

The Impact of Exercise on Mental and Physical Health

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Abstract: exercise is a planned, organized and repeated physical activity, which can improve physical and mental health. This paper summarizes the influence and mechanism of exercise on individual physical and mental health, and finds that exercise has an impact on many aspects of individual psychology and physiology, which can promote the level of physical and mental health, prevent and treat diseases. The article points out that the effect of exercise intervention is regulated by factors such as exercise intensity, exercise time and exercise type. This paper suggests that future research should further strengthen the exploration of the deep mechanism of the impact of exercise on physical and mental health, clarify the dose effect of exercise intervention, and explore the impact of individual subjective attitude on the effect of exercise, so as to provide a theoretical basis for scientific exercise to improve the level of physical and mental health and assist clinical treatment.

Key words: sports; Mental health; Sleep; Cognition; emotion

Introduction

Exercise is a planned, organized, repetitive activity designed to improve physical fitness. The beneficial effect of exercise on individual physical and mental health has been confirmed in many aspects, such as delaying aging, promoting cardiopulmonary function, improving bone mineral density, increasing brain function, adjuvant treatment of diseases, and promoting mental health. However, the mechanism of the impact of exercise on individual physiology and psychology is still unclear. In addition, the adjustment variables such as exercise intensity, exercise time, exercise style and individual characteristics affect the exercise effect. Therefore, this paper will focus on the influence of sports on individuals. Starting from the influence of nervous system, circulatory system, respiratory system and immune function, this paper summarizes the influence and mechanism of exercise on individual physical and mental health, so as to provide the basis for the formulation of scientific exercise program.

1. The influence of exercise on mental health

1.1. Sleep

Exercise can reduce insufficient sleep and improve sleep quality. First, exercise can improve sleep disorders such as sleep apnea and insomnia. Research shows that cardiopulmonary function is moderately negatively correlated with insomnia related symptoms. With the reduction of exercise, the subjects' insomnia increases. Secondly, the metabolic effects of exercise and the biomarkers produced affect sleep quality. The acute increase of glucose metabolism, GH (growth hormone) and BDNF release caused by exercise affect sleep quality. In addition, the relationship between sleep disorders and exercise is bidirectional. Sleep disorders can lead to fatigue, thus reducing exercise, and less exercise will increase sleep disorders.

1.2. Brain and cognition

First of all, exercise activates some brain regions and increases cerebral blood flow. During exercise, the cerebellum, insula, anterior cingulate cortex, medial prefrontal cortex, hippocampus and thalamus are involved in cardiovascular regulation and circulatory regulation of exercise. Periaqueductal gray matter (PAG), which plays a key role in the nerve circuit of central command, is activated during exercise. Structured exercise training increases cerebral blood flow by increasing the formation of blood vessels in the brain.

Secondly, exercise leads to positive changes in brain structure and function. Exercise induced hippocampal volume increase and enhanced cognitive function. Single exercise can reduce the activation of prefrontal cortex, play a role of "Relaxation", and improve cognition. A clinical trial for the elderly (average age =70) found that 6 months of progressive resistance physical training can increase the GM (gray matter) volume of the posterior ACC (anterior cingulate cortex). A clinical study on Baduanjin found that Baduanjin could increase ACC activity in patients with mild cognitive impairment at rest.

Thirdly, exercise promotes the increase and expression of BDNF, thereby improving cognitive ability. Exercise increases the expression of brain-derived neurotrophic factor (BDNF), vascular endothelial growth factor (VEGF) and insulin-like growth factor (IGF1). The expression of BDNF enhances synaptic plasticity, such as dendritic growth, neurogenesis and long-term potentiation of neurons, and improves cognitive function. It is conducive to the treatment and rehabilitation of patients with neurological diseases. Finally, exercise contributes to the rehabilitation of neurological diseases. Exercise has a positive effect on brain adaptation, reorganization ability and neural plasticity in patients with Parkinson's disease. Exercise can compensate patients with attention deficit hyperactivity disorder. Catecholamine level can reduce the impulsivity and hyperactivity of patients, improve attention and enhance executive function.

Finally, exercise not only promotes the cognitive performance of healthy individuals, but also has a positive impact on patients with neurological diseases. Aerobic exercise has a variety of positive effects on patients with neurological diseases by increasing cerebral blood flow and neurotransmitter release, changing brain tissue structure, central nervous system and wake-up level, and establishing an anti-inflammatory environment.

