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Laser Scanning Confocal Microscopy Study on Intracellular Calcium Changes in Rat Myocardium after Endurance Training and Suspension

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Abstract: Long-term high-intensity physical training will cause the heart of athletes to be prone to myocardial strain due to a state of oppression. How to scientifically and rationally plan the endurance training time and intensity of athletes to ensure the health of athletes has always been a sports coach. And the hot issues concerned by various biomedical scientists. To this end, this article uses laser scanning confocal microscopy to study the changes of calcium ions in rat cardiomyocytes after endurance training and suspension training, with the purpose of specifically analyzing the mechanism of changes in the structure and function of the sports heart to provide scientific planning for athletes' endurance training theoretical reference. In this paper, 40 adult male SD rats were selected as experimental objects. After one week of normal feeding, they were randomly divided into 12 endurance training groups, 8 training control groups, 12 suspension training groups, and 8 suspension control groups. Animal training model was established and intracellular calcium samples were prepared. Then, the laser scanning confocal microscope was used to observe the changes of calcium ion in each group. The final result is that endurance training is beneficial to the proliferation and division of myocardial cells; different training cycles and suspension cycles have a greater impact on calcium ion concentration, the longer the training time, the greater the intracellular calcium ion concentration in the myocardium, and with the extension of the suspension period, the rate of decrease in calcium ion concentration also increases accordingly; endurance training does not have much effect on the body's hematological indicators ($P>0.05$); endurance training is conducive to improving calcium ion intake and release of myocardial sarcoplasmic reticulum and ATPase activity of calcium ion. The results of the study prove that calcium changes in cardiomyocytes are important signals for changes in cardiac structure and function.

1. Introduction

1.1. Background and Significance

In recent years, the development of my country's sports undertakings has been improving day by day. While athletes have won glory for the country, they have also suffered great damage to their bodies due to long-term endurance training. The high-load endurance training causes the athlete's heart to suffer long-term compression and myocardial strain, which seriously endangers the health of the body. In order to reduce the inconvenience and pain caused by athletes' sports injuries, many experts and scholars have conducted research on this issue. Based on the research of your predecessors, this article proposes an animal model for establishing endurance training, using laser scanning microscope a method to observe the changes of myocardial cells and intracellular free calcium after endurance training and suspension training.

The laser scanning microscope is a modern high-tech technology that combines laser scanning technology and microscope imaging technology. It is equipped with a laser scanning device on the microscope, which can realize all-round observation and detection of trace elements such as cells. Observe major breakthroughs in instruments and equipment in biology and other fields. Using a laser scanning microscope to observe the changes in calcium in myocardial cells after endurance training and suspension of training is conducive to a more detailed and accurate judgment of the effect of endurance training on intracellular calcium changes in rat myocardial cells, so as to better study the endurance training on the human body Influence, to provide sports athletes with scientific planning of endurance training time and intensity.

1.2. Related Work

Sports activities are a worldwide event, which is related to the honor and status of each country. To show the sports style and charm of a country, it is inseparable from the hard work of each athlete. However, long-term excessive physical training has caused a certain amount of injury to athletes. Research and analysis of the impact of endurance training on human function, and scientific training for athletes to protect their health have become hot topics for discussion and research by experts and scholars from various countries.Xian Qian and Xiaolu Shi studied the effect of pa glucoside, the main monomer component of Jinxueyuan granules, on the Ca^{2+} concentration in salivary gland cells to further explore the salivation promotion mechanism and effective monomer composition of Jinxueyuan granules. He proposed a method of cultivating neonatal rat salivary gland cells in vitro and adding Fluo-3AM fluorescent probe to observe the change of intracellular Ca^{2+} concentration with confocal laser scanning microscope. The research results showed that there was no significant change in intracellular Ca^{2+} concentration in the Hank medium treatment group without pa medicin or the high-dose pa medicin (10^{-2}mol/L) Hank medium treatment group ($P>0.05$); However, in the low-dose pa glucoside (10^{-4} mol / L) treatment group, intracellular Ca^{2+} concentration increased significantly ($P=0.001$). They indicated that treatment with calcium channel blocker verapamil hydrochloride or D-Hank's medium without Ca^{2+} could not prevent pa pharmacoside-induced intracellular Ca^{2+} elevation (10^{-4} mol/L) ($P<0.05$), however, Pa glucoside can promote the release of endogenous calcium, thereby increasing the concentration of intracellular Ca^{2+} [1]. Ma Nan and Zhao Naishi also studied the effects of three methods of myogenic induction on Ca^{2+} control system differentiation of umbilical cord blood mesenchymal stem cells (UCB-MSCs). They used three types of 5-azacytidine (5-aza), cardiomyocyte lysate and cardiomyocyte induction medium to induce canine umbilical cord blood-derived mesenchymal stem

