ORIGINAL ARTICLE

Correlation between athlete training intensity and cardiac performance

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Abstract

Objective: An effective analysis of correlation between training intensity of athletes and cardiac performance is done to develop scientific and reasonable exercise program and to promote health of athletes.

Methods: During December 2013-December 2015, 3600 students from different sports schools were selected for the test. All the athletes were randomly grouped, that is half-hour running group, one-hour running group and 90 -minute running group, which are named A, B, C groups respectively. The three groups of athletes received 5 days of testing per week, and took rest in the remaining two days, maintaining a total of 10 days. Exercise intensity of personnel accepting test was detected by RPE, and effective analysis was made on cardiac function change before and after test of three groups of the college students.

Results: Resting heart rates of B, C group students were considerably decreased after exercise. In comparison of falling range of group C and group A, there is a statistically significant difference, P <0.05.

Conclusion: By strengthening athletes' training intensity, we can effectively enhance athletes' cardiac performance. t As a result, athletes' body becomes healthier, which is conducive to athletes' physical and mental development.

Key words: Athlete, cardiac performance, correlation, training intensity

Date of Acceptance: 03-Sep-2016

Introduction

In the human body, cardiac troponin is an important biochemical marker. With such calcium protein, an effective analysis of the body's myocardial damage can be done.[1] Brain natriuretic peptide [Figure 1] is also a key indicator for the analysis of cardiac performance of the human body. Therefore, these two substances are important indicators to monitor intensity of the heart. Clinical medicine shows that, after acute exercise, serum levels will show significant upward trend. There is a significant correlation between myocardial damage and cardiac dysfunction. To effectively improve athletes' heart function, correlation between training intensity and cardiac performance should be effectively observed. The author selected 3600 students from different schools for study, randomly divided the students participating in the study into A, B, C three groups, each group with 1200 students. The three groups of students participated in running exercise of different intensities, with final results elaborated.

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Access this article online

Quick Response Code:

Website: www.njcponline.com

DOI: 10.4103/1119-3077.196064

How to cite this article: Xiao T, Zhang Y. Correlation between athlete training intensity and cardiac performance. Niger J Clin Pract 2017;20:248-51.

Methods

General Information

The students in this study are 3,600 subjects from different schools from December 2013 to December 2015 who haven't undergone long-term training. They were randomly divided into three groups: **Group A**: students with half- hour running; **Group B**: students with one- hour running; **Group C**: students with 90-minute running. **Group A**: male 560; female students: 640; students were aged between 18 and 21 years; **Group B**: 582 male students; 628 female students, students were aged between 17 years and 22 years; **Group C**: male students: 590; 610 female students, students were aged between 18 and 20 years old. Gender, age and height, etc. of the three groups of students have no statistically significant difference and are worth comparing [Table 1]. All the objects in this study have no cardiovascular disease and can have normal training.

Experimental Methods

Let three groups of subjects take running exercise on the playground every day in accordance with an appropriate intensity. The athletes run five days a week and rest two days, continuing for four weeks. Training intensity of athletes is effectively controlled with RPE. On this basis, changes in athletes' cardiac function before and after training are observed in detail.[2]

Statistical Methods

The study takes SPSS17.0 statistical software for the data analysis and processing, with measurement data denoted by mean ± average ($\bar{x} \pm$ s) and tested with t. $P < 0.05$, which means that difference is statistically significant.

Results

Comparison of Changes in Cardiac Function Before and After Test of the Three Groups of Athletes

After the subjects take training, observe the three groups of athletes' changes in cardiac function before and after test effectively. It can be found that, after training, resting heart rate of Group B, C athletes show significant downward trend, and the decline of Group C athletes' resting heart rate is most significant. Compared with resting heart rate of Group A athletes, there is a significant statistical significance ($P < 0.05$). This shows that high-intensity exercise training can lead to strong changes in athletes' resting heart rate, and that high-intensity training is with relatively large stimulation on athletes' heart. Resting heart rate of normal adult is shown in [Figure 2] below, and data is shown in [Table 2].