3. emotion

Exercise can improve mood, reduce stress response, reduce depression and anxiety symptoms, promote individual health and increase happiness. The influence mechanism of exercise on emotion is as follows. First, exercise can affect emotional state by changing brain structure. Compared with healthy people, the anterior cingulate cortex (ACC) structure of patients with depression, mania and bipolar disorder decreased, and exercise helped to increase the ACC structure. Exercise can enhance the resting state functional connection between amygdala and insula, thus reducing fear. Secondly, exercise can affect the secretion of body substances, and then affect the emotional state. Endorphins released during exercise can enhance and stabilize emotions, regulate emotional function and stress response. The up regulation of BDNF caused by exercise also plays a therapeutic role in depression.

Among the types of sports that regulate emotions, yoga is a comprehensive physical and mental exercise. Physical activities (asanas or asanas) and mindfulness practice (breath control (breath regulation) and meditation (Zen)) are carried out at the same time. Yoga can improve mood and cognition by enhancing attention, emotion regulation, and reducing neurotic or negative continuous thinking (i.e., meditation, worry). It has a positive effect on all ages. Yoga promotes the increase of BDNF, reduces the response of sympathetic nervous system and HPA axis to stress, and is related to the long-term increase of hippocampal gray matter, so as to regulate mood. Yoga can effectively improve the symptoms of depression in a variety of clinical diseases, such as MDD (severe depression), post-traumatic stress disorder (PTSD), schizophrenia and so on. Yoga can promote the increase of BDNF and hippocampal gray matter, reduce the response of sympathetic nervous system and hypothalamus pituitary adrenal axis to stress, and thus regulate mood.

2. Effects of exercise on individual physiology

1. circulatory system

(1) Heart

Exercise affects individual cardiac output, heart rate, cardiopulmonary function and other indicators, promotes myocardial remodeling, and prevents the development of heart failure and cardiovascular disease.

Cardiac output refers to the total amount of blood ejected from one side of the ventricle per minute. It is an evaluation of circulatory system efficiency. Cardiac output is determined by heart rate and stroke volume. Exercise increased stroke volume, decreased resting heart rate and increased peak cardiac output. The increased cardiac output flows to skeletal muscle, which improves exercise ability. Exercise training has the effect of anti arrhythmia. In addition, long-term regular exercise can induce left ventricular hypertrophy and remodeling, and improve ventricular systolic function.

Exercise can reduce the risk of heart failure. The subjects who exercised had a 10% lower risk of heart failure than those who did not exercise. Exercise can be used as a tool for prevention, treatment and prediction of patients with heart failure.

Exercise can prevent and promote the rehabilitation of cardiovascular disease. A large number of studies have shown that exercise can reduce the prevalence of cardiovascular diseases such as stroke, coronary heart disease and heart failure. Exercise can reduce cardiovascular risk factors, and promote the rehabilitation of cardiovascular disease by regulating angiogenesis, basic heart rate, endothelial function, and arterial stiffness.

(2) Blood

Exercise training can increase plasma, total blood volume and angiogenesis, and reduce blood viscosity. Exercise can also improve erythrocyte deformability. In large muscle exercises such as running, cycling and boating, systemic vascular resistance and blood pressure decrease. Exercise can improve insulin sensitivity, increase glucose uptake of muscle and fat cells, and reduce blood glucose levels.

2. respiratory system

The respiratory system is an organ system for gas exchange between the human body and the external environment. It is generally believed that hypoxia caused by exercise will destroy the oxidative balance and cause lung inflammation. Exercise causes excessive ventilation, which makes the lungs more in contact with toxic particles and microorganisms in the environment, thus causing respiratory tract inflammation. Severe exercise can produce symptoms similar to upper respiratory tract infection.

Flat to ensure adequate glucose supply to muscles. The range of hormone changes increases with the increase of exercise duration and intensity.

3. immunologic function

Exercise can enhance immune function. During exercise, the number of white blood cells, lymphocytes, especially T cells and natural killer cells increased rapidly and significantly. Within a few hours after exercise, these cells migrate to tissues to look for cells infected with viruses and bacteria. Exercise can also enhance the vaccine response and promote long-term immunity. Aerobic exercise training can also prevent or delay the decline of age-related immune function.

3. The moderating variables of the influence of exercise on physical and mental health

The influence of exercise on physical and mental health varies according to the difference of exercise intensity, exercise type and exercise time.

1. Exercise intensity

First of all, in terms of sleep, compared with moderate and low-intensity exercise, the sleep quality after high-intensity exercise is

higher.

