

# *Improvement and Recovery of Athletes' Physical Fitness by Music Regulation Combined with Sports Nutrition*

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**Keywords:** Music regulation, Sports nutrition, Improvement and recovery of physical fitness, Product difference correlation coefficient

**Abstract:** The most important thing for athletes to improve their performance is to train hard day after day. If they can't keep up with their physical fitness at this time, it will not only be difficult to improve their performance, but also cause damage to their health. In order to study the intervention effect of music on Athletes' physical fitness under the condition of daily sports nutrition supply, this paper selects 12 athletes and divides them into group A and group B according to whether they listen to music during exercise and recovery stage. Group A is the music listening group. Twelve athletes were asked to ride the bicycle at 60 speed and 120 W load. The riding time was determined by the physical fitness of the athletes. The RPE, heart rate, thigh circumference and reaction time were measured before and after the exercise, 5 minutes, 10 minutes, 15 minutes and 20 minutes after the exercise. After the experiment, we found that the RPE values of the two groups were almost the same at the end of the exercise, which was 11.66 in group A and 12.4 in group B. after 10 minutes, the data of group B was 1.34 higher than that of group A. After 15 minutes, group B was 1.61 higher than group A. 20 minutes after the end of exercise, the RPE values of group A and group B were 8.16 and 6.32 respectively. Therefore, music has a significant effect on the improvement and recovery of athletes' physical fitness, and the effect is more prominent 10 minutes after the end of the exercise.

## **1. Introduction**

Sports fatigue is the decline of athletes' physiological or psychological function in training, which is an important topic in sports medicine. The incidence of sports fatigue of athletes is significantly higher than that of non athletes. If they can not be intervened in time, it may lead to sports diseases and injuries. In recent years, music therapy is moving into many fields.

Reasonable use of sports nutrition supplements is an effective means for athletes to improve physical fitness and eliminate sports fatigue. Based on the research results of music regulation and sports nutrition supplement, this paper analyzes the sports nutrition measures of improving and recovering high-level athletes' physical fitness, so as to provide inspiration for maintaining athletes' health and improving their sports ability.

Emotional self-regulation is considered to be one of the most important reasons for music participation of all ages. However, little is known about how the use of music self-regulation develops in one's life. Deperrois discusses the central process and strategy of adult emotional

self-regulation. The data are collected by group interview and the results are analyzed by qualitative content analysis. Participants were 21 people aged between 21 and 70. The people selected by deperrois have certain differences, which are not convincing to some extent[1]. Simon believed that music is an effective means to regulate emotions. However, there is no scale to evaluate the use of different regulatory strategies related to music activities. Therefore, in order to better verify his theory, he constructed a scale. In the scale, he conducted a survey of 10-20-year-old adolescents (n = 1515). The measurement model of music used in emotion regulation scale was based on the previous theoretical model of teenagers using music to regulate emotion. Through a series of confirmatory factor analysis of the survey data, Simon established the music in emotion regulation (MMR) 40 item scale. In addition, Simon also explored the relationship between measurement and related concepts, and studied the differences in the application of music in emotion regulation. This is a good way to verify, but because of individual differences, each person's feelings about music are different, so his scale can not accurately achieve the purpose of the study [2]. Track and field is based on aerobic ability, which requires athletes to have higher aerobic ability. Ross took the track and field athletes as the research object and randomly divided them into experimental group and control group. Methods athletes with sports anemia were selected as experimental group and normal athletes as control group. During the normal training, the experimental group was given iron combined exercise nutrition for 12 weeks, and the control group was given placebo treatment. Red blood cell (RBC), hemoglobin (HB), hematocrit (HCT), serum iron, serum ferritin and TRF were observed before and after the experiment. Ross's experiment is too simple to be accepted, and more experiments are needed to compare [3]. In order to find out the method of functional evaluation and nutrition recovery of athletes during pre competition training, Bachman selected 32 athletes in the national track and field competition for four weeks and tested their biochemical indexes. Bachman through the experimental observation of nutrition recovery during the pre competition training period, when the athletes' functional state is good, the overall performance is better. Bachman's experiment is more accurate, but the environment also has a very important impact on the recovery of athletes' physical strength, so a group of control groups with different environments should be added [4].