cells. Confocal microscopy detected intracellular calcium ions combined with Flu-3/AM. Their results showed that after induction by the three methods, intracellular calcium concentration changed spontaneously. KCl stimulated 5-Aza and myocardial lysate-treated MSCs to release intracellular Ca^{2+} instantaneously. Myocardial induction medium-treated MSCs also reacted with KCl, but could not induce Ca^{2+} release, but could prolong Ca^{2+} release time [2]. Based on the above research, many are about the effect of exercise on the change of calcium concentration in human bones or cells, but there are few studies on the effect of changes on human heart and its function. Therefore, this paper proposes to use rats to establish animal models, through laser scanning confocal Observe the changes of intracellular calcium in rat myocardium after endurance training and suspension training with a microscope to study the effect of exercise on the function of human heart and the changes of calcium ions in the surrounding cells.

1.3. Innovation in this Article

The innovations of this article are mainly reflected in the following aspects: (1) The research theme is in line with current hotspots and current affairs, which has extremely high social practical significance and discussion value; (2) The establishment of animal models makes the study of myocardial intracellular calcium available. Carrier, and the use of laser scanning confocal microscope also makes the detection of experimental results more accurate and scientific; (3) The content of experimental research and detection includes changes in the number of cardiomyocytes, changes in peak and concentration of intracellular free calcium in the myocardium, different The effect of endurance training cycle and suspension cycle on the calcium ion of myocardial cells in each group of rats, hematological changes standard, the maximum calcium ion uptake and release of myocardial sarcoplasmic reticulum, and the calcium ion ATPase activity of cardiac sarcoplasmic reticulum The factors considered are numerous and involve a wide range of aspects, which makes the conclusion of this study reasonable and has high credibility.

2. Laser Scanning Confocal Microscope to Observe the Changes of Intracellular Calcium in Rat Myocardium after Endurance Training and Suspension of Training

2.1. Laser Scanning Confocal Microscope

(1) Laser scanning technology and optical microscope imaging technology

Laser scanning technology is also called three-dimensional laser scanning technology. It is a high-tech technology that began to appear in the 1990s. It can quickly acquire the three-dimensional coordinate data of the surface of the measured object in a large area and high resolution through high-speed laser scanning measurement. It is quickly and automatically stored and aggregated into cloud data, and then analyzed by a computer system connected to it, and finally a three-dimensional three-dimensional model is built in the form of an image. Compared with the traditional single-point measurement method, laser scanning can achieve more accurate and rapid measurement of complex objects and environments [3-4].

Optical microscope imaging technology is widely used in the fields of medicine and biological research. It is one of the most important technologies for observing and studying microbial cells, and is also the key to open the door to the world of microbes. It uses optical principles to image and magnify the projections of microorganisms that cannot be seen by the human eye, so that people can observe and study the internal structure information of microorganisms. With the development of science and technology, people have developed confocal microscopes with higher magnifications,

which have higher optical resolution and visual contrast than traditional microscopes, and the image quality is clearer. The confocal microscope is based on the traditional microscope with a pinhole baffle, using the principle of confocal, it uses point-by-point illumination and spatial pinhole modulation to remove the non-focus plane scattered light of the sample, only to the sample the scanning measurement of the focus improves the accuracy of the measurement [5-6].

(2) Working principle of laser scanning confocal microscope

Adding a laser scanning instrument to the confocal microscope is a laser scanning confocal microscope. Its working principle is to use the light hole behind the light source of the confocal microscope and the detection hole located in front of the detector to achieve point illumination and point detection of the observed object. , Use a laser scanner to emit detection light from a point light source, and focus the light source through the aperture to the object to be observed. If the object to be observed is exactly at this focus, then confocal to the object is achieved, also called Confocal; if the object is not in focus, then by continuously adjusting the lens, the detection light is folded in other directions through the lens until it is focused on the pinhole position of the baffle. This small hole is the focus position. In addition to the focal point, the reflected light at any other point will be blocked by the detection hole. Finally, through the point-by-point collection, the detection of the depth and height of the focus is completed, and the three-dimensional scanning and measurement of the object are completed, thereby establishing the three-dimensional model of the object [7].