Secondly, exercise intensity affects cerebral blood flow. Moderate intensity exercise leads to a sharp increase in cerebral blood flow. However, high-intensity exercise made the cerebral blood flow velocity stable or decreased. Exercise intensity is a potential regulator of BDNF expression. High intensity aerobic exercise can significantly increase the level of BDNF after exercise. Low and medium intensity aerobic exercise has little effect on the increase of BDNF level.

Thirdly, the symptoms of fatty liver are regulated by exercise intensity. Both high-intensity exercise and moderate intensity exercise can reduce the liver triglyceride content in patients with nonalcoholic fatty liver disease (NAFLD), and increase the liver lipid accumulation after strenuous exercise, thus aggravating NAFLD.

Finally, blood glucose levels are affected by exercise intensity. Different intensity exercises use different fuels. Moderate intensity endurance training can reduce blood glucose levels, while light intensity endurance training has no effect.

2. Joints

According to the main metabolic energy sources used during exercise, exercise can be divided into two forms: anaerobic exercise and aerobic exercise. Anaerobic exercise is characterized by high muscle contraction intensity. Aerobic exercise is characterized by low muscle contraction rate, involving major muscle groups and increasing body oxygen consumption. Aerobic exercise can reduce blood glucose concentration during and after exercise, while anaerobic exercise tends to cause a sharp rise in blood glucose levels.

3. Exercise time

Exercise time has different effects on circadian melatonin rhythm and sleep stage. Studies have compared the incubation period, recovery time and recovery times after the beginning of sleep after exercise in the morning, afternoon and evening. It was found that when exercising in the morning, these sleep parameters reached the lowest value, indicating that exercise in the morning can improve the quality of sleep at night.

Both acute and long-term exercise can increase the synthesis of BDNF and induce neurotrophic and neuroprotective effects. Acute exercise can change the permeability of blood-brain barrier and promote the release of BDNF.

4. Summary and Prospect

This paper comprehensively expounds the influence and mechanism of exercise on individual physical and mental health from the aspects of nervous system, circulatory system, respiratory system and immune function, and the effect is regulated by exercise intensity, exercise time and exercise type. Although a large number of studies have discussed the impact of exercise on individual physical and mental health, there are still potential problems to be explored in the future.

First, further clarify the dose effect of the regulatory variables that affect the effect of exercise. When, how much and what form of exercise will play the best effect of sports on physical and mental health promotion, it remains to be explored by future researchers. The dose effect of exercise intervention has important practical significance for daily health care and clinical adjuvant therapy.

Secondly, explore the moderating effect of individual subjective attitude on physical and mental health. Man is a complex organism, and his subjective attitude, such as emotion and motivation, will also affect his physical and mental health. What kind of sparks will be produced by the combination of subjective attitude and sports, and whether it has a unique impact on physical health, need to be studied. It is worthy of future researchers' attention to explore the impact of exercise on physical and mental health by taking subjective attitudes such as individual emotion and exercise motivation as regulatory variables.

Finally, further explore the mechanism of the impact of exercise on physical and mental health. There is a lack of discussion on the deep mechanism of exercise influence in the existing research. Clarifying the deep mechanism of the impact of exercise on physical and mental health can provide ideas for opening up new drug treatment tools. Future research should further explore the molecular mechanism, uncover the mystery of the impact of exercise on physical and mental health, and let exercise protect individual health.

References:

- [1] Caspersen, C. J., Powell, K. e., Christenson, G. physical activity, exercise and physical fitness: definitions and distinctions for health related research [j] Public health reports, 1985, 100 (2): 126 – 131
- [2] Nelson, M. e., rejeski, W. J., Blair, S. n., et al. physical activity and public health in older adults: recommendation from the American College of sports medicine and the American Heart Association [j]Med SCI sports exerc, 2007, 39 (8): 1435 – 1445
- [3] Weinstein, S., L., Dolan, L., A., Wright, J., g., et al. effects of bracing in adults with idiopathic scoliosis [j]The New England Journal of medicine, 2013, 369 (16): 1512-1521
- [4] Hansen, M.A., Overgaard, K., Riis, B.J., et al. role of peak bone mass and bone loss in postmenopausal osteoporosis: 12 year study [j]British Medical Journal, 1991, 303 (6808): 961 – 964
- [5] Cattadori, g., segurini, C., picozzi, A., et al. exercise and heart failure: an update [j]ESC heart failure, 2018, 5 (2): 222-232