In this paper, 12 athletes were divided into two groups for control experiment. Except for music condition, other conditions were kept the same. The two groups of athletes were asked to ride the power bicycle. The athletes were measured every 5 minutes within 5-20 minutes after the exercise, including RPE, heart rate, thigh circumference and reaction time, and the indexes of the two groups were compared.

## **2. Effect of Music Regulation on Motor Recovery**

### **2.1 Music Regulation**

Music regulating physical fitness refers to resonating with the rhythm of athletes in the training process through the melody of music, so as to reasonably mobilize their own physical fitness, which is one of the very effective means to eliminate sports fatigue for the improvement and recovery of physical fitness[5].

#### **(1) Classification**

There are three types of music regulation: pleasant, pleasant and strong sense of rhythm. Each of them has its own characteristics and has different effects on Athletes' mental state and physical consumption. However, there is a common feature among the three, that is, it can regulate the bad emotions of athletes, so as to achieve a relatively stable state. In this way, not only can the psychological burden be avoided, but also the mental health can be achieved and the energy consumption can be reasonably distributed [6].

There are three different forms of music regulation on people's emotional state, namely, excitement, personal emotional calm, body function to maintain balance, and music transmits information through sound waves. It is not only conducive to the work encountered in the pressure, brain tension for rapid elimination of people's attention, but also for the brain quickly into calm meditation state is also very helpful, whether for personal exercise or program performance or even confrontation, through the use of music regulation this way, can obtain very good promotion effect Fruit.

In terms of structure and function of music regulation, there are three different types: dynamic music with strong sense of rhythm, relaxing music and quiet and elegant quiet music. Like rock and roll, dynamic music is not only loud, its rhythm is also very throbbing, but also has a wide range and great changes in music itself. This kind of music plays a great role in strengthening the brain nervous system, cardiovascular system and endocrine system. Relaxation music has beautiful melody, orderly harmony and smooth melody, and its range is narrower than that of dynamic music. Relaxation of this kind of music can reduce the excitability of the nerve, thus producing a relaxed mood. And soothing people's body and mind, relax mood, let them in the embrace of nature, such a comfortable music is the main feature of quiet music.

#### (2) Effect on Sports

Music can have a great influence on the psychological and physiological factors of athletes in training or competition. It can not only control the training action frequency and amplitude, but also can induce the athletes to speed up the competition rhythm and stimulate potential. Therefore, if the rhythm of music or similar music is added to the rhythm of sports training or sports competition to mobilize the atmosphere, not only the rhythm of the nervous system, but also the responsiveness of the brain will be greatly improved, and the coordination ability of athletes will be a great help. In addition, music can also control the psychological activities of athletes to move forward in the right direction, so as to improve the attention and thinking ability in sports, and make the athletes' skills more close to reality in practice, so as to achieve the results in training and competition.

Music can also play a role in controlling the load produced in training and competition. In training or physical education, music can effectively control the size of athletes' exercise load, so as to prevent the physical loss caused by excessive fatigue or the exercise load is too small to achieve the purpose of training effect. Whether in training class or in competition, the exercise load of human body should be rooted According to the function, with the increase of training, the load gradually expands, and reaches the expected value in time [7].

The music rhythm will have an impact on the movement and the competition result, each technical movement in the sports item has its characteristic standard and the movement rhythm, therefore the movement rhythm can well reflect the time of different stages in the movement. In other words, because of the change of movement rhythm, the strength of force, the scale of space and the temporality of technical action will change. The ability to feel the rhythm and rhythm of a player can also be cultivated. It comprehensively reflects people's listening ability, understanding of information and imagination of brain. The sense of rhythm in sports shows a sense of power. It is a change of body's ability to sense speed and strength. People's sense of music rhythm is the comprehensive ability to reflect the sense of rhythm. If people with a good sense of music rhythm cooperate with certain training, they can form a good sense of dynamic rhythm, and naturally alternate in the contraction and release of muscles, so that the body can achieve the best state of the body, so that the most labor-saving method can be used to complete the maximum.

