Review of Studies on Exercise on Mφ Cells
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Keywords: sports, macrophages, impact

Abstract: Macrophages (Mφ) are important immune cells involved. The movement of small intensity so that the phagocytic activity of macrophages increased, while high-intensity exercise makes phagocytic macrophages decreased; while body movement also makes a number of neurotransmitter secretion of hormones change, and hormones, nerve changes in neurotransmitter and neuroendocrine regulation of immune system macrophages.

Introduction
Macrophages (Mφ) are widely distributed in the liver, lung, peritoneum, adipose tissue, blood, bone and muscle and other organs and organs. It is the body against the pathogenic microbial invasion of the first line of defense. In recent years, many scholars at home and abroad have done a lot of research in this area. The effects of exercise on macrophages and the mechanism of macrophage immune regulation are still not deep enough; and how to improve the function of macrophages by exercise supplements during exercise or during exercise. Research is still in the initial stage. In this paper, the literature review method, through access to relevant research frontier and literature, the current people on the relationship between exercise and macrophages research, a systematic review. Aimed at the theoretical system to sort out the relationship between the two framework for people to further understand and study the relationship between the two do some theoretical basis

1 Immune Function of Macrophages

1.1 Antigen Presentation
Macrophages are innate and acquired immune bridges, which are scattered in all parts of the body, through the inflammatory response and antigen presenting cells in the form of immune response. In the process of antigen presentation, macrophages engulf foreign microorganisms into phagocytic bodies, and then the foreign protein is digested and processed into antigenic peptides. These peptides are linked to MHC class II molecules and transferred to the surface of macrophages. And CD4 + T lymphocytes interact. The interaction between macrophages and T cells produces antigen-specific T cell clones that ultimately recognize and destroy invasive microbes and provide long-lasting immunity. Macrophage antigen delivery capacity is essential for immune function, when this function is impaired, the probability of onset and infection risk of death will rise.

1.2 Bactericidal Effect
Macrophages are widely distributed in the liver, lung, peritoneum, adipose tissue, blood, bone and muscle and other organs and organs. It is the first line of defense against the invasion of pathogenic microorganisms and can be produced by the "respiratory burst" form, i.e., by the NADPH oxidase-mediated production of reactive oxygen species (ROS), pathogens Microbes, which is the main mechanism of macrophage sterilization, play an important role in the prevention of germs. Pathogen invasion, MΦ can produce a large number of intracellular ROS to kill the invasion of pathogenic microorganisms, which is an important way of sterilization.
2. Effects of Exercise on Macrophages

2.1 Effects of Low-Intensity Exercise on Macrophages

2.1.1 Influence on the Number of Mφ

Adequate evidence suggests that acute exercise can cause an instantaneous increase in the number of Mφ in peripheral blood (50% -100%). Yano H and others found that low-intensity exercise to increase the phagocytosis of liver macrophages using the experiment. Yao Yucai and so on through the Mφ phagocytic neutral red experimental study found that the number of Mφ in 30min and 1h group increased, the number of value with the Mφ phagocytosis enhanced value, it can be seen from the number of macrophages and exercise intensity of the time closely. At this time the number of Mφ changes little.

2.1.2 Influence on the Mφ Function

Yano H and other experiments using rats found that the appropriate intensity of exercise can increase the phagocytosis of liver macrophages. Yao Yucai and so on through the Mφ phagocytic neutral red experimental study found that Mφ phagocytosis in 30min and 1h group increased, anti-tumor function in 30min group increased, indicating that the following 1h exercise on macrophage phagocytosis and anti-tumor function to promote. (30min / d, 6d / w) of C57BL / 6 mice with swimming training for 3 months. The results showed that the phagocytic and antitumor function of macrophages in the aged group was lower than that in young rats, which indicated that moderate exercise training could enhance Mφ function and play a certain anti-aging effect. Fehr found that mice after 25 days treadmill training, intraperitoneal Mφ intracellular enzymes increased, Mφ phagocytosis enhanced. Wood et al. Found that 3-7d medium intensity could increase the activity of TG induced and Propionibacterium acnes-activated rat peritoneal Mφ. Hoffman-Goetz and other studies have found that 25 days after treadmill training mice intraperitoneal macrophages increased enzyme substances, macrophage kinetic energy increased. From the above results can be seen, macrophage phagocytosis and exercise intensity and movement time is closely related.

