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Application strategies of resting heart rate for monitoring training load intensity in football players

Katherine Ning li[1] & Zhiyuan Tan[2]

[1]Associate Professor, Institute of Sports science, Xi'an Physical Education University, China
[2]University of Belgrade, Faculty of Sport and Physical Education, 1000 Belgrade, Serbia

Corresponding Author: Zhiyuan Tan
Corresponding Author Email: zhiyuan_5016@studentmail.fsfv.bg.ac.rs

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ABSTRACT

Resting heart rate, as a vital physiological indicator, holds significant potential in monitoring the training load intensity of football players. This paper systematically explores the concept, role, and application of resting heart rate in football player training. Firstly, it elucidates the concept and role of resting heart rate, including its indication of health status and training adaptation. Secondly, it discusses the importance of resting heart rate in evaluating the training load intensity of football players and proposes corresponding practical application methods. Lastly, it offers some suggestions to facilitate the effective utilization of resting heart rate in football player training. By following these recommendations, coaches and athletes can effectively utilize resting heart rate to optimize training programs for football players, improving their performance and reducing the risk of injury.

Keywords: Resting Heart Rate (RHR), Football Players, Training Load, Medical Supervision.

INTRODUCTION

Resting heart rate refers to the number of heartbeats per minute when the body is at complete rest, typically measured upon waking in the morning, lying in bed, or sitting. With the development of sports medicine and training science, resting heart rate has gradually become one of the critical indicators for assessing individual cardiovascular health and training adaptation. In the training process of football players, monitoring training load intensity is crucial for enhancing athletic performance and preventing sports injuries. As a simple and feasible physiological indicator, resting heart rate has unique advantages in evaluating and adjusting training load. This paper systematically explores the application of resting heart rate in monitoring training load intensity in football players.

A. Concept and Role of Resting Heart Rate

Resting heart rate reflects the basic activity level of the heart, with its leading roles including:

1. Indicator of Health Status: Resting heart rate is often regarded as one of the indicators of cardiovascular health. A lower resting heart rate typically indicates a healthier cardiovascular system, while a higher resting heart rate may be associated with an increased risk of cardiovascular disease（Agbor, V.N.2022）. Therefore, monitoring resting heart rate can provide preliminary insights into the individual's cardiovascular health.

2. Indicator of Training Adaptation: Resting heart rate can also indicate training adaptation. Through long-term aerobic training, the heart muscle gradually becomes more muscular, and the amount of blood pumped per beat increases, leading to decreased heart rate at rest. Thus, changes in resting heart rate can reflect the individual's adaptation to aerobic exercise training（Grässler, B.2021）.

3. Guidance for Training Intensity: Understanding an individual's resting heart rate can help determine training intensity. Based on resting and maximum heart rates, reasonable training goals and intensity can be established to achieve better training effects(Edwards, T.2018).

B. Role of Resting Heart Rate in Football Player Training

1. Evaluation of Training Load Intensity:

Resting heart rate can be essential for evaluating training load intensity. Measuring changes in resting heart rate before and after training can provide insights into the impact of training on the body. Suppose the resting heart rate is higher after training. In that case, it may indicate that the training load is too heavy, necessitating appropriate adjustments to the training plan to avoid adverse consequences of overtraining (Milanović, Z.,2019.)

2. Monitoring Training Effects:

Regularly measuring resting heart rate can monitor changes in training effects (Gąsior, J.S.2024). The resting heart rate may gradually decrease for athletes with sound training effects, whereas for those with poor training effects, the resting heart rate may remain at a higher level or fluctuate. Therefore, resting heart rate can be an essential indicator for evaluating training effects.

3. Adjustment of Training Plans:

Based on changes in resting heart rate, training plans can be adjusted promptly to ensure the scientificity and effectiveness of training. If the resting heart rate increases, reduce training intensity or increase rest time to help the body recover and avoid overtraining (Tesema, G.2021).

C. Practical Application of Resting Heart Rate in Football Training

1. Regular Monitoring:

It is recommended that football players regularly monitor their resting heart rate to understand changes in their physical condition and training effects. Measurement upon waking every morning is suggested to ensure data consistency and comparability. Specifically for football players, especially when team coaches monitor training load, recent hot applications include RPE (Rating of Perceived Exertion) and S-RPE (Session-RPE). These two types of training load recording forms have much subjectivity(Zhao, H., 2023) and there is considerable doubt about the reliability of analyzing training load.

After training, the body can recover to the average resting heart rate within 1-2 days, indicating average training volume. If the resting heart rate remains above the average for one or two days after training, it indicates a lack of sufficient rest. If the resting heart rate remains above the average for 24-48 hours after training, the team can adjust appropriately to enhance players' active recovery.

2. Application of Wearable Devices:

In practice, it is suggested that not only parents or teams with conditions should equip players with wearable bracelets capable of detecting sleep and heart rate, but also the selection of bracelets should be more carefully considered (Capodilupo,2021). Choosing the suitable bracelet is crucial for monitoring sleep and heart rate. Firstly, the bracelet should have high accuracy and reliability to ensure the scientificity and credibility of the data obtained. Secondly, the comfort of the bracelet is also crucial; bracelets that are too large or poorly designed may affect players' wearing experience and even their sleep quality. Therefore, when choosing a bracelet, attention should be paid to its comfort and convenience, ensuring that players can wear it for a long time and obtain valid data.