2.2. Calcium Ion Changes in Cardiomyocytes

(1) Cardiomyocytes

Cardiomyocytes are muscle cell tissues located around the heart, also called myocardial fibers. They are innervated by vegetative nerves and have the ability to excite and contract. According to the histological characteristics and functional differences of cardiomyocytes, they can be divided into working cells and autonomic cells. Working cells are ordinary cells, which have the function of performing contraction. It does not have automatic rhythm, but it has the function of conducting excitement. Under external stimulation, it can produce excitatory transmission to the central nervous system of the brain; autonomic cells are special conduction systems that make up the heart. Not only can it automatically generate rhythmically excitement, but also has the function of transmitting excitement to the brain. It is a special organization that generates excitement and transmits excitement in the heart, and plays an important role in controlling cardiac rhythmic activities [8].

(2) Intracellular calcium ion

Calcium is an indispensable trace element in all mammals, it is the main component of animal bones and teeth, and it is also an important activating factor in cells. It plays an extremely important role in maintaining strong bones, healthy teeth and regular heart rhythm. In addition, for the human body, calcium is also beneficial to improve sleep quality, promote metabolism and strengthen the nervous system. Calcium ion is an important signal that reflects the characteristics of the human body and various animal bodies. It plays an important role in regulating our physiological activities and is a signal of survival and death. Generally, to judge the body's disease, we have to detect the changes of calcium ions in cells in the body, and this change is to check the concentration gradient change between cytoplasmic calcium ions and intracellular calcium pool or extracellular calcium ions [9-10]. This article is to study changes in calcium ions in cells, that is, we want to study the changes in the concentration of cytoplasmic ions and intracellular calcium ions. The laser scanning microscope is an organic combination of three-dimensional laser scanning technology and confocal

microscope technology. It fully utilizes the advantages of laser scanning and microscope imaging, and shows the advantages of 1+1>2. Cell research, geographical geological survey and other aspects have a broader role, is a truly epoch-making and milestone high-tech products.

2.3. Preparation of Rat Cardiomyocyte Samples

First, take a glass beaker with a lid, put a piece of gauze soaked in ether, put the prepared rat in the glass beaker for anesthesia, and then sterilize the abdominal skin with iodine and alcohol. Dissect under sterile conditions to remove the internal heart and quickly place it in 50mmol/L CD-Hanks solution. Then cut the ventricular muscles, rinse the blood, and use surgical scissors to cut them into 1×3mm tissue pieces. After completing the series of steps, drain the CD-Hanks solution, add 10 ml of trypsin solution, let it stand at 35℃ for 5 minutes, then remove the upper suspension and add an equal amount of serum-containing medium. After terminating the digestion, remove the supernatant and add serum-containing culture medium. The pelleted cells were blown away and centrifuged, and a cell suspension was made with serum culture solution, and then placed in an incubator containing 35% carbon dioxide at 35℃. Two days later, the samples were taken for cardiomyocyte separation to obtain myocardial fibroblasts and cardiomyocytes, respectively. Cardiomyocytes were placed in the culture medium at 1×105 cells/ml, and then 5-bromodeoxypyrimidine nucleoside was added to inhibit the proliferation of non-cardiomyocytes, and the culture medium was changed every two days for the cardiomyocytes. After the cardiomyocytes were cultured in the culture medium for 24 hours, they were replaced with serum-free culture medium, the culture was continued for 48 hours, and then the culture medium was changed every 8 hours. Finally, the rat cardiomyocyte sample is completed, and then the cells are collected for measurement [11-12].

3. Laser Scanning Microscope Research on the Changes of Intracellular Calcium in Rat Myocardium after Endurance Training and Training Suspension

In order to explore the effect of exercise on the structure and function of the human heart, and analyze the changes of calcium ion concentration in the myocardial cells of athletes through long-term endurance training. In this paper, SD rats are used as experimental objects to train the endurance training of the rats. Then, the laser scanning confocal microscope is used to observe the changes of calcium ion concentration in the myocardial cells after endurance training and suspension to analyze the endurance training on the myocardium effects of changes in intracellular calcium ions.

3.1. Selection and Grouping of Experimental Objects

In this experiment, 40 adult male SD rats were selected, and their weight was controlled between 200-300g, and they were randomly grouped after 1 week of routine feeding. Among them, 12 were in the endurance training group, 8 were in the training control group, 12 were in the suspension training group, and 8 were in the suspension control group. Rats in each group were reared and numbered in cages, keeping the feeding environment consistent, temperature, moderate and proper, well ventilated, 8 hours of natural light per day, standard common feed feeding, free access to drinking and drinking water, during which the diet was recorded and weighed every weekend once. According to the grouping, the training group and the suspension training group first exercised the normal load at the same load for 6 weeks, and after 6 weeks, the suspension training group was

suspended for 4 weeks. During this period, the performance of the rats on the treadmill before and after training was observed and recorded.