2.2 Large-Intensity Sports Team Macrophages

2.2.1 Influence on the Number of Mφ

With the discovery of LimCL and Yao Yucai, the activity of macrophages was enhanced with the loss of muscle tissue in the body after a long period of intense exercise, and the phagocytic function of the latter was significantly reduced after 2 hours 2h exercise on Mφ phagocytosis inhibitory effect. Li Xiaojun, etc. through the establishment of over-training animal model found that over-training will mononuclear Mφ system function inhibition, suggesting that over-training may cause immune dysfunction. Guo Jianjun and other rats were divided into control group, general training group and intensive training group using incremental load movement, found that general training to improve the ability of MφIL-6, this enhancement in the high-intensity training was significantly inhibited, so Mφ The number also decreases.

2.2.2 Influence On The Mφ Function

Shu-Hui Su and so that strenuous exercise (treadmill exercise to exhaustion) can activate bronchial alveolar macrophages (BAM), improve its phagocytosis, but this increase is temporary, 4 hours after the return to normal levels. But not everyone supports strenuous exercise that can increase the phagocytic function of macrophages. In the study of Raidal et al., 7 weeks of training and vigorous exercise had a detrimental effect on alveolar macrophage phagocytosis, but strenuous exercise had no effect on phagocytosis of macrophages without systematic training. Long-term vigorous exercise on macrophage phagocytosis of the impact of less reported. The effect of exercise on phagocytosis is related to the animal species, in addition to the nature of the movement. LimCL and other studies have found that athletes after a cycle of strenuous exercise, due to muscle tissue damage, the macrophage activity will increase.
2.3 Effects of Exhaustive Exercise on Macrophages

2.3.1 Influence on the Number of Mφ (Value) of the Impact

Guo Jianjun and other rats were divided into control group, general training group and intensive training group, the use of incremental load movement, found through the general training to improve the ability of MφIL-6, this enhancement in the high-intensity training was significantly inhibited. High intensity training can inhibit immune function. Exhaustive cycling exercise can improve the activity of TG induced and Propionibacterium acnes-activated rat peritoneal Mφ, exhaustive exercise to reduce alveolar Mφ antiviral function. PaulsenG and so on with the greatest degree of centrifugal exercise to study the movement caused by muscle damage and delayed white blood cell relationship between the macrophages found that colony-stimulating factor immediately after the movement reached its peak. From the above results we can see that exhaustive exercise increases the number of cells in Mφ.

2.3.2 Influence on the Mφ Function

The available data indicate that the dependence of NOS activity on Ca2 + / caM is different. NOS is divided into two classes, one is the construction of NOS (cNOS); the other is the induction of NOS (iNOS) involved in immune regulation is mainly iNOS catalyzed NO. In this study, we investigated the changes of iNOS activity and the corresponding changes of plasma CD4 + / CD8 + in peritoneal macrophages by exercise training of different load, and discussed the mechanism of different exercise load on the immune function of SD rats and the health effects of SD rats influences. The release of inflammatory cytokines such as interferon-r (IFN-r) tumor necrosis factor (TNF), interleukin-1 (IL-1) and interleukin-2 (IL-2) promotes macrophages, vascular smooth muscle cells and Cardiomyocytes in the iNOS gene transcription and expression, thereby promoting a large number of NO synthesis and release of the immune system to regulate.

3 Influence on Macrophages

Studies have shown that the effect of exercise on macrophage function is comprehensive and profound, most studies suggest that the mechanism of macrophage effects of exercise has eight points: (1) long-term moderate exercise can promote peripheral blood mononuclear cells to M2 macrophages Cell differentiation, reduce adipose tissue, atherosclerotic plaque, tumor tissue macrophage infiltration, but also affect the number of peritoneal macrophages, muscle macrophages phenotype. (2) exercise can increase macrophage chemotaxis. (3) long-term high-intensity exercise can reduce the ability of macrophage antigen presentation, and the ability to reduce the ability of this antigen may be due to antigen processing capacity defects. (4) long-term low-intensity training, short-term strenuous exercise can increase macrophage phagocytosis, and long-term strenuous exercise on macrophage phagocytosis function less information. (5) the impact of exercise on the secretion of macrophages reported different, by the exercise intensity, exercise time, irritant species, whether the pathological model and so on. (6) exercise to change the anti-virus ability affected by a variety of factors, such as: sports attributes (exercise type, intensity, duration), gender, age and tissue parts, diet nutrition. Most studies suggest that moderate exercise can enhance macrophage antiviral ability, and exhaustive exercise can inhibit macrophage anti-virus ability. (7) moderate exercise and exhaustive exercise can increase the anti-tumor activity of macrophages in vitro. (8) Different forms, intensity and duration of exercise have different effects on macrophage glucose and glutamine consumption, hydrogen peroxide production and enzyme activity.
4 Advances in Exercise Complement and Macrophages

