SPORTS TRAINING TO DETECT HEART RATE AND BODY TEMPERATURE IN TEENAGERS

TREINAMENTO ESPORTIVO PARA DETECTAR A FREQUÊNCIA CARDÍACA E A TEMPERATURA CORPORAL DE ADOLESCENTES

ENTRENAMIENTO DEPORTIVO PARA DETECTAR FRECUENCIA CARDIACA Y TEMPERATURA CORPORAL EN ADOLESCENTES

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ABSTRACT

Introduction: There are slight differences in heart rate variation (HRV) between athletes from different sports, and different exercise loads justify the most important reason for this slight difference in HRV. Objective: To study the detection of heart rate and body temperature in adolescents by physical training. Methods: Twelve young basketball players were randomly selected. Heart rate variability and body temperature indicators were collected before starting the sports intervention activity, lasting four weeks in a specific protocol. After the intervention period, the participant's heart rate variability indicators and body temperature indicators were collected again. In an attempt to understand physical function training using comparative analysis and data processing obtained before and after the exercise intervention. Results: A high increase in blood circulation velocity after exercise is directly proportional to the increase in body temperature. After four weeks of training, the heart rate of the 12 athletes increased from 92.35±3.65 to 84.77±5.13 beats per minute. Conclusion: Body temperature can rise from the average temperature of 36.5°C before training to 36.7°C. The maximum temperature of 37°C can be reached within 5 minutes after stopping activity. The increasing intensity in physical function training can effectively improve the Standard deviation of the average normal RR intervals and root mean square velocity in the domain index in heart rate variability. ***Evidence level II; Therapeutic Studies - Investigating the results.***

Keywords: Sports; Training, Exercise; Body Temperature.

RESUMO

Introdução: Existem pequenas diferenças na variação de frequência cardíaca (VFC) entre atletas de diferentes esportes, e a razão mais importante para essa pequena diferença de VFC é justificada por diferentes cargas de exercício. Objetivo: Estudar a detecção da frequência cardíaca e temperatura corporal em adolescentes pelo treinamento físico. Métodos: Doze jovens jogadores de basquete foram selecionados aleatoriamente. Os indicadores de variabilidade da frequência cardíaca e os indicadores de temperatura corporal foram coletados antes do início da atividade de intervenção esportiva, com duração de 4 semanas em protocolo específico. Após o período de intervenção, os indicadores de variabilidade da frequência cardíaca dos participantes e indicadores de temperatura corporal foram coletados novamente. Utilizando a análise comparativa e processamento dos dados obtidos antes e após a intervenção do exercício, buscou-se compreender o treinamento de função física. Resultados: O elevado aumento da velocidade da circulação sanguínea após o exercício é diretamente proporcional ao aumento da temperatura corporal. Após 4 semanas de treino, a frequência cardíaca dos 12 atletas passou de 92,35±3,65 para 84,77±5,13 batimentos por minuto. Conclusão: A temperatura corporal pode elevar-se da temperatura média de 36,5°C antes do treino para 36,7°C. A temperatura máxima de 37°C pode ser alcançada em 5 minutos após a interrupção da atividade. O aumento da intensidade no treinamento de função física pode efetivamente melhorar o desvio padrão nos intervalos RR normais e a raiz da velocidade quadratica média no índice de domínio na variabilidade da frequência cardíaca. ***Nível de evidência II; Estudos terapêuticos - Investigação de resultados.***