3.2. Experimental Equipment Instruments and Reagents, Tools

The instruments and equipment required for this experiment are: laser scanning confocal microscope, incubator, mouse treadmill, fluorescent spectrophotometer, cell analyzer, etc.; the reagents used are: calcium ion concentration change indicator, CD-Hanks solution, Trypsin solution, alcohol, anesthetic; tools: scalpel, surgical scissors, glass beaker.

3.3. Establishment of Endurance Training and Suspension Training Rat Models

In this experiment, the rats were trained by treadmill exercise. All rats were fed normally for 1 week before the experiment, and then randomly divided into 12 endurance training groups, 8 training control groups, 12 suspension training groups, 8 suspension control groups, both endurance training groups and suspension training groups. Perform 6 weeks of treadmill training, during which the training standards are the same, the two groups of rats are equally loaded, the treadmill gradient is 5°, the training time is 6 days per week, 1 hour per day training mode, the training speed is maintained at 10m/ min. After the end of the 6-week training period, the suspension group suspended training for 4 weeks. Observe and record the changes of rats in each group during training period and suspension period.

3.4. Preparation of Calcium Samples in Rat Cardiomyocytes

After the end of the 6-week endurance training period, 12 rats in the endurance training group and 8 in the training control group were sacrificed and dissected after anesthesia treatment; after the end of the 4-week suspension period, 12 rats in the suspension training group were taken out In the control group, 8 rats were dissected in the same way, and then the single live myocardial cells of each group of rats were isolated by isothermal heart perfusion enzymolysis. The specific preparation method is as follows:

First: After the training, the rats in each group were placed in glassware, killed after anesthesia, disinfected with alcohol on the skin of the chest cavity, and then removed the internal heart;

Second: Place the removed organs in CD-Hanks solution, separate them, and cut the myocardial compartment with surgical scissors;

Third: After obtaining the myocardial chamber, wash the surface blood water, and then use a knife to cut into a uniform size of tissue;

Fourth: Discard the CD-Hanks solution, re-add 10ml of trypsin solution to the container, and then put it in a room with a room temperature of 35℃ for 5 minutes;

Fifth: remove the upper suspension and replace it with an equal amount of serum-containing culture medium. After standing for 10 minutes, pour off the supernatant and replace it with serum-containing medium;

Sixth: The cell pellet was blown away and centrifuged to make a cell suspension, which was then placed in a 35℃ incubator containing a small amount of carbon dioxide.

Seventh: Two days later, the samples were taken for cardiomyocyte separation. 5-Bromodeoxypyrimidine nucleoside was added to the serum-containing culture medium to inhibit the proliferation of non-cardiomyocytes. After 24 hours, they were replaced with serum-free culture medium and the culture was continued for 48 hours. The calcium ion sample of rat myocardial cells

is ready.

3.5. Contents of Experimental Observation and Testing

Laser scanning microscope was used to determine the dynamic changes of calcium ions during the contraction of live myocardial cells in rats, including changes in the number of myocardial cells, changes in the peak and concentration of intracellular free calcium in the myocardium, different endurance training cycles and suspension training cycles for each group of rats The influence of myocardial cytosolic calcium ion, hematological change standards, the maximum calcium ion uptake and release of the myocardial sarcoplasmic reticulum and the myocardial sarcoplasmic reticulum calcium ATPase activity.

3.6. Statistical Processing of Experimental Data

The experimental data was analyzed and processed by statistical software SPSS22.0. The data of each group was expressed as the mean ± standard deviation ($x \pm s$). The comparison between the two groups was tested by the t test method, and the analysis of variance between multiple groups was used to $P<0.05$ indicates that the difference is statistically significant. The formulas involved are:

$$\sigma(r)=\sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i-r)^2} \tag{1}$$

$$t=\frac{\overline{X_1}-\overline{X_2}}{\sqrt{\frac{\sigma_{x_1}^2+\sigma_{x_2}^2-2\gamma\sigma_{x_1}\sigma_{x_2}}{n-1}}} \tag{2}$$

$$s^2=\frac{(x_1-M)^2+(x_2-M)^2+(x_3-M)^2+\ldots+(x_n-M)^2}{n} \tag{3}$$

4. Analysis of Experimental Results of Laser Scanning Microscope on Changes of Intracellular Calcium in Rat Myocardium after Endurance Training and Training Suspension

In the third part of the article, we used SD rats as the experimental object, using laser confocal microscope to conduct endurance training and observe the changes of intracellular calcium ion in rat myocardium after suspension training. In this chapter, we will focus on the recorded experiments, analyze the data and phenomena, and discuss the final results of the experiment in detail.

