The effect of HDL-C on cardiovascular disease

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Abstract

Higher levels of HDL cholesterol are associated with a lower risk of heart disease. To some extent, people who have naturally higher levels of HDL cholesterol are at lower risk of heart attack and stroke. Lifestyle changes known to increase HDL, such as moving more, quitting smoking or improving your diet, have been shown to lower the risk of heart attacks.

Keywords: HDL-C; cardiovascular disease; ischemic stroke; coronary artery disease; arteriosclerosis.

Running title: HDL

**Introduction**

High-density lipoprotein cholesterol (HDL-C) and HDL are different, HDL-C refers to cholesterol, HDL is lipoprotein. Fat in the blood depends on the carrying and binding of protein, and the combination of fat and protein is lipoprotein; HDL can inhibit lipid oxidation, restore the function of vascular endothelial cells, and play the role of anti-inflammation and anti-apoptosis, which can be seen in animal models. These properties significantly increase the ability of HDL to inhibit atherosclerosis; systemic and vascular inflammatory responses have been shown to impair the anti-atherosclerotic effect if HDL is transformed into a dysfunctional form. The anti-inflammatory response and the loss of antioxidant protein capacity may be highly related to the promotion of systemic inflammation, which may be one of the other important factors leading to HDL dysfunction[1]. The impact of HDL-C on cardiovascular diseases.

Studies have pointed out that even if the LDL-C concentration of patients is less than 100 mg/dl, low HDL-C still has the opportunity to suffer from cardiovascular diseases (such as coronary artery disease) or ischemic The risk of cerebral infarction, many studies have pointed out that every 1 mg/dl increase in HDL-C can reduce the risk of cardiovascular disease by about 2-3%. According to the National Cholesterol Education Program (NCEP), an HDL concentration of less than 40 mg/dl is defined as low HDL; many medical societies recommend that men with high-density lipoprotein cholesterol (HDL-C) be greater than 40 mg/dl dl (women should be greater than 50mg/dl to be considered normal) [1,2]. HDL cholesterol is often referred to as good cholesterol, and HDL absorbs excess cholesterol in the blood and brings it back to the liver, where it is broken down and eliminated from the body [3]. Epidemiological and observational studies have shown that HDL-C is a strong independent predictor of coronary heart disease (CHD) risk, research and support the idea that increasing HDL-C concentrations may confer clinical benefit, The inverse correlation between HDL-C value in human blood and cardiovascular disease is still one of the most powerful observational studies in epidemiology in the past. This relationship was first described in the research data of Framingham Heart Study in 1977 and has been published in The same relationship was found in a multi-generational study [4].

**Effect of HDL-C on Pathophysiology of Cardiovascular Disease**

Data from clinical trials of drugs that increase HDL-C values can support the concept of clearing inflammatory substances in the body, except that HDL-C plays a role in cholesterol reverse transport and cholesterol released by macrophages after outflow , HDL particles also have properties such as anti-inflammation, anti-oxidation, anti-apoptosis, anti-thrombosis, and expansion of blood vessels. All the functions of HDL contribute to the protective effect of atherosclerosis caused by blood lipids [5].

HDL-C promotes the retrograde operation mode of cholesterol, which will help the circulatory system to transport cholesterol secreted by lipid-containing macrophages from the periphery, back to the liver and excreted through bile [5,6]. It has been found from other animal studies that the function of HDL-C can reduce the complications of atherosclerosis, including: resisting systemic inflammatory response, reducing LDL-C oxidation, increasing the production of nitric oxide in vascular endothelial cells, reducing endothelial expression of cell adhesion molecules, reduction of thrombus and inhibition of apoptosis, etc. However, some recent research results on HDL-C show that the benefits to blood vessels are not great. The therapeutic effect of HDL-C on cardiovascular atherosclerotic plaques faces many challenges. The risk factors of multiple cardiovascular diseases include: male, smoking, central obesity, insulin resistance, and systemic inflammatory response change the value of HDL-C; in addition, there may be no relationship between statin therapy and HDL-C and cardiovascular [4].

