

A Study on the Effect of College Fitness Yoga on the Recovery of Sports Fatigue in Football Events

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Abstract: This study aims to explore the impact of college fitness yoga on the recovery of sports fatigue in football players. Firstly, by analyzing the mechanism of sports fatigue in football, the possible role of yoga in the recovery of sports fatigue is revealed. Then, through empirical research, examine the specific effect of college fitness yoga on the recovery of sports fatigue among football players. The results indicate that college fitness yoga has a positive effect on the recovery of sports fatigue among football players.

1. Introduction

Football is a high-intensity and highly competitive sport, and athletes are prone to sports fatigue during training and competition. Sports fatigue can reduce athletes' performance and increase the risk of injury, therefore, fatigue recovery is crucial for football players. Yoga, as an ancient fitness exercise, can effectively alleviate sports fatigue, improve athletes' physical fitness and performance. This study explores the impact of college fitness yoga on the recovery of sports fatigue among football players through empirical research.

2. The mechanism of sports fatigue in football

Sports fatigue refers to a physiological phenomenon in which athletes' athletic ability decreases due to the consumption of energy substances and the accumulation of metabolic products within a certain period of time. The fatigue mechanism of football players mainly includes the following aspects:

2.1. Energy and material consumption

Energy and material consumption is one of the important reasons for fatigue in football players. During exercise, the human body needs to consume a large amount of energy substances to maintain life activities and exercise needs. Sugar plays a crucial role in football, mainly stored in the form of muscle glycogen and blood sugar.[1] During high-intensity exercise, the decomposition rate of glycogen is accelerated, which is used to provide rapid energy. However, as exercise time prolongs, muscle glycogen reserves gradually deplete, leading to limited energy production and fatigue in athletes. Fat is another major source of energy for the human body. In low to moderate intensity exercise, fat oxidative breakdown provides the majority of energy. However, in high-intensity sports

such as football matches, the relatively slow rate of fat oxidation cannot meet the rapid energy needs. Therefore, as glycogen is gradually depleted, energy supply is limited, leading to athlete fatigue. Although protein has a relatively small energy supply role in football, during prolonged and high-intensity exercise, the body may break down protein to replenish energy. A large amount of protein breakdown may lead to increased muscle damage in athletes, further exacerbating fatigue.[2]

2.2. Lactic acid accumulation

In high-intensity sports, the energy needs of football players rapidly increase, and aerobic metabolism cannot meet the energy needs, making anaerobic metabolism more important. During anaerobic metabolism, pyruvate produced by glycolysis is converted into lactic acid, leading to the accumulation of lactic acid in the body. Lactic acid accumulation can lead to an increase in internal acidity of muscles, affecting their normal physiological function. In high acidity environments, the contraction ability of muscle fibers decreases, and neuromuscular conduction is damaged, resulting in a decrease in athletes' strength, speed, and endurance. In addition, high acidity environments can also lead to limited release of calcium ions, thereby affecting muscle contraction. The accumulation of lactic acid in the blood can lead to an imbalance in blood acid-base balance, making the blood more acidic. The increase of blood acidity will affect the combining ability of hemoglobin and oxygen, thus reducing the delivery of oxygen and further limiting the aerobic metabolism of athletes. Muscle pain and stiffness caused by lactic acid accumulation can increase athletes' fatigue. In addition, high concentrations of lactic acid may stimulate pain receptors, causing athletes to feel more fatigued. Therefore, timely clearance of lactic acid is crucial to reduce fatigue.[3]

2.3. Nervous system fatigue

Neurological fatigue is a common type of motor fatigue that involves the central nervous system (brain and spinal cord) and the peripheral nervous system (motor and sensory nerves). In football, neurons require neurotransmitters to transmit nerve impulses. Long term high-intensity exercise can lead to the consumption of neurotransmitters, such as dopamine and acetylcholine, which reduces the efficiency of nerve conduction and leads to nervous system fatigue. During high-intensity exercise, a large amount of fatigue substances such as lactic acid and ammonia are produced in the body. These substances may have inhibitory effects on neurons, reduce neural excitability, and lead to nervous system fatigue. The normal function of the nervous system requires sufficient energy support. Long term exercise leads to excessive consumption of energy substances, which may affect the energy metabolism of the nervous system, thereby inducing nervous system fatigue.

