

# Study on the Exercise Load Reflected by Heart Rate Monitoring in Football Match

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## Abstract

In the process of campus football development, how to reasonably arrange the sports load, so that students can not only get full exercise from the movement, but also control the load in a safe and reasonable range, has been the concern of physical education workers. From the point of view of exercise physiology, heart rate is the most direct and effective index to reflect exercise load. By monitoring heart rate, we can timely and effectively grasp the intensity of exercise load.

## Keywords

Football; Heart Rate; Exercise Load.

## 1. Introduction

Through MT sports to provide monitoring services for the national team of middle school students, a more prominent performance is: during the competition, the heart rate decreases for a period of time, and the corresponding speed is almost zero. This naturally corresponds to the intermission of the game. From the monitoring, we know that the player's maximum heart rate has reached 190bpm (beats per minute), and can recover to 100bpm to 120bpm at halftime. The center rate changes frequently during the competition. When we pull the time axis of the game apart, we can see that the heart rate of each group will increase significantly after running, and decrease with the slowing down of the speed; when running again, the heart rate will increase immediately. This just reflects the characteristics of the football match - medium and high intensity aerobic energy supply as the main, intermittent anaerobic energy supply as the auxiliary. Due to the differences of age, gender, athletic ability, tactics and situation on the field, it is difficult to define the most suitable heart rate range with a simple interval. However, we can still sum up certain rules from tens of thousands of samples collected by people, and establish multiple mathematical models related to heart rate.

## 2. General rules of heart rate

### 2.1. Age determines the maximum heart rate to some extent

The maximum heart rate is the limit heart rate that the human body can reach. The internationally accepted algorithm is: maximum heart rate (BMP) = 220-age (for example, if a primary school student is 12 years old, the maximum heart rate is  $220-12 = 208$ bpm). But there are also some individual differences.

### 2.2. It's important to know the actual maximum heart rate of a player

Understanding the maximum heart rate is conducive to reasonable control of exercise load. Under laboratory conditions, the test cost is high, we can calculate the maximum heart rate through simple field test: two groups of 400 meter full-scale running or more than two groups of  $12 \times 30$  meter high-speed turn back running, the maximum heart rate value collected during or after the test is basically close to the individual's maximum heart rate.

### **2.3. The maximum heart rate can't simply distinguish good from bad**

There are individual differences in the maximum heart rate, and there is no universal standard. For example, the same 18-year-old professional athletes, more than 80% of the maximum heart rate is more than 200, more than 10% of the maximum heart rate is less than 200, the lowest is only 180. However, it is not clear that there are significant differences in athletic ability among athletes with different maximum heart rates.

### **2.4. The average heart rate can basically reflect the intensity of exercise load**

For football, the average heart rate is generally between 60% and 80% of the maximum heart rate, which can be basically reached in professional matches and high-level campus football matches. The higher the intensity of the game, the higher the average heart rate.

### **2.5. The difference of position and tactics on the field will also be reflected by heart rate**

Generally speaking, the frequency of attack defense conversion of midfield players is higher, the number of activities is more, the heart rate will generally maintain at a high level, less reaching the extreme value of heart rate; front court players and full backs generally need repeated high-intensity running, jogging and walking distance is also more, so the heart rate will generally fluctuate; center backs due to the relatively low intensity and frequency of running, the heart rate level will also change Yes, lower. Therefore, we should pay special attention to the abnormal heart rate situation. In addition, the tactical arrangement and the situation on the field also have a great impact on the heart rate. For example, the overall heart rate level of players is relatively low when.

### **2.6. Analysis of heart rate should be combined with exercise state**

The human body can be compared with a car. The heart rate is equivalent to the speed of the engine. Whether the car can reach a very high speed depends on the exhaust volume, transmission system, road conditions and other factors. Similarly, the analysis of heart rate depends on the specific exercise situation. If the heart rate is very high but the running speed (or jumping, confrontation and other sports) is not high, it indicates that the body's ability to do work is insufficient, which is related to muscle, technology and other factors. The training should pay attention to the cardiopulmonary ability and the body's sports ability at the same time.

### **2.7. Personal vertical comparison is more meaningful**

Because of individual differences and position differences, there is not much reference significance to compare the absolute value of heart rate between players. Although long-term systematic training and physical growth will affect heart rate changes, the short-term heart rate characteristics are relatively stable. Therefore, longitudinal comparison of several consecutive heart rate changes can show the intensity of training or competition, players' engagement and body fatigue.

### **2.8. Fatigue can change the heart rate**

Continuous competition or intensive training will cause the continuous accumulation of fatigue, which can also be reflected from the heart rate. There are several characteristics of heart rate during fatigue: the heart rate rises quickly without much intensity at the beginning of exercise; the heart rate recovers slowly after exercise; the basic heart rate of the day is on the high side, etc. When we find these conditions, we should adjust the training load in time, otherwise we are prone to injury.

## **2.9. Heart rate recovery ability is an effective method to judge exercise load**

Training load can be judged by the speed of heart rate recovery after training or competition. Observe the absolute value and relative value of heart rate drop at 1 minute, 2 minutes and 3 minutes after exercise, and also measure the time when the heart rate drops below 60% of the maximum heart rate. Of course, because the heart rate level before the end of training and competition is not necessarily the same, so the absolute horizontal comparison has little significance. We can judge the exercise load through the statistical value of many people.

## **2.10. With the improvement of training level, the characteristics of heart rate will gradually change**

In the long run, with the improvement of training level and the growth of players, the characteristics of players' heart rate will gradually change. The basic rule is: the basic heart rate will decrease, the overall level of heart rate will decrease under the same intensity of exercise, the heart rate will increase rapidly during high intensity exercise, and the heart rate recovery will accelerate after high intensity exercise.

## **3. Conclusion**

If the heart rate is too high or difficult to reduce, we should pay attention to it; High intensity exercise also needs special attention; It is not a good phenomenon that the heart rate changes too frequently under the condition of continuous exercise of the same intensity, which may be related to excessive fatigue, inadequate body warm-up and physical diseases.

## **4. Suggestion**

Better training plan service for football players and coaches; It is convenient for athletes to adjust their body state in real time and arrange the exercise load reasonably according to their body function; Appropriate and effective function evaluation methods and accurate measurement and analysis of indicators can play an important role in the reasonable and effective adjustment and arrangement of effective training arrangement, the best competitive state, and the prevention of sports injury caused by fatigue training in advance. I believe that with this knowledge, in campus football teaching, training, competition, sports teachers and football instructors can better understand the exercise load through the heart rate.

## **References**

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