4.1. Changes in the Number of Rat Cardiomyocytes in Each Group

After 6 weeks of endurance training and 4 weeks of suspension training, the rats in each group were sacrificed to remove their internal hearts, and then the intracellular calcium samples of the myocardium were prepared. The laser scanning confocal microscope was used to observe the intracellular calcium samples of the rats in each group. The number of cardiomyocytes and cardiomyocyte division index changes, the results are shown in Figure 1.

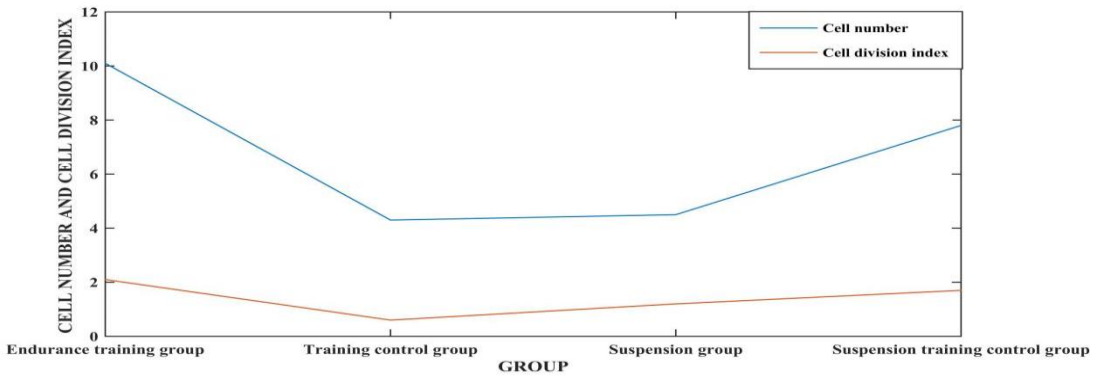

Figure 1. Changes in the number of myocardial cells and division index of rats in each group

Note: The unit of cardiomyocyte number is ×10, and the index unit is ×%.

Figure 1 shows that the number of cardiomyocytes and cardiomyocyte division index of rats in the endurance training group were significantly higher than those of other groups. The number of cardiomyocytes reached 910 and the cardiomyocyte division index reached 5.1%; the number of cells and the index of cardiomyocyte division are the lowest in the four groups; the number of cardiomyocytes and the index of cardiomyocyte division of the rats in the suspension group are significantly lower than those in the endurance training group, and tend to change to normal values. The difference between the groups was statistically significant ($P<0.05$). This shows that endurance training can promote the growth of the number of myocardial cells and the division index of myocardial cells. When in exercise, the myocardial cells will generate excitement and transmit the excitement to the central nervous system of the brain. When this state continues for a long time, in order to maintain normal work, the number of cardiomyocytes will increase significantly, and the cell division index will suddenly accelerate.

4.2. Effect of Different Training Cycles and Suspension Cycles on Calcium Ions in Rat Cardiomyocytes

In order to further examine the effect of different endurance training cycles and suspension cycles on calcium ions in cardiomyocytes, we recorded the weekly changes in the concentration of calcium ions in myocardial cells of each group of rats during the Figure 2 and Figure 3.

As shown in Figure 2, the calcium concentration of myocardial cells in the endurance training group was 425mol/L in the first week. As the training period increased, the calcium ion concentration showed an increasing trend. By the end of the sixth week of endurance training, the The calcium ion concentration reached the highest value, 714mol/L; while the calcium ion concentration of myocardial cells in the training control group rats did not change significantly during the six-week training period, the calcium ion concentration value fluctuated less, and the concentration value was higher than the endurance training The group is much lower. As shown in Figure 3, the concentration of calcium in the cardiomyocytes of the rats in the suspension group is significantly smaller than that of the suspension control group, and with the extension of the suspension period, the decrease in the calcium concentration of the suspension group rats is faster than that of the control group its much faster. This shows that endurance training can increase the concentration of calcium ions in cardiomyocytes, and the longer the training time, the more obvious the increase in calcium ion concentration; after the suspension of training, the cardiomyocytes are

no longer in a high load state, and the free calcium ions The speed also slows down accordingly, causing its concentration to decrease.