## 2.2 Sports Nutrition

Sports nutrition refers to a variety of different nutritional elements obtained from the outside for

human body, and then through their own characteristics to meet the needs of body function [8]. Sports nutrition is a very good partner for athletes. It can not only supplement the heat consumed in training and repair the muscle tissue damage caused by training, but also promote the metabolism of cells, restore the physical fatigue caused by sports, balance nutrition, and then improve their own physique, so as to achieve the best exercise effect.

#### (1) Categories of sports nutrition

Nutrition is supplemented by sugar. Sugar is the most important energy material needed by the brain. The energy consumed by athletes in training is mainly glycogen. When the sugar in the human body is insufficient, it will directly hinder the training quality of athletes and the improvement of all aspects of ability and ability [9]. In addition, the intensity and duration of exercise are directly related to glycogen consumption. During exercise, when the maximum oxygen intake exceeds 60% and the duration of exercise exceeds 40 min, the consumption of glycogen will change significantly. The long-distance running is very consistent with this feature, and glycogen consumption is inevitable in sports. Glycogen is also a guarantee for athletes to recover quickly and exercise for a long time. Therefore, athletes should supplement sugar before, during and after sports, and on the basis of increasing the intake of staple food, take more sugary drinks, and then supplement them reasonably in different periods, so as to achieve a reasonable combination of quantity and time [10].

Nutrition is supplemented by liquid. The liquid is mainly water and electrolyte. In training and competition, when the athlete's body temperature rises, it will produce a lot of sweat, which will cause the loss of electrolyte (mainly sodium, zinc, calcium plasma) and sugar in the body. Moreover, the blood volume will be reduced due to dehydration, which will increase the burden on the heart. A large amount of electrolyte loss in the body will have a great impact on the cell membrane potential, making the nerve excitation transfer function appear obstacle, which will reduce the exercise ability. Therefore, it is very important to replenish fluid reasonably during exercise. The supplementary liquid should contain sugar and electrolyte drinks containing various ions, such as 0.7% potassium chloride, 0.7% sugar, appropriate amount of sodium chloride and zinc aspartate. The most important principle of rehydration is that the amount should be small and the number of times should be large. If the amount is too much, it will not be beneficial but harmful. Before exercise, you can supplement about 300-400ml, and during the period of suspension of competition, 130-280ml can be added. Even after the exercise, a small amount of fluid should be added several times. Mineral water should be paid special attention to athletes. If they drink mineral water during sports, it will cause rapid decrease of plasma osmotic pressure and increase of urine volume, which will lead to serious water loss [11].

The nutrition supplement has the antioxidant, the right amount supplement antioxidant material can not only slow down the fatigue, enhance the body's endurance, but also can prevent the occurrence of sports injury and inflammation. After a long-term heavy load exercise, athletes will have a lot of oxygen free radicals produced in the body, which will cause the lipid peroxidation of cell membrane to be violent, thus damaging the permeability of cell membrane, leading to a rapid decline in sports ability. In basketball, football and other high-intensity, large amount of exercise and other sports, it is also a possible factor causing fatigue. Therefore, we should pay enough attention to the use of anti free radical sports supplements during the training period of athletes. It is one of the important means to delay the occurrence of sports fatigue, promote the elimination of fatigue after exercise and the recovery of body function by supplementing antioxidants to fight against a large number of free radicals generated in sports.

#### (2) The function of sports nutrition

The nutrition needed by human body refers to the comprehensive process in which all parts of the body absorb, digest, absorb and utilize food and nutrients from the external environment. Proper

nutrition supplement is not only good for athletes to improve their sports ability and promote the recovery of the body after exercise, but also the material basis for keeping healthy and good sports ability. This has a very good promotion effect on Athletes' state, physical strength and body recovery after exercise. Reasonable nutrition can provide athletes with appropriate energy, which is helpful to the recovery of body after strenuous exercise, the occurrence of sports fatigue or the reduction of pain. It is also helpful to solve some special medical problems in sports training. The reasonable combination of nutrition can keep the energy substance (glycogen) level in the muscle fiber of the barrier in a relative state, In order to reduce the probability of sports injury.