**The role of HDL-C in cardiovascular diseases**

HDL-C transports cholesterol throughout the body from tissues back to the liver. About 30% of cholesterol in the blood is transported through HDL-C. According to research, HDL can remove cholesterol plaque from atherosclerotic plaque and arteries and transport it Back to the liver, then converted into bile acid or directly excreted from the intestinal tract through bile acid[4]; so clinical health education patients often say that HDL is a kind of anti-atherosclerotic plasma lipoprotein, and it also reduces the incidence of coronary heart disease Good cholesterol; exercise is the most obvious way to increase HDL. In terms of lifestyle adjustments, increasing HDL-C concentration, high-intensity exercise and continuous and regular moderate-intensity physical activity can increase HDL concentration by 5-10%, possibly HDL-C has a particularly strong response to exercise, mainly through the increase in insulin sensitivity. The results of the study support the benefit of exercise in reducing the risk of cardiovascular disease; therefore, maintaining the current AHA guidelines, for adults Fitness activities, at least 3 times a week, for at least 30 minutes each time, are still helpful for weight loss [5]. Western diet high in saturated or trans fat may lower HDL-C and raise LDL-C; in addition, processed carbohydrates such as fructose (a high glycemic index food) may also lower HDL-C And increase the inflammatory response, and increase the risk of cardiovascular disease [6]. Smoking causes cardiovascular oxidative stress and both high-density lipoprotein concentration and function decline. Smokers' HDL-C concentrations are often 5-10% lower than the general population, and smoking cessation will increase HDL-C by about 4mg/dL. Some drugs may lower HDL-C, including: steroids, atypical antipsychotic drugs, antiretroviral drugs for HIV, β-receptor blockers and immunosuppressants, etc. In addition, liver diseases include: liver cirrhosis, etc. Lower HDL by impairing apolipoprotein production, low HDL-C concentrations often occur in acutely inflammatory states; statins are still the first-line treatment for patients with too low HDL-C concentrations and significant cardiovascular risk, and plus lifestyle improvements include: improving HDL-C concentrations and increasing cardiovascular protection [1]. The impact of HDL-C on cardiovascular diseases, people with metabolic syndrome (including central obesity, high blood pressure and high fasting blood sugar, etc.) usually have lower HDL concentrations; through enhancing the endothelial synthesis of nitric oxide (NO). NO is an effective vasodilator, and HDL can also improve vascular endothelial dysfunction; in addition, HDL can reduce the expression of adhesion molecules on endothelial cells, thereby reducing systemic inflammation, and inhibiting LDL (low-density lipoprotein) etc. Oxidative stress to delay coronary atherosclerotic plaques. Increased physical activity in addition to weight loss can also simultaneously reduce triglycerides (the most common neutral type of fat in the body) and simultaneously increase HDL concentrations [5]. It is recommended to do at least 60 minutes of moderate-intensity aerobic exercise per week; try to avoid trans fat in the diet, because trans fat can increase low-density lipoprotein cholesterol (LDL-C) and reduce the concentration of high-density lipoprotein cholesterol in the body. Pastries and biscuits, such as those made with shortening, are usually high in trans fats; most fried foods and some margarines are also high in trans fats; in addition, it is necessary to limit the intake of saturated fatty acids, which are also found in meat and full-fat dairy products; in addition, smoking will reduce the concentration of HDL (high-density lipoprotein), so it is recommended that heart disease patients quit smoking, especially in women, smoking will increase low-density lipoprotein and triglycerides [5]. In the guidelines of the National Cholesterol Treatment Group of the United States, the content of metabolic syndrome pointed out that male HDL-C<40 mg/dL and female HDL-C<50mg/dL are defined as low, while male HDL-C<40 mg/dL Low HDL-C <50 mg/dL in women is an unfavorable factor for cardiovascular disease, and low HDL-C is associated with premature coronary heart disease[1]; the impact of HDL-C on cardiovascular diseases is mainly to reduce low Drugs with high-density lipoprotein and triglyceride levels can sometimes increase high-density lipoprotein levels. For example: clinically used drugs such as niacin or fibrates such as: gemfibrozil, or statins such as: simvastatin and rosuvastatin; but for several Clinical trials of drugs specifically designed to increase HDL concentrations were stopped early because these studies failed to reduce the risk of heart attack.

**Conclusion**

Changes in eating habits, increased smoking rates and reduced exercise, leading to increased incidence of cardiovascular risk factors such as dyslipidemia, diabetes, obesity and hypertension; the impact of HDL-C on cardiovascular diseases: dyslipidemia is the cause of atherosclerosis One of the main risk factors of cardiovascular disease, affecting arteries in important parts of the body, leading to ischemia in the brain, heart or lower limbs; the higher the HDL-C in the body, the lower the chance of atherosclerosis. HDL-C is important for the human body The benefits include that HDL-C can drive the reverse cholesterol transport of cholesterol, and help remove excess cholesterol in the blood vessel wall, bring it back to the liver and then excrete it through the bile and intestinal tract [2]. The changes in life style are The first step to improve HDL-C, obesity, smoking or inactivity will reduce HDL-C concentration, on the contrary weight loss and smoking cessation, exercise can increase HDL-C concentration, the literature shows that smoking cessation can increase HDL-C in the body up to 4 mg/dL, eating less high-fructose foods can also increase HDL-C.

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