Descritores: *Esportes; Treinamento Físico; Temperatura Corporal.*

RESUMEN

Introducción: Existen pequeñas diferencias en la variabilidad de la frecuencia cardíaca (VFC) entre atletas de diferentes deportes, y la razón más importante de esta pequeña diferencia en la VFC se justifica por las diferentes cargas de ejercicio. Objetivo: Estudiar la detección de frecuencia cardiaca y temperatura corporal en adolescentes mediante entrenamiento físico. Métodos: Doce jóvenes jugadores de baloncesto fueron seleccionados al azar. Se recogieron indicadores de variabilidad de la frecuencia cardíaca e indicadores de temperatura corporal antes del inicio de la actividad de intervención deportiva, con una duración de 4 semanas en un protocolo específico. Después del período de intervención, se recogieron nuevamente los indicadores de variabilidad de la frecuencia cardíaca y los indicadores de temperatura corporal de los participantes. Utilizando el análisis comparativo y el procesamiento de datos obtenidos

antes y después de la intervención de ejercicios, se buscó comprender el entrenamiento de la función física. Resultados: El elevado aumento de la velocidad de la circulación sanguínea después del ejercicio es directamente proporcional al aumento de la temperatura corporal. Después de 4 semanas de entrenamiento, la frecuencia cardíaca de los 12 atletas pasó de 92,35±3,65 a 84,77±5,13 latidos por minuto. Conclusión: La temperatura corporal puede subir desde la temperatura media de 36,5°C antes del entrenamiento hasta los 36,7°C. La temperatura máxima de 37°C se puede alcanzar dentro de los 5 minutos después de detener la actividad. El aumento de la intensidad en el entrenamiento de la función física puede mejorar efectivamente la desviación estándar en los intervalos RR normales y la velocidad cuadrática media en el índice de dominio en la variabilidad de la frecuencia cardíaca. ***Nivel de evidencia II; Estudios terapéuticos - Investigación de resultados.***

Descriptores: *Deportes; Entrenamiento Físico; Temperatura Corporal.*

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INTRODUCTION

Adolescents are the hope of a country and a nation, and a strong youth means a strong country. In recent years, youth sports are booming, regarding the training monitoring of young athletes, it also gradually gets people's attention.[1] Because young people are quite different from adults in terms of form, function, and psychology, therefore, the monitoring of sports training for young athletes is not the same.[2] How to monitor, what kind of method is used for monitoring, become a hotspot of people's research. With the continuous development of science and technology, people prefer to use simple and non-invasive indicators, the indicator of heart rate variability is simple, convenient, and non-invasive, therefore, this indicator has been paid more and more attention by sports training academia.[3] Heart rate variability (HRV) refers to the difference between the fluctuations of the RR interval (instantaneous heart rate) between heartbeats, in essence, its size reflects neurohumoral factors and regulates the sinus node.[4] Used to evaluate the activity and quantification of the cardiac autonomic nervous system, assess cardiac sympathetic and parasympathetic (vagus) tension and balance. Due to the use of HRV for analysis, it is easy to operate and non-invasive, and can be used to evaluate the state of autonomic nerve function, therefore, it has been widely used in various fields such as medicine, psychology, and sports training. Existing research in the field of sports training, it mostly focuses on the analysis of heart rate variability of adult athletes, college students, middle-aged and elderly fitness people before and after exercise, and research on heart rate variability of adult athletes in different sports before and after competitions, however, there is a lack of research on the heart rate variability of young athletes, and there are few studies on the long-term heart rate variability in different training stages.[5] On the basis of current research, the author is to study the detection of adolescents' heart rate and body temperature by exercise training, randomly select 12 young basketball players, age 18.50±1.35 years old, height 181.10±3.54cm, weight 65.9±5.73kg. Conduct 4-week physical function training for young basketball players, before the start of the 4-week exercise intervention, collect the subjects' heart rate variability indicators and body temperature indicators, after 4 weeks of exercise intervention, the subjects' heart rate variability indicators and body temperature indicators were collected again, through the comparative analysis and processing of data before and after exercise intervention, understand the effects of physical function training on the heart rate variability and body temperature of young basketball players.[6]

METHOD

Research objects

Randomly select 12 young basketball players, age 18.50±1.35 years old, height 181.10±3.54cm, weight 65.9±5.73kg. Good living habits, no respiratory system, disorders of the cardiovascular system, motor and nervous system.