## 2.3 Improvement and Recovery of Physical Fitness

### (1) Physical recovery

The physical fitness level of athletes is very important, which can directly have a great impact on the results of the competition [12]. Athletes' physical fitness consumption is very large in heavy load sports, so nowadays, more and more attention has been paid to improving and restoring physical fitness. In recent years, with the development of science and technology and the innovation and development of sports nutrition, more and more researchers and coaches pay attention to scientific and reasonable supplement of physical fitness, which plays a very important role in maintaining athletes' good physical fitness.

### (2) Effect of sports nutrition on physical recovery

It is a practical and effective way for athletes to recover their physical fitness to provide reasonable use of sports nutrition supplements and appropriate music regulation. There are many kinds of sports nutrition supplements with different effects. We need to supplement and select the nutrition according to the professional characteristics of sports, so as to find the most suitable energy supply needs of athletes. For men's basketball games, the recommended total energy intake of athletes is 3600-4600k. Among them, the three major nutrients required by human body are: carbohydrate 54% - 65%, protein 12% - 16% and fat 25% - 30%. The recommended values of vitamins in the body are vb15-10mg, vb22-2.8mg, vc-140mg, ve6-10mg, The recommended values of mineral intake were: calcium 1000-1800  $\mu$  g, potassium 2500-5000mg, iron 20-26mg, zinc 20-25mg, selenium 50-130mg, sodium < 4800mg. Basketball training and competition is mainly anaerobic exercise, so athletes in training have a very large demand for sugar, control the ratio of nutrients necessary for the three human body, achieve a balanced diet and guide athletes to develop good eating habits. In order to reach the best and most suitable balance point, the individual differences among athletes should be different in diet and nutrition.

## 3. Experiment Process and Method

### 3.1 Experimental Process

#### (1) Subjects

50 male students who are willing to participate in the experiment were collected from a sports university in our city. The basic physical fitness test was conducted for these 50 students. The test contents included heart rate, RPE, responsiveness, muscle strength and leg circumference. In all the test results, a total of 12 healthy athletes with similar test results were selected. One month after the end of the physical fitness test, the athletes fully recovered their physical fitness, and then found 12 students selected before and equally divided them into two groups, 6 in each group. One group listened to music during the exercise experiment and during the period of physical recovery. We referred to the group listening to music as group A. the other group did not listen to any music during the exercise experiment and exercise in the daily environment. We called this group B. the

two groups maintained the intake of sports nutrition during the experimental process and the period of physical recovery.

## (2) Experimental steps

At the end of a month's physical recovery time, find the students of the two groups, and strictly control their exercise amount and diet in the following week, try to make the actions and diet of the two groups consistent, and avoid any dangerous activities, so as to ensure the physical health of the athletes. At the beginning of the experiment, the metronome was placed on the power bicycle, and the athletes were put on the heart rate meter, muscle strength tester and reaction time tester. In addition, the athletes in group A should wear earphones and music players on this basis. Adjust the metronome to the same speed as the power car. Let the athletes sit on the power car which is level with the greater trochanter of femur and do the preparatory work before the start of exercise. Slowly increase the load to 120W within one minute of the athlete's preparation.

After the preparation, the athletes ride the bicycle with 60 speed and 120 W load. At the same time, we also monitor each athlete's heart rate to avoid accidents. From the beginning of the experiment, athletes were asked every three minutes as the basis for recording RPE fatigue value. When the athletes have reached the maximum heart rate value, can not increase or slightly decrease, athletes think that the body can no longer bear to continue to exercise. The heart rate, leg circumference, RPE value and maximal isometric strength of quadriceps femoris were measured immediately after the experiment. The recovery period starts from the fifth minute after the end of the experiment. All the athletes who finish the experiment lie down on the muscle strength tester to recover. Among them, the athletes in group a listened to 60 beats per minute in the recovery stage, while group B did not listen to music, the other conditions were the same as group A. heart rate, reaction time, calf circumference and RPE were measured at 5 minutes, 10 minutes, 15 minutes and 20 minutes after the end of the experiment, and the differences between group A and group B were compared.

