Calculating cholesterol

Fats which circulate in the blood are often referred to as lipids. The two major lipids in the blood are cholesterol and triglyceride. As fats do not dissolve easily they are carried around the body in ball-like structures which are water soluble. These structures also contain proteins and are called lipoproteins.

Lipoproteins

There are five major lipoproteins which have been named by the way in which they are separated in the laboratory.

- Chylomicrons
- Very Low Density Lipoproteins (VLDL)
- Intermediate Density Lipoproteins (IDL)
- Low Density Lipoproteins (LDL)
- High Density Lipoproteins (HDL)

All of these lipoproteins contain both cholesterol and triglycerides but in varying amounts e.g. VLDL contain a lot of triglycerides and a little cholesterol and LDL contain a lot of cholesterol and little triglycerides.

Measured total cholesterol includes cholesterol from all five lipoprotein structures. Hospital laboratories usually measure total cholesterol and HDL- cholesterol and calculate a value for LDL- cholesterol. Chylomicrons are found in the blood only after meals and so are not usually present in fasting samples. VLDL and IDL-cholesterol are not included in the figure generated by the calculation of LDL-cholesterol.

Non HDL- cholesterol is the sum of all the lipoproteins which contribute towards the development of atherosclerosis (narrowing of the arteries) and is thought to be a better predictor for cardiovascular disease (CVD) than using LDL-cholesterol alone. It incorporates the harmful elements of the lipoprotein profile to include triglyceride rich remnant particles from VLDL and IDL, as well as LDL-cholesterol. It is also better for monitoring response to treatments such as lifestyle changes and medication. It can be calculated by a simple subtraction (total cholesterol minus HDL- cholesterol), there is no need to fast for the test and It has been recommended as the target for lipid modification in guidelines by the National Institute for Health and Care Excellence (NICE) and the Joint British Societies (JBS3)

LDL- Cholesterol is calculated using the Friedewald Formula as follows (all measurements are in millimoles per litre/mmol/L):

LDL-cholesterol = **Total cholesterol – HDL cholesterol** – (**Total triglyceride ÷ 2.19**)

The formula used is reasonably accurate providing total triglyceride levels are below 4.5 mmol/L but unreliable when triglycerides are high due to the effects of triglyceride – remnant particles which will be included in VLDL and IDL- cholesterol measures.

Cholesterol/HDL ratio is another measurement used to determine CVD risk and is obtained by dividing total cholesterol by HDL-cholesterol.

So just for example a lipid profile may look like this:

Total cholesterol = **5 mmol/L**
LDL-cholesterol - calculated = **3.49mmol/L**
HDL-cholesterol = **1.2 mmol/L**
Non-HDL Cholesterol = **3.8mmol/L**
        (5mmol/L minus 1.2mmol/L)
Triglyceride = **0.7 mmol/L**
TC/HDL ratio = **4.2 (5 mmol/L ÷ 1.2 mmol/L)**