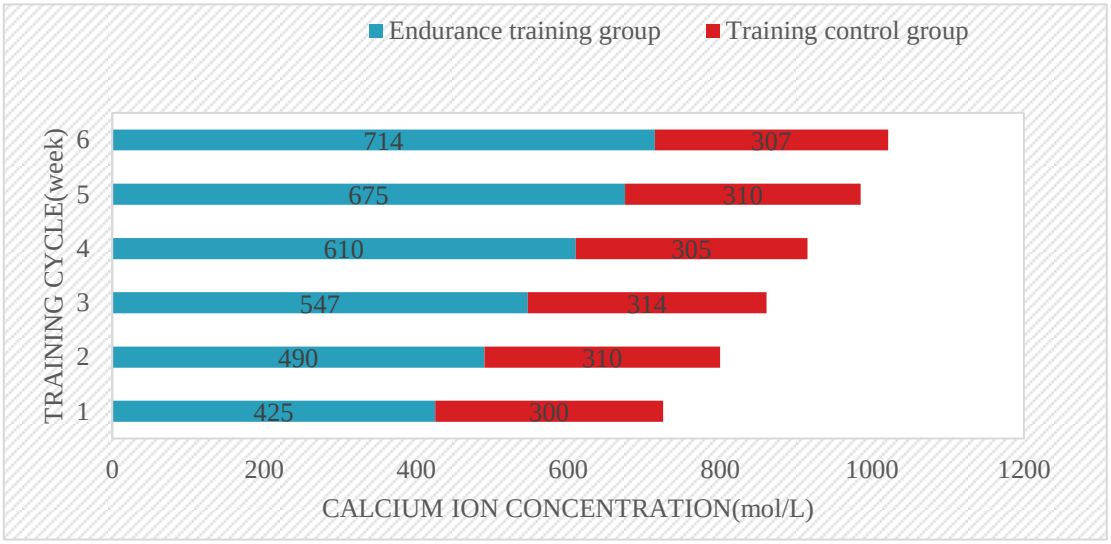

Figure 2. The effect of different training cycles on calcium ion in rat cardiomyocytes

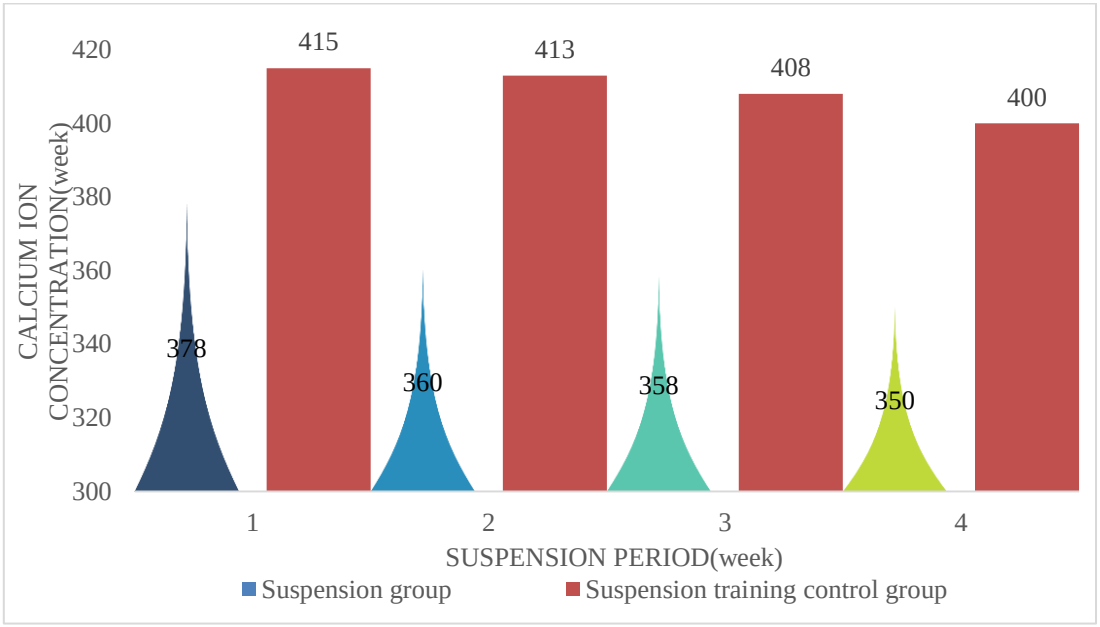

Figure 3. The effect of different suspension periods on calcium ion in rat cardiomyocytes

4.3. Analysis of Test Results of Rat Hematology Indexes

After 6 weeks of endurance training, we compared the hematology indexes of the endurance training group and the suspension training group with those of the control group. The measured indexes were the number of red blood cells, hematocrit, and hemoglobin content. The comparison results are shown in Table 1 and Figure 4.

