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Mini Review

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Dyslipidemias and Obesity

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Abstract

The studies that initially suggested the association between obesity, dyslipidemia and coronary heart disease were population-based studies, in which the predictive factors for coronary heart disease were investigated. In a later study of this same Framingham group, it was suggested that obesity was an independent risk marker for coronary artery disease. Other reports showed that also in obese individuals the elevation of the fraction of low-density lipoprotein-LDL and the reduction of the fraction of high-density lipoprotein-HDL had a positive correlation with the risk of coronary heart disease. It was also observed that triglyceridemia would have a positive correlation with the risk of coronary heart disease. Hypertriglyceridemia in the obese results from greater synthesis and less removal of triglyceride-rich lipoproteins. In the obese individual, the greater supply of free fatty acids supplied to the liver promotes the greater production of very low-density lipoprotein particles-VLDL cholesterol rich in triglycerides. The hyperinsulinemia observed in metabolic syndrome contributes to the increased formation of these particles in the hepatocyte. For the treatment of dyslipidemia associated with obesity, the patient should receive guidance to lose weight, through an adequate diet and physical exercises. Regarding the diet, there is a controversy about which carbohydrate content it should contain, since, once the fat content is decreased, an increase in the carbohydrate content may occur, favoring hyperinsulinism and postprandial hyperglycemia. In individuals undergoing a strict weight losing diet, a transient phase of increased triglyceride and total cholesterol levels and decreased HDL-cholesterol levels may occur. In some cases, it is necessary to use lipid-lowering medications, the choice of which will depend on the type of lipid alteration found and the patient's response to treatment.

Keywords: Obesity, Hypertriglyceridemia, Hypercholesterolemia, Lipoproteins, Exercise, Diet

Abbreviations: HDL: High Density Lipoprotein; LDL: Low Density Lipoprotein; VLDL-c: Very Low Density Lipoprotein Cholesterol.

Introduction

Several epidemiological studies have demonstrated the association between dyslipidemia and the increased risk of coronary heart disease and the beneficial effect of the correction of lipid disorders on the frequency of coronary heart disease. Several researchers [1-5] have suggested that obesity is often associated with these lipid changes and also contributes to the increased risk of coronary heart disease.

The studies that initially suggested the association between obesity, dyslipidemia and coronary heart disease were population-based studies, in which the predictive factors for coronary heart disease were investigated. Thus, it was demonstrated that descendants of Japanese living in Japan had lower mortality from coronary heart disease than those living in Hawaii, who were more obese and had higher triglyceride levels [6,7]. The prospective study of Los Angeles veterans [8], in which patients were followed for 15 years, and the prospective Framingham study [9], in a 12-year follow-up, also demonstrated that obesity and hypercholesterolemia were related to increased risk of coronary heart disease. In a later study of this same Framingham group [10], it was suggested that obesity was an independent risk marker for coronary artery disease.

Other reports showed that also in obese individuals the elevation of the low-density lipoprotein (LDL) fraction and the reduction of the high-density lipoprotein (HDL) fraction had a positive correlation with the risk of coronary heart disease [11-14]. It was also observed that triglyceridemia would have a positive correlation with the risk of coronary heart disease [13-16]. In the prospective multicenter study PROCAM, it was found that, in individuals aged between 20 and 59 years, the prevalence of hypercholesterolemia (>200 mg/dL) ranged from 26 to 76% in men and from 28 to 86% in women, and a positive correlation was observed between cholesterolemia and the degree of obesity in the groups of younger individuals (20 to 29

years); however, the same was not observed in the groups of older individuals [17]. The prevalence of low levels of HDL-cholesterol (<35 mg%) ranged from 10 to 39% in men and from 3 to 13% in women and there was an inverse correlation with the degree of obesity, regardless of age group. Regarding hypertriglyceridemia (>200 mg%), the frequency ranged from 5 to 42% in men and from 2 to 14% in women and it was observed that the higher the degree of obesity, the higher the triglyceride levels in the different age groups. Vaque [17] associated obesity with the distribution of fat in the trunk-abdominal, that is, with obesity of the android type, with a higher frequency of diabetes, atherosclerosis and gout.

Studies have shown that obesity with android distribution, that is, of the type accumulated in the abdomen, is often associated with glucose intolerance or diabetes, hyperinsulinism, insulin resistance, hypertriglyceridemia and arterial hypertension [18-24]. This association has also been called "metabolic syndrome", "fatal tetrad" [23], also described as "Syndrome X" [24,25] by Reaven et al. who have suggested that these changes would be independent of the presence of obesity and yes related to insulin resistance and hyperinsulinism. Some authors have associated one more alteration to this syndrome, hyperuricemia [25,26].

The mechanism by which dyslipidemia occurs is not fully understood, since not every obese, even with android distribution, has the aforementioned changes. It is possible that genetic factors may contribute to the appearance of lipid alterations in obese individuals [27].

Hypertriglyceridemia in the obese results from greater synthesis and less removal of triglyceride-rich lipoproteins. In the obese individual, the greater supply of free fatty acids supplied to the liver promotes the greater production of very low-density lipoprotein (VLDL) cholesterol particles rich in triglycerides. The hyperinsulinemia observed in metabolic syndrome contributes to the increased formation of these particles in the hepatocyte. On the other hand, the lipoprotein lipase enzyme, responsible for the catabolism of triglyceride-rich lipoproteins, has its activity decreased, thus promoting an accumulation of these in the blood [1,28-32].

The lower catabolism of triglyceride-rich lipoproteins decreases the speed of transfer of these components, necessary for the formation of the HDL fraction, thus leading to the hypoalphalipoproteinemia observed in the obese. The reduction in HDL-cholesterol levels may also be secondary to the increased activity of the hepatic lipase enzyme responsible for the catabolism of this lipoprotein [33]. Hypercholesterolemia is rarely concomitant with hypertriglyceridemia, since in obese individuals the rate of cholesterol turnover may be increased [34].

In the obese individual, there is an increase in the speed of renewal of free fatty acids and there are regional differences in the lipolytic response to catecholamines. Thus, adipocytes from the omental tissue have a higher rate of fatty acid synthesis than those from the subcutaneous tissue, as well as a greater lipolytic response to catecholamines [35]. This fact is important in android obesity, where there is a greater supply of free fatty acids to the liver, with consequent greater synthesis of VLDL-c particles rich in triglycerides, altering the lipid profile more unfavorably than in the gynecoid form [1].

For the treatment of dyslipidemia associated with obesity, the patient should receive guidance to lose weight, through an adequate diet and physical exercises. Regarding the diet, there is a controversy about which carbohydrate content it should contain, since once the fat content is reduced, an increase in the carbohydrate content may occur, favoring hyperinsulinism and postprandial hyperglycemia [36,37]. In individuals submitted to a strict weight-losing diet, a transitory phase of increased triglyceride and total cholesterol levels and decreased HDL-c levels may occur [38]. A meta-analysis study of 70 reports in the literature [39]. demonstrated that weight loss is associated with decreased triglyceride levels by 32%, total cholesterol by 13%, LDL-c by 11% and increased HDL-c by 12%.

In relation to physical exercise, it is known that it promotes the improvement of the lipid profile, regardless of weight loss. In a meta-analysis study of 95 reports in the literature [40], a decrease in triglycerides from 11 to 16%, cholesterol from 3 to 10% and an increase in HDL-c by 3%.

In some cases, it is necessary to use lipid-lowering medications, the choice of which will depend on the type of lipid alteration found and the patient's response to treatment.

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Conflict of Interest

None.

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