

# CHOLESTEROL AND YOUR HEART

This is one of the booklets in the CHIKE OKOLI *Heart Information Series*.

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## About this booklet

This booklet is for people with a high blood cholesterol level, and for their family and friends.

It explains:

- what cholesterol, lipoproteins and blood lipids are
- the role of cholesterol in coronary heart disease
- when a high blood cholesterol level matters
- what causes high blood cholesterol
- why smoking, physical inactivity and high blood pressure are important
- how blood cholesterol is measured
- how physical activity and healthy eating can help, and
- how medication can help.

It also gives information about the drugs that are used to treat high blood cholesterol levels.

This booklet is not a substitute for the advice your doctor, dietitian or cardiologist (heart specialist) may give you based on his or her knowledge of your condition.

## What are cholesterol, lipoproteins and blood lipids?

### Cholesterol

Cholesterol is a fatty substance which is mainly made in the body. The liver makes it from the saturated fats in food. Very little cholesterol is found in foods, except for eggs, liver, kidneys, and seafood such as prawns, all of which do contain some cholesterol.

Cholesterol plays a vital role in how every cell wall works, throughout the body. It is also the material which the body uses to make other vital chemicals. However, too much cholesterol in the blood can increase your risk of getting coronary heart disease. Cholesterol has a special 'transport system' for reaching all the cells which need it. It uses the blood circulation as its 'road system' and is carried on 'vehicles' made up of proteins. These combinations of cholesterol and proteins are called lipoproteins.

### Lipoproteins

There are two main forms of lipoproteins.

- Low density lipoproteins (LDL), which carry cholesterol from the liver to the cells.
- High density lipoproteins (HDL), which return the extra cholesterol that isn't needed to the liver.

### Blood lipids

You may also have heard the term 'blood lipids'. This is a name for all the fatty substances in the blood, including HDL cholesterol, LDL cholesterol and triglycerides.

If you have high levels of both triglycerides and blood cholesterol, you run a greater risk of coronary heart disease. The risk is particularly high if you also have a low level of HDL cholesterol and a high level of LDL cholesterol. (See the illustration on the next page.) A high level of triglycerides also increases the risk of coronary heart disease and stroke.

## How cholesterol is carried around the body

Your body produces more cholesterol if:

- you eat a diet that has a lot of saturated fat, or
- you have an inherited tendency to have a high cholesterol level.

If there is a high level of cholesterol in the blood, the artery walls take up too much LDL. The risk of this happening is greater if you smoke or have high blood pressure.

The amount of cholesterol removed from the blood circulation is regulated by the cells which need cholesterol. In people with familial hypercholesterolaemia (see page 30), the cholesterol is removed at a much slower rate.

HDL returns the extra cholesterol which is not needed to the liver.

LDL cholesterol HDL cholesterol

## What part does cholesterol play in coronary heart disease?

Coronary heart disease is caused when the blood vessels to the heart (the coronary arteries) become narrowed by a gradual build-up of fatty material within their walls. This condition is called 'atherosclerosis'. The fatty substance is called 'atheroma'.

Atheroma develops when LDL cholesterol is chemically changed (a process known as 'oxidation') and is taken up by cells in the coronary artery walls where the narrowing process begins.

On the other hand, HDL cholesterol removes cholesterol from the circulation, and appears to protect against coronary heart disease. The goal is to have a low level of LDL and a high level of HDL. The level of LDL cholesterol in the blood tends to rise, and HDL falls, with the amount of saturated fats you eat. On the other hand, unsaturated fats have a good effect as they tend to lower LDL levels. As part of a healthy diet, it is important to eat unsaturated instead of saturated fats, and to reduce the total amount of fat you eat.

## How is blood cholesterol measured?

Measuring blood cholesterol level involves a simple blood test. This can be done in two ways.

- Either a blood sample is taken with a syringe and needle and sent to a laboratory for analysis.
- Or a finger prick (capillary sample) is taken and analysed on a desktop analyser.