4.1 Effects of Supplemental Sugar on Macrophages

4.1.1 Effects of Supplemental Monosaccharides on Macrophages

Exercise can affect macrophage antiviral ability has been a large number of experiments confirmed that this process is affected by nutritional supplements. Monosaccharide it is the body most likely to absorb and absorb the fastest of a carbohydrate, when the human discomfort, the most commonly used supplements is glucose, often referred to as energy. Monosaccharides are the basic components of polysaccharides, Shi Yali study shows that long-term high-intensity exercise of mice gavage of Ganoderma lucidum polysaccharide (GLP), the study of high-intensity mouse macrophage function, polysaccharide on the body's immune function obvious. Thus it is concluded that monosaccharides have a potent effect on the function of macrophages.

4.1.2 Effects of Supplemental Polysaccharides on Macrophages

At home and abroad in the field of pharmacology on polysaccharides on the mechanism of MФ done a lot of reports, and in the field of sports medicine reported particularly small. (YP) can significantly increase the ability of MФ to secrete NO and IL-1β in high-intensity exercise mice and improve its phagocytosis. Zhou Jing and other research results show that Lycium barbarum polysaccharide (LPB) can enhance the phagocytosis of MФ. Li Mingchun and other studies have found that Ganoderma lucidum polysaccharide (GLP) can antagonize the respiratory burst of MФ, M Ф to reduce the production of reactive oxygen free radicals. (PPS) had a significant effect on the production of NO in the myocardium of MCC, and the concentration of glutathione (GSH) decreased with the increase of NO concentration. It is suggested that GSH in MФ may play a role in regulating NO production in MФ and protecting host cells from NO-mediated cytotoxicity. Huang Dinan and other studies have shown that Polyporus umbellatus polysaccharide (PPS) can make M Ф iNOS mRNA expression increased and iNOS activity increased. (GPP), it was found that GPP and its components could prolong the swimming time of mice in excessive exercise and improve the immunity ability of mice, especially the ability of phagocytosis of Mφ in the abdominal cavity. The study suggests that GPP and its main components enhance the phagocytic capacity of MФ in mice may be one of the reasons for prolonging the time of mouse exhaustion. The report suggests that the use of polysaccharide components against hyperactivity on the negative effects of macrophages is an effective means.

4.2 Effects of Glutamine Supplementation on Macrophages

Glutamine is an important source of energy for macrophages. It is still a controversial issue to supplement glutamine when exercising. (E1: 179.10 ± 29.10; EG1: 172.58 ± 49.62) was significantly lower than that of the overtraining group (P <0.01 (P <0.01), and there was no significant difference (P <0.01) ), Indicating that over-training supplementation of glutamine and cannot change due to over-training caused by inhibition of ROS, macrophages ROS-mediated physiological function of no improvement. After 1 week of exacerbation, over-training supplemented the glutamine group of macrophages in the ROS returned to the quiet group level. However, another study reported that rats with 85% .VO2max intensity for 1h treadmill exercise on neutrophil ROS production had no effect, and exercise and supplementation of glutamine ROS production increased this may be with the exercise intensity, duration and Cell type is different.

5 Conclusion

The results show that appropriate moderate and small intensity exercise can enhance macrophage phagocytosis, and high-intensity exercise and over-training on macrophages have damage or inhibition of macrophage phagocytosis function, that is, different intensity of exercise Training caused macrophage function changes are inconsistent. Moderate exercise can enhance macrophage anti-virus ability, while exhaustive exercise is to inhibit macrophage anti-virus ability; exercise effects of macrophage capacity in addition to exercise intensity, duration and frequency of
movement, but also by sex, age and Nutritional effects of macrophages may play a role in influencing hormone levels, macrophage phagocytosis, intracellular reactive oxygen production and nitric oxide synthesis.

References