Experimental method

Conduct 4-week physical function training for young basketball players, before the start of the 4-week exercise intervention, collect the subjects' heart rate variability indicators and body temperature indicators, after 4 weeks of exercise intervention, collect the subjects' heart rate variability indicators and body temperature indicators again, through the comparative analysis and processing of data before and after exercise intervention, understand physical function training, the influence on the heart rate variability and body temperature of adolescent basketball players .[7]

Test index

Heart rate variability indicators include two aspects: Time domain indicators and frequency domain indicators: HRV time domain indicators need to be tested mainly include the root mean square value of the difference between adjacent N-N intervals (RMSSD), standard deviation of normal sinus R-R interval (SDNN), NN50 accounts for the percentage of the number of all NN intervals (PNN50) and the standard deviation of the difference between adjacent intervals (SDSD). HRV frequency domain indicators need to be tested mainly including total power (TP), power in the very low frequency range (VLF), power in the low frequency range (LF), the power in the high frequency range (HF), the ratio of LF to HF (LF/HF) and other indicators.

Test method

The instrument used in the ECG test is the Omegawave test system provided by Omegawave Technologies, Inc. of the United States. The experiment mainly collects 5 minutes of ECG data, the collected signal is processed and analyzed by the sporttechnologysystem with heart rate variability analysis software. During the whole test, the test environment should be kept as quiet as possible, and the indoor temperature should be suitable.

Physical function training methods

Physical function training is to improve athletes' exercise level, and new training theories and methods to improve athletes' performance. It includes two aspects, one is motor function training, this is mainly for no dysfunction, exercises of physical athletic ability carried out by athletes with unrestricted movement; The other is physical therapy, mainly aimed at athletes who have movement impairments and restricted activities, first, diagnose the athlete's physical condition, perform targeted training and correction based on the diagnosis results, improve and enhance the body's athletic ability.

The training content includes: Motor function action screening (FMS, SFMA), explosive training (jumping and depth), agility training, muscle strength training (bench press, squat, etc.), recovery training, etc. (active separation stretching, hydrotherapy, etc.) content.

RESULTS

Analysis of Heart Rate Variability Index

HRV is one of the indicators to evaluate the control ability of the autonomic nervous system, in recent years, more and more scholars have begun to pay attention to HRV, and many scholars have devoted themselves to its related research.[8]

Heart rate changes

Exercise intervention lasts for 4 weeks, the subjects' heart rate is measured every week, record the overall changes in the subject's heart rate throughout the training process. The heart rate test was recorded 5 times in the 4 weeks before the start of the sports training, the last measurement is after the training, the heart rate changes in 4 weeks are shown in Table 1. After 4 weeks of training, heart rate of 12 athletes, from the previous 92.35±3.65 times/minute to 84.77±5.13 times for 1 minute.

Analysis of changes in HRV time-domain indicators before and after physical function training

Time domain analysis is one of the more primitive and simple HRV analysis methods. Its analysis indicators are all through mathematical statistics, in order to quantitatively describe the changes in the cardiac cycle. The current analysis of HRV necessarily requires the acquisition of ECG signals. The current commonly used method is the short-term acquisition method, its time is 5 minutes. This method requires a short analysis time, it is not easy to be interfered by the outside world, and the objective conditions of analysis are easy to control, wide range of applications. Table 2 Changes of HRV time domain indicators before and after physical function training.

By analyzing the results of HRV time domain indicators before and after physical function training, SDNN and RMSSD in the HRV time domain index have significant differences. Although SDSD and PNN50 have an upward trend after training, but the difference is not significant. Confirmed by experiments, a lot of physical function training can effectively improve the SDNN and RMSSD in the HRV time domain index.