If you are having your triglyceride level measured, you will be asked not to eat anything, and to drink only clear fluids, for 12 hours before you have the test.

The total blood cholesterol, HDL cholesterol, LDL cholesterol and triglyceride levels are all measured in units called millimols per litre of blood, usually shortened to 'mmol/litre' or 'mmol/l'. Your target is to have:

- a total cholesterol level under 5 mmol/l
- an LDL level under 3 mmol/l
- an HDL level above 1 mmol/l, and
- a triglyceride level under 2 mmol/l.

There can be quite a lot of variation in the levels of blood cholesterol and other blood fats – both from day to day and at different times of the day. So your doctor won't be worried if you have one high

reading. He or she will not usually decide about treating you with drugs until they have a series of these readings.

After a heart attack or heart surgery the blood cholesterol measurement may give a falsely low reading. So, if you have recently had a heart attack or heart surgery, you might not have the blood test until about six weeks later.

Doctors can also assess your risk of coronary heart disease by measuring the ratio of your total cholesterol to your HDL cholesterol level. You can work this out yourself by dividing your total cholesterol level by your HDL cholesterol level. The higher the figure, the greater your risk of coronary heart disease.

## When does a high blood cholesterol level matter?

The average blood cholesterol level of people living in England is 5.5 mmol/l. This is high compared to other countries. For example, in China the average is 4.5 mmol/l.

A high level of cholesterol is one of the most important risk factors for coronary heart disease. (A risk factor is something that increases your chances of getting the disease.) The other major risk factors are:

- smoking

- high blood pressure
- not being physically active enough
- being overweight or obese (very overweight)
- diabetes, and
- if you have a family history of premature coronary heart disease. (This means if a close blood relative of yours developed coronary heart disease before the age of 55 for a man or 65 for a woman.)

The higher your cholesterol level, the higher your risk of coronary heart disease.

Your overall risk of having a heart attack is much greater if you have other major risk factors as well as a high cholesterol level – for example if you smoke or have high blood pressure, or if you are overweight or not physically active. The more risk factors you have, the higher your risk of having a heart attack.

Other 'lifestyle' factors which increase the risk of heart disease are:

- not getting enough omega-3 fats (which are found in oily fish)
- not eating enough fruit and vegetables
- drinking too much alcohol, and
- having too much salt.

The risk of having a heart attack is also increased if you already have angina or if you have already had a heart attack. There is also a greater risk of heart attacks among people who have familial hyperlipidaemia – an inherited condition in which the blood cholesterol level is very high.

How the individual risk factors add up

*This diagram shows how important the individual risk factors – lack of physical activity, obesity, high blood pressure, high blood cholesterol levels and smoking – are in coronary heart disease. For example, 46% of the people who die from coronary heart disease under the age of 75 have a high blood cholesterol level.*

*The more individual risk factors you have, the higher your risk of coronary heart disease.*

*All people who died from coronary heart disease (CHD) under the age of 75*

*CHD related to high blood pressure 13%*  
*CHD related to lack of physical activity 37%*  
*CHD related to obesity 6%*  
*CHD related to high blood cholesterol levels 46%*  
*CHD related to smoking 19%*

What you can do to help yourself

- Smokers can halve their risk of a heart attack within one year of quitting smoking.
- Physical activity can halve the risk of a heart attack.
- For people with high blood pressure, reducing blood pressure by 5 mmHg can reduce the risk of having a heart attack by about 16%.
- For people who are overweight, reducing weight can help reduce cholesterol levels and also reduce the risk of a heart attack.

### What causes high blood cholesterol?

The most common cause of high blood cholesterol levels in people in the UK is too much saturated fat in the diet.

Some people have high cholesterol levels as a result of an underactive thyroid gland, chronic renal (kidney) failure, or alcohol abuse. Also, 1 in 500 people have high cholesterol levels because of an inherited disorder called familial hyperlipidaemia

### How can physical activity help to improve my cholesterol level?

Doing regular physical activity – for example brisk walking, swimming or cycling – for 30 minutes a day at least five times a week can help improve your cholesterol level. Physical activity increases the level of HDL cholesterol (the protective cholesterol), but does not affect LDL cholesterol. Physical activity also plays an important part in helping you to maintain or reach a healthy weight. People who are obese are more likely to have higher cholesterol levels.