Table 1. Comparison of test results of hematological indexes of rats in each group

Group	Number of red blood cells ($\times 10^{12}$/L)	Hematocrit (%)	Hemoglobin content (g/L)
Endurance training group	9.568±0.341	39.476±4.217	170.213±14.271
Training control group	7.590±0.658	37.376±4.190	165.259±13.219
Suspension group	8.950±0.632	38.573±4.60	169.249±13.557
Suspension training control group	7.739±0.578	37.510±4.202	164.036±14.019

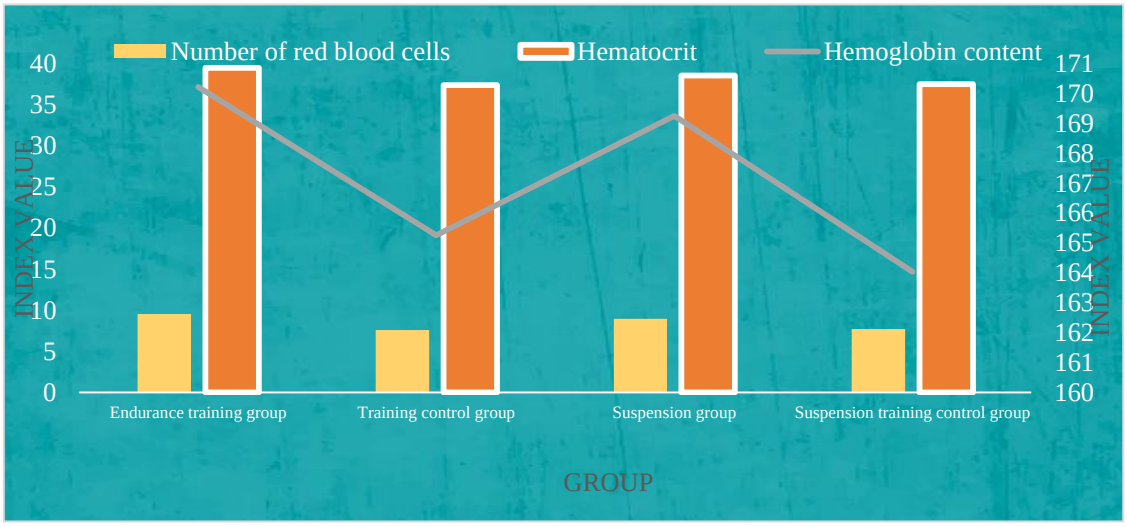

Figure 4. Comparison of test results of hematological indexes of rats in each group

According to Table 1 and Figure 4, the changes in the three indexes of red blood cell count, hematocrit, and hemoglobin content in the endurance training group and the training control group did not fluctuate much, and the three indexes between the two groups were not significantly different ($P>0.05$); the three indexes of red blood cell count, hematocrit and hemoglobin content between the suspension training group and the suspension training control group were also not significantly different ($P>0.05$). Therefore, there is no statistical difference between the endurance training and the suspension training on the hematological indexes of rats.

4.4. Analysis of Calcium Ion Uptake and Release in Rat Myocardial Sarcoplasmic Reticulum and Calcium Ion Atpase Activity

The specific conditions of calcium ion uptake and release, and calcium ion ATPase activity of the myocardial sarcoplasmic reticulum of rats in each group are shown in Table 2 and Figure 5.

Table 2. Calcium ion uptake and release of myocardial sarcoplasmic reticulum in each group of rats and sarcoplasmic reticulum calcium ATPase activity

Group	Number	Ca^{2+} uptake	Ca^{2+} release	Ca^{2+}-ATPase
Endurance training group	12	1.342±0.155	1.764±0.455	0.098±0.015
Training control group	8	0.328±0.174	0.846±0.479	0.042±0.057
Suspension group	12	0.621±0.346	0.540±0.225	0.042±0.035
Suspension training control group	8	0.841±0.267	1.021±0.358	0.080±0.023