## 3.2 Experimental Methods

Correlation analysis method can well measure the closeness and correlation characteristics between two or more variables. SPSS is one of the most widely used and influential correlation analysis methods, which plays an important role in natural science and social science. The degree of closeness between the two variables can be obtained through the two variable correlation analysis of SPSS. The main mode is to limit the value range of any one variable and observe the change direction and range of the other variable. If the two variables can be seen obvious linear relationship after the scatter plot, and they are normal continuous variables, then we can conclude that there is a linear correlation between the two variables. Product difference correlation coefficient is a commonly used index to show the degree of bivariate correlation. Its main feature is that the product difference correlation coefficient can be used to quantify it. The calculation formula is as follows:

$$S^2 = \frac{\sum (X - \mu)^2}{N} \quad (1)$$

$$\text{Cov}(x, y) = E_{XY} - E_X \times E_Y \quad (2)$$

$$r_{12} = \frac{s_{12}}{\sqrt{s_{11}s_{22}}} \quad (3)$$

The correlation coefficient of  $r_{12}$  is between the two variables, where  $s_{11}$  is the variance of variable 1,  $s_{22}$  is the variance of variable 2, and  $s_{12}$  is the covariance between the two variables.

## 4. The Change of Four Kinds of Indexes Before and after the Experiment and the Discussion of Music Effect

### 4.1 Index Changes of the Two Groups Before and after Exercise

Heart rate, reaction time, RPE, calf circumference and muscle strength of group A and group B were measured and compared before the experiment. On the one hand, it is to ensure that the indexes of the two groups before the experiment are almost the same, otherwise the subsequent comparison will be meaningless. On the other hand, it can reflect the influence of exercise on these four indicators. Table 1 shows the five kinds of index values of 12 athletes participating in the experiment before the experiment.

*Table 1 Five Kinds Of Index Values Before Exercise.*

Group	A	B
Heart rate	71	72.17
RPE	6	6
Reaction time(s)	0.331	0.323
Calf circumference(cm)	41.48	41.48
Muscle strength(N·m)	535.5	530.67

It can be seen from Table 1 that in terms of RPE and calf circumference, the data of the two groups before the experiment are the same. In the other three aspects, although there is a gap between the two groups, the difference is small. In terms of heart rate, the six athletes in group B are 1.17 higher than those in group A. in terms of reaction time, the reaction time required by group A is 0.008 more than that of group B. in terms of muscle strength, group A is 4.83 more than group B. therefore, the values of five groups before exercise of the two groups are basically similar.

All the athletes ride the power bicycle with 60 speed and 120 W load, and judge the experiment time according to the athletes' physical conditions. During the exercise process, six athletes in group a wear earphones to listen to music, while group B has no music. The five types of values at the end of the exercise are shown in Table 2.

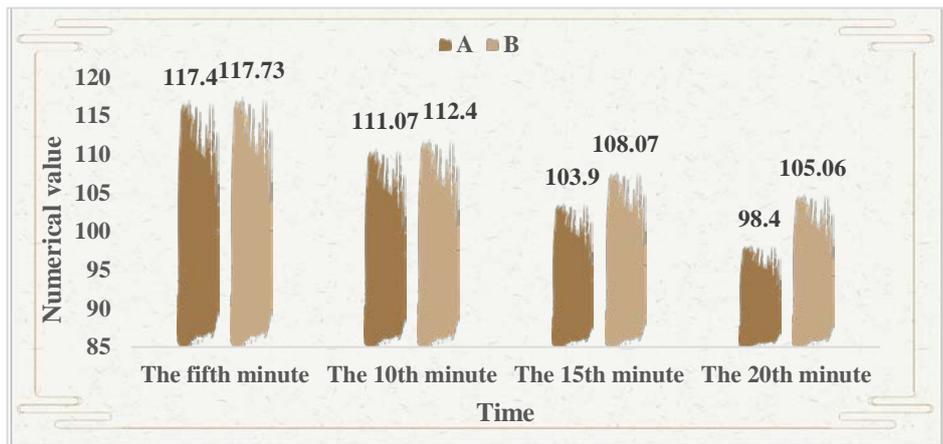
*Table 2 Five Kinds Of Index Values after Exercise.*