### How can healthy eating help lower my cholesterol level?

It is possible to lower cholesterol levels by cutting down on the total amount of fats you eat, and replacing some of the saturated fats with unsaturated fats. The aim is:

- to reduce your total cholesterol, and
- to raise your level of HDL cholesterol (the 'protective' cholesterol).

Foods containing fat are made up of a combination of saturated, polyunsaturated and monounsaturated fats. Saturated fats increase LDL cholesterol. Monounsaturated fats can lower the LDL level and do not lower the level of HDL cholesterol (the more protective cholesterol). Polyunsaturated fats are an essential part of the diet and can help lower LDL cholesterol, but they

also lower HDL cholesterol.

Eating healthily can help reduce your cholesterol levels by between 5% and 10%. However, it is easier for some people to reduce their cholesterol level by eating healthily than it is for others.

#### Choosing healthier fats

To help reduce your cholesterol level you need to do the following.

- Cut right down on saturated fats and replace them with moderate amounts of monounsaturated fats and polyunsaturated fats.

- Reduce the *total* amount of fat you eat – especially if you are overweight (as fat is also very high in calories). For example, you could cut down on the amount of fatty foods you eat, such as pastries, crisps and biscuits, and replace them with healthier alternatives such as fruit. Or, at mealtimes, you may be able to cut down on the amount of fatty foods you eat by filling up with starchy foods such as bread, pasta or rice instead.

Enjoy oily fish as this provides the richest source of omega-3 fatty acids, which can help reduce triglyceride levels and help prevent blood clotting.

The cholesterol found in foods – for example in eggs, liver, kidneys, and in seafood such as prawns – does not usually make a great contribution to blood cholesterol levels. (There should be no problem in having up to four eggs a week, as long as your overall diet is healthy and well balanced.) If you need to reduce your cholesterol level, it is much more important that you eat food that is low in saturated fat.

Eating a high-fibre diet may also help to reduce the amount of cholesterol that is absorbed from your intestine into the bloodstream. For example, porridge, beans, pulses, fruit and vegetables are all high in a type of fibre which can help lower cholesterol. And a high-fibre diet helps to fill you up – making you less likely to snack on fattening foods.

To help reduce your cholesterol level, cut down on saturated fats and replace them with small amounts of monounsaturated and polyunsaturated fats. Omega-3 fats are good for your heart too.

What do  
they do?

Which foods  
are they  
found in?

Monounsaturated  
fats

Monounsaturated  
fats can help lower  
LDL levels and do  
not lower the HDL  
cholesterol level.

Monounsaturated  
fats are found in:

olive oil

walnut oil

rapeseed oil

avocado.

Some margarines  
and spreads are  
made from  
monounsaturated  
fats.

Saturated fats  
increase LDL  
cholesterol  
levels.

Saturated fats  
are found in:

butter

hard cheese

lard

dripping

suet

ghee

coconut oil

palm oil.

Saturated fats

Polyunsaturated  
fats

Polyunsaturated fats  
can help lower LDL  
cholesterol, but they  
also lower HDL  
cholesterol (the  
'protective'  
cholesterol).

Polyunsaturated fats  
are found in:

cornflower oil

sunflower oil

soya oil

fish oil.

Some margarines  
and spreads are  
made from  
polyunsaturated fats.  
Omega-3

fats

Omega-3 fats are a particular type of polyunsaturated fat. They can help prevent blood clotting, and help reduce triglyceride levels.

Omega-3 fats are found in:  
fish oil  
oily fish such as herring, kippers, mackerel, pilchards, sardines, salmon, trout and fresh tuna.

Our bodies can also make omega-3 fats from rapeseed oil, and from the oil in walnuts and soya.

