

# The significance of plasma high density lipoprotein cholesterol (hdlc)

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## ABSTRACT

High Density Lipoprotein (HDL) transports in plasma, phospholipids, cholesterol, and triacylglycerol. The cholesterol associated with HDL (HDLc) is cholesterol that is scavenged from peripheral tissues back to liver. The liver converts this cholesterol into bile acids, bile salts, and esterifies the rest and secretes them into bile. Low HDLc is a risk factor for atherogenesis. Higher levels of HDLc in plasma are therefore an index of safety from coronary heart disease and atherosclerosis. Regular physical exercise, and changes in life style like cessation of smoking, lowered alcohol consumption, modified dietary fat intake and certain medications can improve the level of HDLc in plasma.

**Keywords:** Plasma HDLc Atherosclerosis coronary heart disease.

## INTRODUCTION

High Density Lipoprotein (HDL) is a plasma lipoprotein transporting 30.0% phospholipids, 25.0% cholesterol and 5.0% triacylglycerol. Its high density is due to 40.0% proteins. The cholesterol associated with it is unutilized excess cholesterol from tissues. This cholesterol is returned to liver. The liver converts it into bile acids, bile salts, and cholesteryl esters. The two bile salts formed in the liver are sodium glycocholate and sodium taurocholate. These compounds are secreted by liver into bile and through bile they reach the small intestines.

## REVERSE TRANSPORT OF CHOLESTEROL

The returning of the scavenged cholesterol to liver from peripheral tissues by HDL is known as "Reverse cholesterol transport".<sup>1</sup> Pre- $\beta$ -HDL cholesterol; rich in apoprotein A-1 is synthesized by liver and intestinal mucosal cells and released into circulation. Plasma Lecithin-Cholesterol Acyl Transferase (LCAT) converts free cholesterol in pre- $\beta$ -HDL to cholesteryl ester, resulting in the formation of  $\alpha$ -HDL cholesterol.



LCAT catalyzes the freely reversible reaction which transfers the fatty acid at C<sub>2</sub> in lecithin to cholesterol.

It is  $\alpha$ -HDL which takes part in the reverse cholesterol transport.

HDLc inhibits the oxidation of Low Density Lipoprotein cholesterol (LDLc) and reduce the risk of thrombosis by inhibiting platelet aggregation.<sup>2</sup>

### Plasma HDLc

Plasma total cholesterol in a normal adult is in the ranger of 130-220 mg/dL. Free cholesterol constitutes 1/3 of total cholesterol and 2/3 is esterified.

LDL ( $\beta$ -lipoprotein) transports maximum cholesterol in plasma from liver to peripheral tissues (Forward transport of cholesterol). 1/5<sup>th</sup> of total cholesterol on an average (40 mg/dL is HDLc in man and 1/4<sup>th</sup> of total cholesterol (50mg/dL) is the HDLc in the woman.

### CLINICAL SIGNIFICANCE OF HDLc

A higher level of HDLc is an index of safety from the risk of coronary heart Disease (CHD). This is due to the fact that unutilized excess cholesterol which is potentially harmful, is scavenged from the tissues by HDL preventing its deposition and plaque formation.<sup>3</sup> Low plasma HDLc is a risk factor for CHD<sup>4</sup> particularly in the male.<sup>5</sup> Experimental studies in laboratory animals and epidemiological studies in population groups have shown that raising the level of HDLc in plasma may retard the development of atherosclerosis.<sup>6</sup>

## EFFECT OF LIFE STYLE MODIFICATIONS ON HDLc IN PLASMA

**1. Exercise:** Walking seems to have no significant effect in increasing HDLc in plasma.<sup>7</sup> Regular aerobic exercises increase HDLc in plasma up to 9.0% in sedentary people.<sup>8</sup> Exercise is believed to increase HDLc by stimulating the production of pre- $\beta$ -HDLc and increasing reverse cholesterol transport.<sup>9</sup>

**2. Cessation of cigarette smoking:** Cigarette smoking is associated with lowered HDLc and LCAT activity.<sup>10,11</sup> After cessation of smoking HDLc is observed to increase.<sup>12</sup>

**3. Alcohol Intake:** Moderate alcohol intake is good as it raises the plasma HDLc<sup>10</sup> by increasing esterified fraction of cholesterol in plasma.<sup>13</sup>

**4. Dietary intake of Fat:** Both LDLc and HDLc in plasma are reduced with low intake of fat. A fat rich in polyunsaturated fatty acids has a beneficial effect in raising plasma HDLc.<sup>14</sup>

