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RESEARCH PROGRESS OF AEROBIC EXERCISE ON ENDOTHELIAL DYSFUNCTION

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Abstract

The active substances secreted by vascular endothelial cells play an important role in regulating the function of vascular endothelial cells. The two main substances are vasoconstrictor factor (endothelin) and vasodilator factor (NO), which play a joint role in regulating the function of vascular endothelial cells. Vascular endothelial dysfunction is mainly the impairment of normal endothelial function of blood vessels. Vascular endothelial dysfunction has increased the incidence of cardiovascular diseases such as hypertension, atherosclerosis, obesity and diabetic heart disease. Now more and more people suffer from cardiovascular diseases, cardiovascular diseases have gradually been paid attention to in recent years. In recent years, the research on the improvement effect of aerobic exercise on vascular endothelial dysfunction is increasing. This paper collects the related literature on the improvement of vascular endothelial dysfunction by aerobic exercise, and summarizes the related literature on the improvement of vascular endothelial dysfunction by aerobic exercise.

Key words：Aerobic exercise Vascular endothelium,Vascular endothelial cells,Vascular endothelial dysfunction

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1. Relationship between aerobic exercise and vascular endothelial dysfunction

Endothelial dysfunction is a pathological damage to cells with normal homeostasis of the vascular endothelium, including endothelium-dependent vasoconstriction, coagulation, and inflammation. This prevents endothelial cells from secreting their active substances and causing endothelial dysfunction in blood vessels. . Many studies have shown that suitable aerobic exercise can effectively promote the secretion of nitric oxide (NO) and endothelin by cells and improve the vascular endothelial function disorder [1]. The two major substances secreted by vascular endothelial cells (endothelin) and vasodilators (NO) maintain the normal function of vascular endothelial cells, and the balance between them is considered to be a sign of the normal function of endothelial cells [2] When endothelial cells are invaded by pathological factors, the equilibrium state between them is broken by pathological factors. After that, endothelial dysfunction occurs. The most prominent feature of endothelial dysfunction is endothelial cell-dependent blood vessels. The diastolic function is impaired, that is, the ability of NO released by vascular endothelial cells is decreased, and the diastolic function of the vascular endothelium is affected, which leads to the occurrence of hypertension, atherosclerosis, diabetes, obesity and the like.

Aerobic exercise stimulates phosphorylation of vascular endothelial AMP-activated protein kinase (AMPK) [3]. When vascular endothelial cell AMPK is activated by phosphorylation, it promotes phosphorylation of endothelial nitric oxide synthase (eNOS). More nitric oxide, nitric oxide can effectively improve endothelium-dependent relaxation and vascular endothelial function, and the shear stress generated during aerobic exercise can also activate eNOS and increase nitric oxide. Synthetic amount, further enhance vascular endothelium-dependent diastolic function [4], comprehensive analysis: aerobic exercise allows endothelial cells to secrete more nitric oxide in a variety of ways, improve endothelium-dependent diastolic function and improve endothelial dysfunction .

2. Analysis of the effect of aerobic exercise on vascular endothelial dysfunction

2.1 Effects of aerobic exercise on vascular dysfunction in patients with hypertension

Hypertension is a very complicated chronic vascular disease and the first risk factor for cardiovascular and cerebrovascular diseases. Aerobic exercise can play a good protective effect on the blood vessels of hypertensive rats by reducing the resistance of blood flow in blood vessels, the level of plasma AngII and the sensitivity of decompression reflex [5]. Hypertension also has an effect. The study found that aerobic exercise during the afternoon can significantly reduce the rise in blood pressure within 24 hours after exercise. This change can effectively reduce the incidence of cardiovascular events [6], suitable aerobic exercise Altering the calcium regulation of cerebral arterial smooth muscle cells, calcium regulates the dynamic balance of contractile-diastolic calcium ions in the cerebral arteries, reduces the abnormalities of cardiovascular and cerebrovascular functions, and thus plays a protective role on cardiovascular and cerebrovascular functions [7], although many The specific mechanism of aerobic exercise to reduce hypertension was not clearly stated in the study, but many articles have been confirmed by the protective effect of aerobic exercise on hypertensive vasculature.