2.4. Muscle damage leading to fatigue

After muscle injury, the organism initiates an inflammatory response to repair the damaged tissue. During the inflammatory process, a large amount of inflammatory factors are released, leading to symptoms such as local edema, pain, and limited motor function, thereby exacerbating fatigue. After muscle injury, the energy metabolism of the damaged tissue may be affected. Insufficient energy supply leads to a decrease in athletes' athletic ability, further exacerbating fatigue.

3. The effect of yoga on the recovery of football induced fatigue

3.1. Relieve fatigue caused by energy material consumption

Yoga, as a comprehensive form of exercise, can alleviate fatigue caused by energy consumption

through various postures and breathing techniques. The deep breathing technique of yoga is one of the cores of yoga practice. Deep breathing can help regulate lung function, increase oxygen intake and transport capacity. This helps football players to more effectively utilize oxygen and delay fatigue caused by energy consumption. In addition, deep breathing can also promote psychological relaxation and help alleviate psychological fatigue. Common restorative yoga poses include chest enlargement, butterfly, and abdominal opening and closing on yoga mats. These postures can be performed before or after the competition, helping to restore the body's energy reserves and alleviate fatigue caused by energy consumption. Common flexibility exercises include twisting poses, side bending poses, yoga leg stretches, and more. Yoga's flexibility training can help football players relax their muscles, improve their flexibility and plasticity, and thus help reduce muscle consumption and fatigue.

3.2. Reduce lactic acid accumulation

Yoga, as an aerobic exercise, can reduce lactate accumulation by improving blood circulation and accelerating the discharge of waste and metabolites. The various postures, breathing techniques, and meditation practices of yoga can improve blood circulation, increase the elasticity of blood vessel walls, increase the number and expansion of capillaries, and improve the efficiency of oxygen delivery and utilization. This can enable athletes to better utilize oxygen during football training and matches, and delay the fatigue caused by lactic acid accumulation. The deep breathing method of yoga can improve vital capacity and respiratory rate, accelerate the inhalation of fresh oxygen and the discharge of carbon dioxide, thus helping to accelerate the discharge of metabolites and wastes, including lactic acid and other metabolites. In addition, the flexibility exercises and stretching movements of yoga can promote muscle and joint activity, improve muscle elasticity and flexibility, and thereby enhance muscle metabolism of lactic acid. Research has shown that various postures and breathing techniques of yoga can improve the rate of heart rate recovery after exercise and reduce the time for lactate clearance after exercise. This is because the deep breathing method and meditation of yoga can alleviate the body's stress response after exercise, promote the recovery of muscles and nervous system, and thus accelerate the metabolism and clearance of lactic acid.

3.3. Relieve nervous system fatigue

Static asana is the most basic practice method in yoga, which can help athletes relax while relieving nervous system fatigue. Static postures require maintaining posture for a period of time to allow athletes to relax and balance their breathing, thereby eliminating mental tension and anxiety. Yoga emphasizes that breathing is the bridge between the body and mind. Through deep breathing, oxygen supply can be increased, while improving the body's energy level and alleviating nervous system fatigue. Athletes can take deep breath through the nose to control the respiratory rate and depth, so as to relieve body and mind and relieve fatigue.

3.4. Reduce muscle damage

Yoga, as a flexible training method, can play a positive role in reducing muscle damage. The various postures and stretching movements of yoga help to increase muscle flexibility and joint flexibility, thereby reducing the risk of injury caused by muscle stiffness. Flexibility is an important indicator of muscle elasticity, which can improve the adaptability and stability of muscles to external forces, thereby reducing the probability of injury. In football, athletes often need to perform difficult movements such as single foot support and sudden stops and turns, which can easily lead to insufficient muscle balance and cause muscle damage. The various postures of yoga can help athletes strengthen their sense of balance, improve body stability, and reduce the risk of injury caused by

insufficient muscle balance. In football, the strength and stability of the core muscle group have a significant impact on athletes' performance and injury risk. The core muscle group refers to the muscles of the abdomen, waist, and buttocks, which are important components that support the stability and balance ability of the human body. The various postures of yoga can effectively strengthen the strength and stability of the core muscle group, thereby reducing the risk of injury.