**5. Medication:** Niacin, Fibrates and Statins have been found to increase HDLc in plasma.<sup>15</sup>

These medications also lower LDLc and TG in plasma. Niacin is most effective in raising plasma HDLc. However, the side effects of niacin like cutaneous flushing and dyspepsia have to be taken care of. Fibrate therapy has resulted in an increase of plasma HDLc by 10-25%.<sup>15</sup> Gemfibrozil has significantly reduced the risk of coronary heart disease. Statins (Simvastatin, Atorvastatin) have been found to elevate plasma HDLc by raising apolipoprotein A-1 synthesis.<sup>16</sup>

LDL is associated with the "Forward transport of cholesterol" from liver to peripheral tissues for several metabolic functions necessary for life's processes. From the cholesterol brought by LDL, steroid hormones, and vitamin D<sub>3</sub> are synthesized. A lowering of LDLc in plasma or any attempt made in this direction is suicidal and bad bargain in controlling cholesterol induced diseases. Any unutilized cholesterol in peripheral tissues should not be allowed to remain there and cause a disease but should be promptly scavenged. This is precisely what the HDL is doing. HDL transports this unutilized cholesterol from the peripheral tissues to liver by the 'reverse transport' mechanism. The liver takes care of this cholesterol returned to it by converting it into bile acids and cholesterol esters and eliminating them through bile. The higher amount of cholesterol associated with HDL is a healthy index. Besides good exercise, like aerobic exercises, dietary modifications of fat intake, cessation of smoking, moderate alcohol intake and medication if necessary can increase the cholesterol scavenging function of HDL and prevent/reduce coronary heart diseases, atherosclerosis and myocardial infarction.

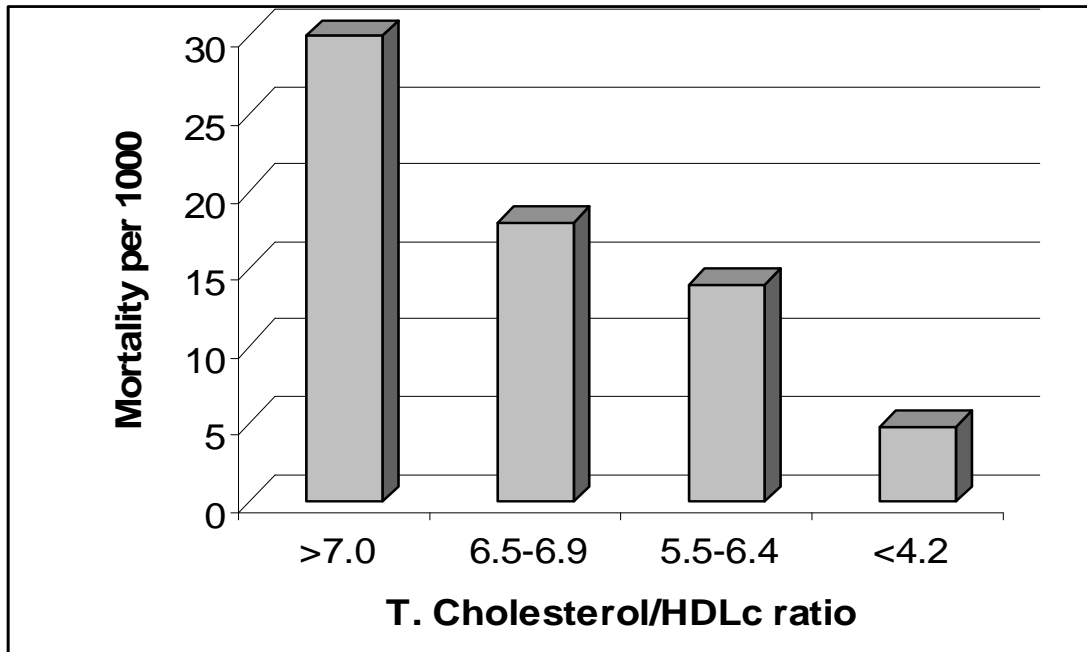
It is in fact, ideal to know the ratio of plasma total cholesterol/ HDL cholesterol rather than the absolute values, since lowered total cholesterol and a proportionate reduction in HDLc is still a good index. Coronary mortality in relation to serum total cholesterol/HDLc is given in Fig.1.<sup>3</sup>

It is observed that the mortality is least when the ratio is <4.2, due to relative higher value of HDLc or a fall in total cholesterol or both.

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**Fig. 1.** Coronary mortality in relation to serum total cholesterol/HDLc ratio