Furthermore, monitoring items can be further expanded in addition to recording the team's sleep duration, quality, and resting heart rate levels. For example, players' exercise volume and training intensity can be recorded to assess their physical condition and training effects comprehensively (Javed, F.,2023).At the same time, players' emotional and mental states can be recorded to understand their psychological pressure and emotional fluctuations, providing a reference for adjusting training plans. By integrating various data, a more comprehensive understanding of players' physical condition and training status can be obtained, providing a scientific basis and personalized recommendations for training management. This comprehensive monitoring approach helps improve players' training effects, prevents sports injuries, and enhances players' overall health levels. Therefore, continuous exploration and improvement of monitoring methods should be conducted in practice to meet players' personalized needs and achieve the goals of scientific and practical training management.

3. Adjusting Training Plans Reasonably:

Firstly, if resting heart rate continues to increase, it may indicate that the athlete's physical load is too heavy or they are overtraining(Ghouili,2021). In such cases, reasonable adjustments include appropriately reducing training intensity or increasing rest time to aid in recovery and avoid adverse consequences of overtraining. Additionally, if the athlete's maximum heart rate decreases or heart rate variability increases, it may indicate problems with the athlete's cardiovascular function. In such cases, gradually reducing training intensity and considering cardiovascular examinations and treatments should be undertaken(Ghouili2021),. In

conclusion, adjusting training plans reasonably based on heart rate changes requires comprehensive consideration of the athlete's physical condition, training goals, and environmental factors, along with targeted measures to ensure the scientificity and effectiveness of training.

4. Enhancing Athletes' Health Awareness:

Firstly, athletes should understand the basic structure and function of the cardiovascular system, including the heart, blood vessels, and blood, among others. They need to grasp the importance of a healthy cardiovascular system for athletic performance and physical health, as well as the potential harm caused by unhealthy lifestyle habits and unreasonable training methods.

Secondly, athletes must understand methods and indicators for evaluating cardiovascular health, such as resting hands and maximum heart rates. They should learn to properly monitor and record their heart rate data and adjust their training plans to ensure their cardiovascular system remains in good condition.

Furthermore, cardiovascular health education includes guidance on nutrition and lifestyle. Athletes should understand which foods contribute to cardiovascular health and how to balance their diet to improve cardiovascular function properly（Chen, Y.2019）. Additionally, they need to be mindful of controlling their diet's salt, fat, and sugar intake, avoiding smoking and excessive alcohol consumption, maintaining adequate sleep, and engaging in moderate exercise.

5. Application for Returning Athletes:

Returning athletes can assess their physical recovery status by monitoring their resting heart rate. Changes in resting heart rate can reflect the body's adaptation to training and competition, helping athletes determine if they have recovered sufficiently to cope with high-intensity competition and training.

Also, resting heart rate can be essential for adjusting training plans. By regularly monitoring changes in resting heart rate, athletes can promptly identify situations of excessive or insufficient training load and adjust training intensity and duration accordingly to ensure their bodies reach optimal conditions and minimize the occurrence of injuries caused by overtraining.

Lastly, resting heart rate can also be a significant indicator for assessing physical recovery status. Between competitions and training sessions, athletes can judge whether they have fully recovered and can continue with the next round of competition and training by monitoring changes in resting heart rate. This approach can help athletes schedule rest time reasonably, avoid excessive fatigue and injuries, and maintain a competitive state.

CONCLUSION AND RECOMMENDATIONS

Resting heart rate, as a vital physiological indicator, holds significant potential in monitoring the training load intensity of football players. This paper systematically explores the concept, role, and application of resting heart rate in football player training. Firstly, it elucidates the concept and role of resting heart rate, including its indication of health status and training adaptation. Secondly, it discusses the importance of resting heart rate in evaluating the training load intensity of football players and proposes corresponding practical application methods. Lastly, it offers some suggestions to facilitate the effective utilization of resting heart rate in football player training.

By monitoring resting heart rate, coaches and athletes can gain insights into an athlete's overall health and recovery from training. An elevated resting heart rate may indicate overtraining,

illness, or other health issues. Conversely, a decreased resting heart rate may indicate that training is effective or that the athlete is recovering well from training.

Furthermore, resting heart rate can be used to assess training load intensity. In general, high-intensity training will result in a transient elevation in resting heart rate, whereas low-intensity training will result in a decrease in resting heart rate. By monitoring resting heart rate, coaches can adjust training programs to ensure that athletes are receiving appropriate training stimulus, while avoiding overtraining.

In order to effectively utilize resting heart rate, coaches and athletes should consider the following recommendations:

1） Establish a baseline resting heart rate: Measure resting heart rate prior to the commencement of a training program to establish a baseline.

2）Monitor resting heart rate regularly: Monitor resting heart rate regularly throughout the training period to track training load intensity and the athlete's recovery.

3）Consider other factors: Consider other factors, such as sleep, stress, and nutrition, when interpreting resting heart rate changes.

4）Use in conjunction with other measures: Use resting heart rate in conjunction with other measures (e.g., perceived exertion scales and training logs) to gain a more comprehensive view of an athlete's training load intensity.

By following these recommendations, coaches and athletes can effectively utilize resting heart rate to optimize training programs for football players, improving their performance and reducing the risk of injury.

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