Group	A	B
Heart rate	171.67	170.83
RPE	17.83	18
Reaction time(s)	0.379	0.382
Calf circumference(cm)	42.11	42.09
Muscle strength(N·m)	497.17	491.67

According to the data in Table 2, after exercise, the heart rate of group A was 171.67, which was 0.84 higher than that of group B, and RPE was 0.17 lower than that of group B. in terms of reaction time, group A was 0.379s and group B was 0.382s. The leg circumference of group A was 0.02CM larger than that of group B, and the muscle strength of group A was 5.5 higher than that of group B. Compared with the data before exercise, it can be found that music regulation has an effect on the improvement of physical fitness.

### 4.2 Comparison of Heart Rate and Rpe Value between the Two Groups during Recovery

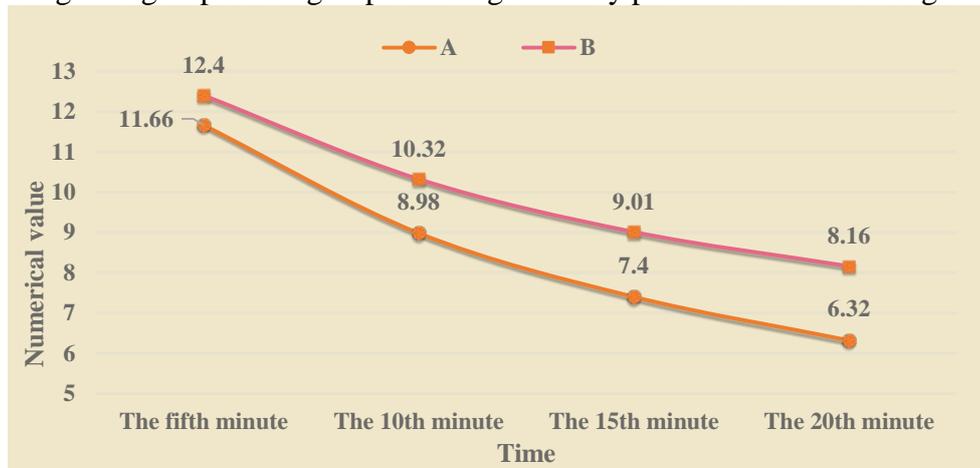
When the athletes can not continue to exercise, that is, the end of the exercise, the fifth minute after the end of the exercise is the starting point of the recovery period. After that, the heart rate, RPE value, leg circumference and reaction time were tested every five minutes. The heart rate changes of group A and group B during recovery period are shown in Figure 1.



*Fig.1 Heart Rate Changes of Group a and Group B during Recovery Period*

According to the data changes in Figure 1, the heart rate of group a decreased more rapidly than that of group B. The average heart rate of group A was 117.4 and that of group B was 117.73 at 5 minutes after exercise. Ten minutes later, the average heart rate of group a dropped to 111.07 and that of group B to 112.4. After 15 minutes, the difference began to be more obvious, with 103.9 in group A and 108.07 in group B. At the last test, the average heart rate of group A was 98.04, and that of group B was 105.06.

The RPE changes of group A and group B during recovery period are shown in Figure 2.



*Fig.2 Rpe Changes in Group a and B during Recovery Period*

According to the data in Figure 2, the RPE values of the two groups were almost the same at the end of five minutes, which was 11.66 in group A and 12.4 in group B. After 10 minutes, the data of group B was 1.34 higher than that of group A. After 15 minutes, group B was 1.61 higher than group A. 20 minutes after the end of exercise, the RPE values of group A and group B were 8.16 and 6.32 respectively.

#### **4.3 Comparison of Reaction Time and Leg Circumference between the Two Groups during Recovery**

The reaction time and leg circumference can also reflect the recovery of athletes. The reaction time of the two groups is shown in Figure 3.