Analysis of changes in HRV frequency domain indicators before and after physical function training

Frequency domain analysis is one of the more common analysis methods of HRV indicators, also known as the frequency spectrum or frequency domain analysis of the heart rate. This method is mainly analyzed and calculated by statistical methods, heart rate fluctuation curve over time, can be decomposed into the sum of sinusoids of different frequencies and amplitudes, further analysis and processing to obtain the HRV spectrum. Table 3 shows the changes of HRV frequency domain indicators before and after exercise intervention.

Increase heat production and maintain body temperature

It can be seen from the temperature curve in Figure 1, body temperature can rise from the average temperature of 36.5℃ before training to 36.7℃, and the maximum temperature of 37℃ can be reached within 5 minutes after stopping the activity. This kind of timely and appropriate activity, when the human body is not sweating, the body function can reach a higher level of excitement, in order to meet the needs of activities, a large amount of liver glycogen is decomposed to participate in metabolism, at this moment, the energy released by sudden movement and catabolism cannot be converted into mechanical energy (muscle activity), but more often it is released in the form of heat energy, through the rapid blood circulation after exercise, make the body temperature rise drastically.

Table 1. Changes in average heart rate after physical function training (times/min).

testing time	Heart rate situation
Week 1	92.41±3.59
Week 2	91.31±4.39
Week 3	88.61±5.44
Week 4	85.99±4.56
After training	84.69±5.23

Table 2. Changes of HRV time domain indicators before and after physical function training.

index	Before training	After training
SDNN	29.41±14.31	37.29±18.30
RMSSD	26.26±12.43	36.34±15.98
SDSD	28.45±16.42	33.48±14.91
PNN50	5.16±2.79	5.42±4.59

Table 3. Changes of HRV frequency domain indicators before and after physical function training.

index	Before training	After training
TP	278.41±145.99	339.48±187.99
HF	91.50±86.64	115.87±86.97
LF	129.59±97.29	138.41±163.22
LF/HF	2.04±1.31	1.30±0.41
VLF	55.89±31.23	58.59±25.98

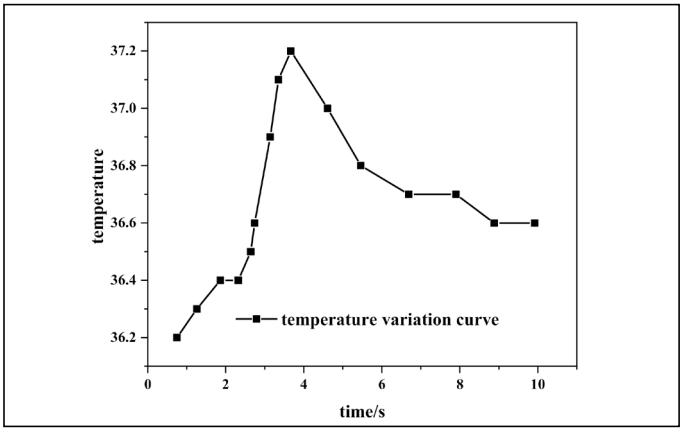

Figure 1. Injury prevention and rehabilitation of runners.

DISCUSSION

The cardiovascular system is one of the important diseases that endanger people's health, studies have shown that insufficient physical activity has become one of its important risk factors, this is also related to decreased vagus nerve tone.[9] It has been proven to reduce the time of sitting and less moving, increasing physical activity can effectively improve the tone of the vagus nerve, reduce the heart rate at rest and increase the heart rate reserve.[10]

CONCLUSION

The author proposes to study the detection of adolescents' heart rate and body temperature by exercise training, randomly select 12 young basketball players for training, analyze indicators of heart rate variability. Experiments have confirmed that a lot of physical function training, it can effectively improve the SDNN and RMSSD in the HRV time domain index. There are more and more studies on the impact of exercise intervention on HRV, however, the index of heart rate variability varies with subjects' age, exercise intervention time, exercise intervention intensity, exercise intervention amount, and exercise content and items, there are also differences in research results.

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