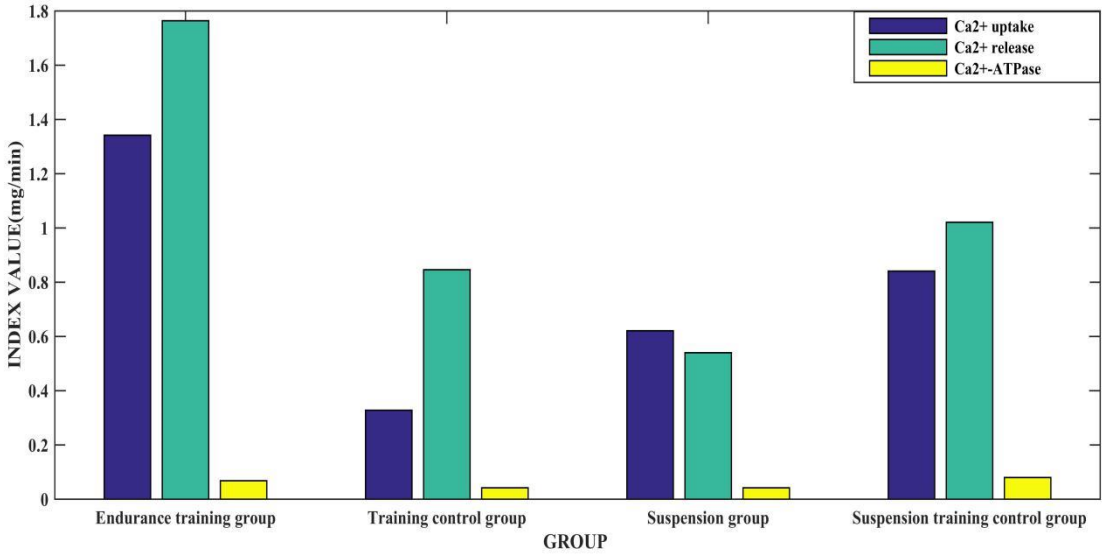

Figure 5. Calcium ion uptake and release of myocardial sarcoplasmic reticulum in each group of rats and sarcoplasmic reticulum calcium ATPase activity

From Table 2 and Figure 5, we can see that the endurance training group is significantly different from the training control group ($P<0.01$). Calcium ion uptake and release of myocardial sarcoplasmic reticulum and calcium ion ATPase activity in the endurance training group were significantly higher than those in the general control group; the difference between the suspension training group and the suspension training control group is also significant ($P<0.05$); and the difference between the endurance training group and the suspension training group is more significant ($P<0.01$). According to the data, the calcium intake and release of the myocardial sarcoplasmic reticulum and the calcium ATP enzyme activity of the suspension group were only half of the endurance training group. This shows that the endurance training and the suspension of training have a significant effect on the changes of myocardial calcium.

In summary, the number of cardiomyocytes, cardiomyocyte division index, calcium ion concentration changes in cardiomyocytes, calcium ion uptake and release of myocardial sarcoplasmic reticulum, calcium ion in cardiomyocytes ATPase activity has a certain effect, but there is no significant effect on the hematological indicators such as the number of red blood cells, hematocrit and hemoglobin content of cardiomyocytes. Endurance training increases the number of cardiomyocytes and cell division index, increases the concentration of calcium ions in cardiomyocytes, and the longer the training time, the greater the concentration of calcium ions in cardiomyocytes.What is more, endurance training also improves the calcium ion uptake and release of the myocardial sarcoplasmic reticulum, and increases the calcium ion ATPase activity in the myocardial cells.

5. Conclusion

In recent years, sports activities and events have attracted the attention and enthusiasm of the people of the whole country and even the world. As a participant of sports, athletes' physical quality has attracted much attention. We know that strenuous exercise will damage the human mechanism. For sports athletes, long-term high-intensity sports endurance training has accumulated a lot of pain

in their bodies, such as bone damage and myocardial strain. In order to reduce the torture caused by athletes' sports injuries and improve their physical performance, it is particularly important to study and analyze the impact of endurance training on human function.

This study specifically studied the impact of endurance training and suspension training on cardiac function and structure. By using SD rats as the experimental object and using treadmill training to establish an animal model of endurance training and suspension training on calcium changes in rat myocardial cells, then use the current new high-tech observation instrument-laser scanning confocal microscope to observe and detect the changes of calcium ions in myocardial cells after endurance training and suspension of training.

The final results of this study show that endurance training is beneficial to the proliferation and division of cardiomyocytes; different training and suspension cycles have a greater impact on calcium ion concentration, the longer the training time, the greater the intracellular calcium ion concentration in the myocardium, and with the With the extension of the training suspension period, the rate of decrease in calcium ion concentration is accelerated accordingly; endurance training does not have much effect on the body's hematological indicators ($P>0.05$); endurance training is conducive to improving calcium ion intake and release of the myocardial sarcoplasmic reticulum Amount and calcium ion ATPase activity. All in all, the calcium ion in myocardial cells is an important messenger to transmit the signal of human heart function change. After endurance training and suspension training will have a certain impact on human function, and this effect is reflected by the change of calcium ion. Therefore, through the detection of calcium ions in athletes' myocardial cells, their physical function can be judged, so as to provide guidance for their scientific and reasonable arrangement of endurance training.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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