Unsaturated fats

Will eating sterol-enriched margarines and spreads help reduce my cholesterol level?  
There is evidence that substances called plant sterols and stanols – which are added to certain margarines and spreads – may reduce blood cholesterol levels. However, these margarines and spreads are expensive. These products may be helpful for people who cannot take the statin drugs (drugs to reduce cholesterol levels – see page 25), or people who have high cholesterol levels even though they have already made changes to their diet. Even if you do eat these types of margarines and spreads, it is still important to make sure you follow a healthy diet.

Other important ways to eat well to protect your heart

While it is important to lower your cholesterol level, it is even more important to focus on protecting your heart by eating a healthy diet. You can do this in the following ways.

- Eat more oily fish – such as sardines, trout, mackerel, pilchards, salmon and herrings. These fish contain special omega-3 fats which can help to lower blood triglyceride levels and to prevent the blood from clotting and the heart from beating irregularly. Aim to have 2 portions of fish a week. One of these portions should be oily fish. There is some evidence to suggest that people who have angina or have had a heart attack should aim to have 2 or 3 portions of oily fish a week, to help protect their heart.
- Eat more fruit and vegetables. Aim for at least 5 portions of a variety of fruit and vegetables

every day.

- Cut down on salt. Don't add salt to your food. Use extra pepper, herbs, garlic or spices to add flavour to your food instead. Choosing more fresh foods rather than ready meals or processed foods can also help.

- Drink alcohol in moderation. Keep within the sensible limits – no more than 14 units of alcohol a week for women, and no more than 21 units a week for men.

- Keep to a healthy weight for your height. If you are not sure whether you are overweight, ask your doctor or practice nurse. If you are overweight, losing weight can help lower your cholesterol level, and also reduce other risk factors for coronary heart disease such as high blood pressure and diabetes.

Aim to eat at least five portions of fruit and vegetables a day

What counts as a 'portion'?

Fruit

Apple, orange or banana 1 fruit

Very large fruit (for example, melon or pineapple) 1 large slice

Small fruits (for example, plums, kiwis, satsumas) 2 fruit

Raspberries, strawberries, grapes 1 cupful

Fresh fruit salad or stewed or

canned fruit 2 to 3 tablespoonfuls

Dried fruit  $\frac{1}{2}$  to 1 tablespoonful

Fruit juice 1 glass (150mls)

Vegetables

Raw, cooked, frozen or canned vegetables 2 tablespoonfuls

Salad 1 dessert bowlful

## How can medication help?

### Statins

The main type of drug used to reduce cholesterol levels is statins. Examples of statins are simvastatin, pravastatin and atorvastatin. Statins are cholesterol-lowering drugs which became available in the mid-1990s. Statins can reduce total cholesterol levels by more than 20%. Overall, they reduce the risk of dying from coronary heart disease by around 25%. Treating people in their 70s with statins is as effective as it is in middle-aged people.

There are several statins available in the UK. Many of these have been tested in long-term trials that have looked not just at the cholesterol levels they produce but also at their effect on health and long-term safety. So far the research has covered over 12 years of treatment. For people who are already at high risk of having a heart attack, the benefits of taking statins are likely to outweigh the possible risk of side effects.

Statins are not used for people who have liver

disease or for women who are pregnant or breastfeeding.

A rare side effect of statins is inflammation of the muscles (myositis). So you should tell your doctor if you have any unexpected muscle pain, tenderness or weakness.

It's best to take statins in the evening as most of our cholesterol is made at night.

**Other cholesterol-lowering drugs**

There are two other types of drugs which can be used when statins are not suitable. These are fibrates and drugs which bind bile acids.

**Fibrates**

Fibrates come in tablet or capsule form. They include bezafibrate, ciprofibrate, fenofibrate and gemfibrozil. Fibrates are used for people who have a high level of both blood cholesterol and triglycerides. You will not usually be given them if you are also taking statins (see opposite), except under strict medical supervision. If you are also taking anticoagulants, your doctor will start you on them cautiously.

**Drugs which bind bile acids**

These drugs (which are also called 'bile acid binding drugs') include cholestyramine and colestipol. They come in powder form, in sachets.