2.2 Effects of aerobic training on vascular dysfunction in arteriosclerosis

Atherosclerosis (AS) is associated with vascular endothelial dysfunction and vascular risk factors. Appropriate aerobic exercise is one of the ways to improve atherosclerosis. Aerobic exercise can reduce aortic stiffness and reduce collagen concentration. Increases elastin concentration, decreases pulse wave velocity (PWV), and prevents aging-related endothelial dysfunction, mainly due to acetylcholine-induced aortic endothelial-mediated vasodilation [8], aerobic exercise not only Conducive to the regulation and improvement of the cardiovascular system, strengthen the vasodilatation and contraction of blood vessels, and strengthen the elasticity and toughness of blood vessels, thereby protecting the normal function of vascular endothelial cells [9], inhibiting lipid peroxidation through aerobic exercise Role, enhance the body's ability to inhibit peroxidation, and thus the trend of atherosclerosis [10]. It is also speculated that suitable

aerobic exercise can stimulate endothelial cells to repair their own damaged cells and maintain the functional integrity of the vascular endothelium, which may also be an effective way to relieve atherosclerosis.

2.3 Effects of aerobic exercise on vascular endothelial function in obesity

The growing problem of obesity in the population has received increasing attention. Studies have found that obesity can also contribute to cardiovascular disease. Obesity is more common in children and adolescents. In recent years, many studies have shown that aerobic exercise reduces the levels of BMI and total cholesterol in obese children, thereby improving endothelial dysfunction [11]. Aerobic exercise reduces oxidative stress and inflammation. It can help to improve vascular endothelial dysfunction in obese children and adolescents, thereby improving vascular endothelial dysfunction, and is conducive to enhancing the normal function of cardiovascular and cerebrovascular. After 4 weeks of aerobic exercise to lose weight, male ATC2 decreased significantly in obese children and adolescents, ACAT2 activity decreased, which will reduce the ability of cholesterol and fatty acid to synthesize cholesterol ester, thereby inhibiting the deposition of large amounts of cholesterol ester in cells and slowing atherosclerosis. Occurrence and development , aerobic exercise can also reduce the expression of ET-1 by inhibiting renin-angiotensin in obese children, increase the expression of NO in vascular endothelial cells, regulate the contractility and relaxation of vascular smooth muscle cells, and improve Vascular endothelial cell dysfunction. Many studies have relied on aerobic exercise to reduce excess cholesterol in the body and reduce the amount of cholesterol in the blood vessels, thereby stabilizing the normal endothelial function of the blood vessels, and also achieving the purpose of reducing body weight.

2.4 Effects of aerobic exercise on diabetic vascular dysfunction

Diabetes is a major chronic complication of vascular disease. Most of the patients with type 2 diabetes have been found in the literature. Aerobic exercise can promote the accurate

expression of eNOS and release more nitric oxide from endothelial cells, and can up-regulate its upstream signaling protein Akt, reducing the expression of inflammatory factor TNF-α. This mechanism is aerobic exercise to improve diabetic rats. Principle of vasodilation , suitable aerobic exercise can effectively improve the function of glucose metabolism in diabetic rats, and can accurately express the protein in the insulin signaling pathway and increase its protein activity, thereby facilitating insulin. The rapid and accurate transmission of the signal reduces the insulin sensitivity of diabetic patients and mobilizes insulin in the body to reduce the tendency of blood glucose to rise in the body. Aerobic exercise promotes the use of free fatty acids and cholesterol, which reduces the incidence of diabetes. In addition, a large amount of blood sugar is consumed during exercise, which also reduces the burden of islets in the body , allowing insulin secreted by islets to Reduce blood sugar in the body. Other studies have shown that aerobic exercise can also reduce the degree of damage of vascular endothelial cells, promote the release of more nitric oxide from vascular endothelial cells, maintain normal vascular endothelial cell function, and prevent the occurrence of diabetes.

3. Conclusion and outlook

In related research, aerobic exercise can improve the incidence of cardiovascular disease. Aerobic exercise can increase the blood flow velocity in the body, maintain the normal function of endothelial cells, promote the phosphorylation of eNOS, produce more nitric oxide, and lower cholesterol in the body. The content and the stability of blood sugar. Although the mechanism of aerobic exercise to improve vascular endothelial function is not clear, it is inseparable from the role of nitric oxide. Many studies have shown that proper aerobic exercise can improve cardiovascular and cerebrovascular function, regulate blood pressure and blood sugar, and then lower the heart. The probability of angiogenesis.

The literature also mentions the effects of acute aerobic exercise and intermittent exercise, as well as smoking, alcohol abuse, vitamin deficiency and other factors on vascular endothelial dysfunction, but this research is less and insufficient, so these factors on vascular endothelial

function The impact of the obstacles remains to be explored.

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