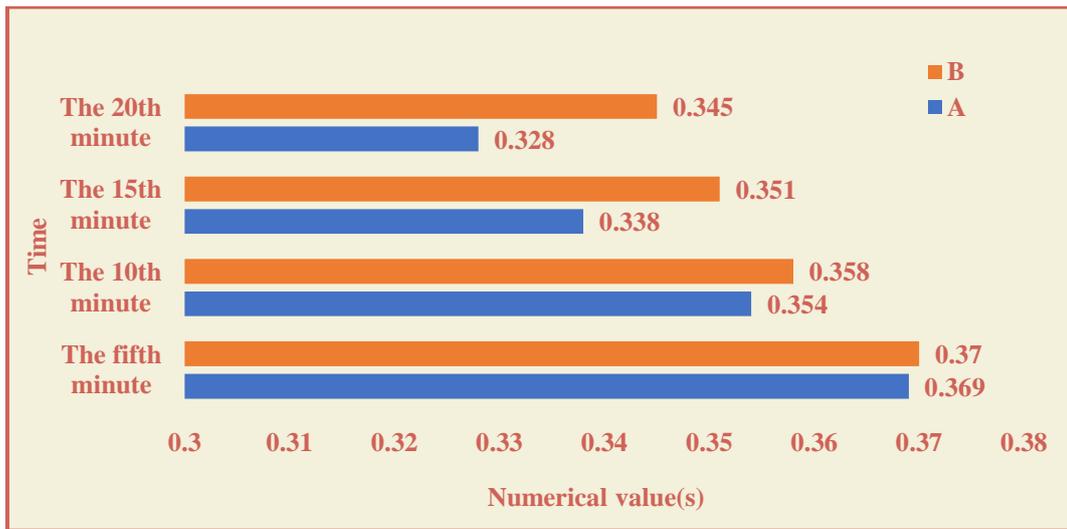


Fig.3 Response Time Changes of Group a and Group B during Recovery Period

It can be seen from Figure 3 that the reaction time of six athletes in group B changes little, while that of group a changes greatly. After 5 minutes of exercise, the reaction time of group A and group B were 0.369 and 0.37 respectively, which were basically the same. The difference began at 10 minutes, and the time difference of 15 minutes became larger. By the last measurement, group A had dropped to 0.328, while group B was still at 0.345.

The changes of leg circumference in group A and group B during recovery period are shown in Figure 4.



Fig.4 Leg Circumference Changes of Group a and Group B during Recovery Period

According to the data in Figure 4, the gap between group A and group B gradually widened from 5 minutes to 10 minutes after exercise. Group a decreased from 41.84 to 41.67, and group B from 41.92 to 41.81. But as you can see from the figure, the gap between the two sets of data at 15 minutes and 20 minutes has narrowed again. Therefore, the effect of music regulation on the calf circumference is the most obvious at the end of exercise 10 minutes.

## 5. Conclusion

For athletes, physical fitness is more important than ordinary people. On the one hand, when in training or competition, lack of physical fitness is likely to cause accidents and cause physical injury. On the other hand, when athletes compete more frequently, physical fitness is particularly important for athletes to play a normal level. In recent years, music therapy is becoming more and more popular. In order to further understand the effect of music regulation, we conducted controlled experiments to highlight the role of music in improving and recovering physical fitness.

In this paper, 12 athletes with similar basic information are selected and divided into group A and group B. The number and daily sports nutrition of the two groups are the same, but the athletes of group A listen to music during and after exercise. The indexes of the two groups were compared, including heart rate, leg circumference, RPE and reaction time. We found that in the comparison before and after the exercise, the difference between the two groups is not significant, which can be ignored. At the fifth minute after the exercise, the difference between group A and group B is not obvious, but at the end of 10 minutes, the change of leg circumference is more obvious. At the next 15 minutes and 20 minutes of measurement, the difference between the two groups was smaller, but the difference of other three indicators increased rapidly during this period, especially heart rate and RPE.

Therefore, music regulation has an obvious effect on the recovery of heart rate, RPE and reaction time of athletes. It is better to insist on listening to music from 15 minutes to 20 minutes after the end of exercise, and the recovery of calf circumference is more obvious in 5-10 minutes after exercise. And what kind of cells and tissues music has changed needs further research.

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