You must soak some types in fruit juice before you take them. Others are already mixed with fruit flavouring and you just need to add water. You can make them up beforehand and keep them in the fridge if you want to.

You should take these drugs immediately before or during a meal. A convenient time to take them might be before breakfast. A dose of two sachets before breakfast is often a good starting point in treating high blood cholesterol. At first this dose may make you feel fuller than usual, but most people gradually get used to this. Some people who take these drugs may get heartburn or constipation, but this is more likely with larger doses. These drugs are not absorbed into the body, so they can also be used safely by children and pregnant women.

**Drugs which reduce absorption of cholesterol**

Some people are unable to take statins. A drug called ezetimibe has recently been produced to help lower blood cholesterol levels. It works by preventing cholesterol from being reabsorbed from the bowel. More research is needed to confirm the long-term benefits of this drug.

## Will I need to take medication?

The choice of whether or not to take cholesterol-lowering drugs depends on your overall risk of coronary heart disease as well as your total cholesterol, HDL and LDL levels.

The higher your risk of coronary heart disease, the more likely it is that your doctor will recommend cholesterol-lowering drugs. Doctors prescribe statins for people who have high blood cholesterol levels and people who are at greatest overall risk of suffering from coronary heart disease. People at highest risk are:

- those who have already had a heart attack
- those who have angina or peripheral vascular disease, and
- those who have had bypass surgery or angioplasty.

There is also evidence that many people with diabetes would benefit from taking statins.

Your doctor may consider that your risk is sufficiently high to justify having statin treatment if you also have a combination of other major risk factors such as being a smoker and having high blood pressure. Your age is also relevant, as

cholesterol levels usually rise with age. Your sex is relevant too, as women's risk of coronary heart disease lags about 10 years behind that of men.

Your risk may also be greater if you have a strong family history of premature coronary heart disease (if a close relative developed coronary heart disease before the age of 55 for a man, or 65 for a woman).

There are various sets of guidelines to help doctors decide whether to recommend you to take cholesterol-lowering drugs. This means that people with a wide range of cholesterol levels may be treated with cholesterol-lowering drugs. For example, a man of 40 who had four major risk factors might be treated with statins even if his cholesterol level was 5.0 mmol/l. However, a man with no risk factors might not be treated with statins even if his cholesterol level was much higher.

Statins are a long-term and effective treatment. However, it is important to lower your overall risk of coronary heart disease as much as possible. This includes getting your lifestyle right as well as taking statins. Stopping smoking, changing your diet, taking regular physical activity, controlling your weight and making sure your blood pressure is normal, will all help.

## About the CHIKE OKOLI Foundation

The Chike Okoli Foundation is a Non-Governmental Organization formed to create awareness on cardiovascular diseases.

### Technical terms

atheroma

atherosclerosis

blood cholesterol

blood lipids

cholesterol

coronary heart

disease

ECG

electrocardiogram

familial hypercholesterolaemia

familial

hyperlipidaemia

HDL

hypertension

LDL

lipids

lipoproteins

Fatty material that can build up within the walls of the arteries.

The build-up of fatty material within the walls of the arteries.

Cholesterol found in the blood.

Fatty substances found in the blood.

A fatty substance mainly made in the body by the liver.

When the walls of the arteries become narrowed by a gradual build-up of fatty material called atheroma.

See 'electrocardiogram'.

A test to record the rhythm and activity of the heart. Also called an ECG.

Another term for 'familial hyperlipidaemia'.

An inherited condition in which the blood cholesterol level is very high.

High density lipoprotein.

The 'protective' cholesterol.

High blood pressure.

Low density lipoprotein.

The more 'harmful' cholesterol.

Fatty substances in the blood.

Combinations of cholesterol and proteins.

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mmHg

mmol/l

omega-3 fat

triglycerides

Millimetres of mercury. A unit for measuring blood pressure.

Millimols per litre. Used for measuring cholesterol and other fats in the blood.

A protective oil found in certain types of fish.

A type of fatty substance found in the blood.

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