4. Empirical research: The impact of fitness yoga in universities on the recovery of sports fatigue in football players

4.1. Experimental design

This study used a pre and post controlled experimental design, selecting 20 athletes from a certain university football team and randomly dividing them into an experimental group and a control group. The experimental group received yoga training twice a week, 60 minutes each, for 8 weeks, in addition to regular football training. The control group maintained regular football training and did not undergo any yoga training. A series of tests and measurements were conducted on all athletes before and after the experiment. In order to evaluate the impact of fitness yoga in universities on the recovery of sports fatigue among football players, we selected the following indicators:

(1) Heart rate recovery rate: Athletes measure their heart rate after resting for 10 minutes after load training. Then, record the rate of heart rate decrease per minute, which is the rate of heart rate recovery.

(2) Blood lactate clearance speed: After load training and resting for 10 minutes, athletes collect blood samples and measure blood lactate concentration. Then, the rate of decrease in blood lactate concentration, i.e. the rate of blood lactate clearance, is recorded every minute.

(3) Psychological stress level: Athletes fill out psychological stress questionnaires to evaluate their psychological stress level.

(4) Flexibility, strength and balance ability: The athletes conducted flexibility, strength and balance achievement test to assess the physical quality of athletes.

4.2. Experimental results

After the experiment, we conducted data statistics and analysis, and obtained the following experimental results:

(1) Heart rate recovery rate: The heart rate recovery rate of the experimental group athletes was (15.20 ± 2.36) bpm/min, while the heart rate recovery rate of the control group athletes was (11.35 ± 2.54) bpm/min. The difference in heart rate recovery speed between the two groups of athletes was statistically significant ($P < 0.05$).

(2) Blood lactate clearance speed: The blood lactate clearance speed of the experimental group athletes was (2.01 ± 0.34) mmol/L/min, while the blood lactate clearance speed of the control group athletes was (1.49 ± 0.23) mmol/L/min. The difference in blood lactate clearance speed between the two groups of athletes was statistically significant ($P < 0.05$).

(3) Psychological stress level: The psychological stress score of the experimental group athletes was (18.2 ± 3.1) , while the psychological stress score of the control group athletes was (22.8 ± 4.2) . The difference in psychological stress scores between the two groups of athletes was statistically significant ($P < 0.05$).

(4) Flexibility, strength, and balance ability: The flexibility, strength, and balance ability of the experimental group athletes were significantly improved. In the flexibility test, the average score of the experimental group athletes was (86.2 ± 3.7) points, while the average score of the control group athletes was (80.5 ± 4.2) points; In the strength test, the average score of the experimental group athletes was (75.6 ± 4.1) points, while the average score of the control group athletes was (69.4 ± 3.8)

points; In the balance achievement test, the average score of the athletes in the experimental group was (78.5 ± 5.2) points, and the average score of the athletes in the control group was (72.3 ± 4.5) points. The differences in the three indicators were statistically significant ($P < 0.05$).

In summary, the experimental results indicate that college fitness yoga has a positive effect on the recovery of sports fatigue among football players, and can significantly improve their recovery ability and performance during training and competition. Among them, the heart rate recovery rate and blood lactate clearance rate of the experimental group athletes were significantly faster than those of the control group, indicating that yoga training has a certain improvement effect on the cardiovascular function and metabolic level of athletes; The psychological stress scores of the experimental group athletes were significantly lower than those of the control group, indicating that yoga training can help alleviate the psychological stress of athletes; The flexibility, strength, and balance abilities of the experimental group athletes have significantly improved, indicating that yoga training has a certain promoting effect on the physical fitness of athletes.

5. Conclusion

This study analyzes the mechanism of sports fatigue in football and empirically studies the effect of college fitness yoga on the recovery of sports fatigue for football players. It is concluded that college fitness yoga has a positive effect on the recovery of sports fatigue for football players. Providing an effective fatigue recovery method for football players can help improve their training effectiveness and game performance. However, this study only conducted empirical research on a certain university football team, with a limited sample size. Future research can expand the sample range to further verify the universality and effectiveness of university fitness yoga on the recovery of sports fatigue for football players. At the same time, the role of yoga in fatigue recovery can be studied for athletes at different stages and different sports, providing more effective methods for athletes' fatigue recovery.

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