 45-49	3	Age 70-74	14
Age 50-54	6	Age 75-79	16

	Points				
Total Cholesterol	Age 20-39	Age 40-49	Age 50-59	Age 60-69	Age 70-79
<160	0	0	0	0	0
160-199	4	3	2	1	1
200-239	8	6	4	2	1
240-279	11	8	5	3	2
≥280	13	10	7	4	2

Appendix A: Continued

	Points				
	Age 20-39	Age 40-49	Age 50-59	Age 60-69	Age 70-79
Nonsmoker	0	0	0	0	0
Smoker	9	7	4	2	1

HDL (mg/dL)	Points	HDL (mg/dL)	Points
≥60	-1	40-49	1
50-59	0	<40	2

Systolic BP (mmHg)	Points		Systolic BP (mmHg)	Points	
	If Untreated	If Treated		If Untreated	If Treated
<120	0	0	140-159	3	5
120-129	1	3	≥160	4	6
130-139	2	4			

Point Total	10-Year Risk %	Point Total	10-Year Risk %	Point Total	10-Year Risk %
<9	<1	14	2	20	11
9	1	15	3	21	14
10	1	16	4	22	17
11	1	17	5	23	22
12	1	18	6	24	27
13	2	19	8	≥25	≥30

Appendix B: Information Sources

The following sources provide information on the prevention and treatment of heart disease and offer publications on heart disease and heart health.

- NHLBI Web site: www.nhlbi.nih.gov
- *The Heart Truth*: A National Awareness Campaign on Women and Heart Disease: www.nhlbi.nih.gov/health/hearttruth
- Your Guide to Lowering High Blood Pressure: www.nhlbi.nih.gov/hbp/index.html
- Live Healthier, Live Longer (on lowering elevated blood cholesterol): www.nhlbi.nih.gov/chd
- High Blood Cholesterol: What You Need To Know: www.nhlbi.nih.gov/health/public/heart/chol/hbc_what.htm
- Aim for a Healthy Weight: www.nhlbi.nih.gov/health/public/heart/obesity/lose_wt/index.htm
- Act in Time to Heart Attack Signs: www.nhlbi.nih.gov/actintime/index.htm

- Stay Young at Heart Recipes: www.nhlbi.nih.gov/health/public/heart/other/syah/index.htm

Additional Resources:

- American Heart Association: www.americanheart.org
- National Women's Health Information Center, Office on Women's Health,
- U.S. Department of Health and Human Services: www.4woman.gov
- WomenHeart: the National Coalition for Women with Heart Disease: www.womenheart.org

APPENDIX C: HIGH BLOOD CHOLESTEROL AND THE TLC PROGRAM

Therapeutic Lifestyle Changes (TLC) program includes a low-saturated fat, low-cholesterol diet that helps to reduce LDL cholesterol, increase physical activity, and control weight. Adopt the TLC approach, and you will lower your chances of developing heart disease, future heart attacks, and other heart disease complications.

If your LDL cholesterol is above your goal level (see page 28), you should start on the TLC eating plan right away. The TLC diet will help to reduce your LDL cholesterol and lower your chances of developing heart disease. If you already have heart disease, it will lessen your chances of a heart attack and other heart-related problems. On the TLC diet, you should eat:

- Less than 7 percent of the day's total calories from saturated fat. Lowering saturated fat is the most important dietary change for reducing blood cholesterol.
- Less than 200 mg of dietary cholesterol a day.
- Just enough calories to achieve or maintain a healthy weight.

If your blood cholesterol is not lowered enough on the TLC diet, your doctor or registered dietitian may advise you to increase the amount of soluble fiber and/or add cholesterol-lowering food products. These products include margarines that contain ingredients called "plant sterols" or "plant stanol esters," which lower LDL cholesterol. If your LDL level is still not lowered enough, your doctor may prescribe a cholesterol-lowering drug along with the TLC diet. For more, see NHLBI's Web page, "Live Healthier, Live Longer"

APPENDIX D: OTHER FACTORS THAT AFFECT HEART DISEASE

Postmenopausal Hormone Therapy: What Every Woman Needs to Know

As women approach or reach menopause, choosing whether to use hormone therapy (also known as hormone replacement therapy) is one of the most important health decisions they will make. Until recently, many women took an estrogen plus progestin medication to try to lower their risk of heart disease. But a recent study indicates that this type of hormone therapy *increases* the chances of developing heart disease and other serious conditions. These findings come from the Women's Health Initiative, a 15-year set of studies on ways to prevent a number of medical disorders in women. In one of the studies, 16,608 healthy, postmenopausal women took either estrogen plus progestin or a placebo (a pill that contains no drug) to see if the medication would help to prevent heart disease and hip fractures. The results: Women who took the estrogen plus progestin treatment were more likely to have heart attacks, strokes, blood clots, and breast cancer than women who did not take the medication.

The hormone treatment also benefited women, by reducing the risks of hip fractures and colon cancer. But overall, the risks clearly outweighed and outnumbered the benefits. If you are currently on postmenopausal hormone therapy, these findings can't help but concern you. It is important to know, however, that the study results apply to a large group of women. For an individual woman, the increased risk of disease is quite small. For example, each woman in the study who took the estrogen plus progestin treatment had an increased risk of breast cancer of less than one-tenth of 1 percent per year.

Estrogen Plus Progestin: Risks versus Benefits

The Women's Health Initiative study examined the impact of estrogen plus progestin medication on women's health. Results showed that the medicine caused the following risks:

- Eight more strokes each year for every 10,000 women.
- Seven more heart attacks each year for every 10,000 women.
- Eight more cases of breast cancer per year for every 10,000 women.

- Eighteen more women with blood clots each year for every 10,000 women.

The following benefits were noted:

- Six fewer colorectal cancers each year for every 10,000 women.
- Five fewer hip fractures each year for every 10,000 women.

The postmenopausal hormone therapy that was studied—estrogen plus progestin—is the most commonly prescribed hormone treatment for women who have a uterus. A study is still underway about the benefits and risks of taking estrogen alone, typically taken only by women who have had a hysterectomy. If a patient currently takes estrogen plus progestin, or is considering it, here are some guidelines for consideration:

- Do not continue or start this medication to prevent heart disease. Talk with a physician about other ways of preventing heart attack and stroke, includ-

ing lifestyle changes and medicines such as cholesterol-lowering statins and blood pressure drugs.

- Discuss with a physician the possible benefits against personal risks for heart attack, stroke, blood clots, and breast cancer by taking this medication. Consider alternate treatments that are safe and effective in preventing osteoporosis and bone fractures.
- Consult with a physician about whether to continue or start estrogen plus progestin to treat menopausal symptoms such as hot flashes or sleeping problems. The study didn't test the short-term risks and benefits of using this medication for menopausal symptoms. If a patient decides to take hormone therapy to control menopausal symptoms, it should be used for as brief a period as possible.
- Whatever decision is made, it should be reviewed regularly with a doctor. Individual risks for heart disease, stroke, osteoporosis, and other conditions may change over time. Safer and more effective treatments may become available. Stay informed.

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