The Relationship between Athlete Training Intensity and Cardiac Markers

An effective test was carried out for cardiac markers of the study subjects, which found that after running training, gradual increase in the training intensity of the three groups of athletes will gradually increase their cardiac performance. After the three groups of athletes received training of different intensities, there is a significant improvement in their cardiac function to a certain extent, especially Group C athletes receiving 90-minute running. After training, athletes' cardiac muscle is effectively enhanced, and their myocardial strength is significantly improved, which results in a great help for athletes' blood pressure training.[3] Compared with the athletes in Group A and Group B, Group C athletes' running training exerts relatively large influence on athletes' blood circulation, and resulting strong skill response also brings a very significant change. Specific situations are shown in [Table 3].

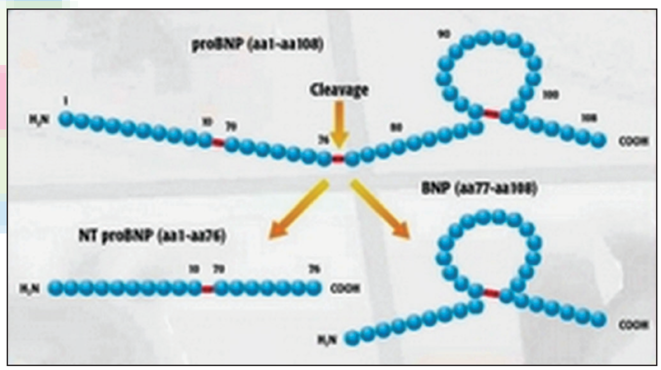

Figure 1: Brain natriuretic peptide

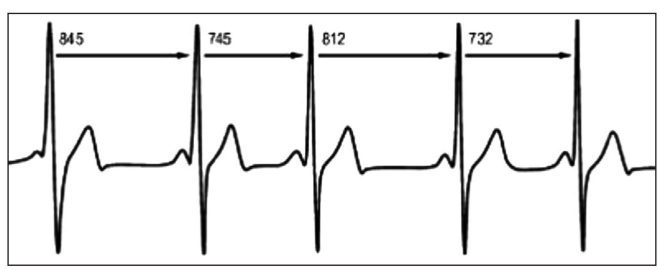

Figure 2: Resting heart rate of normal adult

Table 1: Comparison of basic data of three groups of subjects

Group	*n*	Age (year)	Height (cm)	Weight (kg)
A	Male: 560; Female: 640	(20.25 ± 1.13)	(164.56 ± 3.45)	(60.67 ± 3.54)
B	Male: 582; Female: 628	(21.04 ± 1.05)	(162.75 ± 3.67)	(62.78 ± 4.28)
C	Male: 590; Female: 610	(20.34 ± 1.26)	(163.84 ± 3.42)	(61.55 ± 2.74)

Table 2: HR rest before and after exercise and Instant heart rate after exercise (beat/min)

Group	HR rest before exercise	HR rest after exercise	Instant heart rate after exercise
A	(72.76 ± 3.05)	(72.96 ± 2.87)	(97.74 ± 5.42)
B	(72.54 ± 2.78)	(70.18 ± 2.05)	(112.07 ± 5.32)
C	(72.67 ± 3.02)	(68.94 ± 2.45)	(126.47 ± 8.76)

Table 3: Changes of cardiac function indexes

Group	Stage	SV/ml	CO (L/min)	CI (L/min/m2)	HOV (ml/mm)
A	Before exercise	95.27 ± 8.55	5.92 ± 0.55	4.14 ± 0.95	26.98 ± 8.45
	After exercise	95.79 ± 8.50	6.95 ± 0.57	4.06 ± 0.88	56.55 ± 7.02
B	Before exercise	93.56 ± 9.13	6.92 ± 0.64	4.07 ± 0.64	57.75 ± 8.62
	After exercise	94.47 ± 9.12	6.88 ± 0.65	4.24 ± 0.67	56.28 ± 8.43
C	Before exercise	93.87 ± 6.91	7.15 ± 0.48	3.98 ± 0.73	57.54 ± 8.24
	After exercise	95.84 ± 7.02	6.97 ± 0.57	4.12 ± 0.87	55.23 ± 10.18

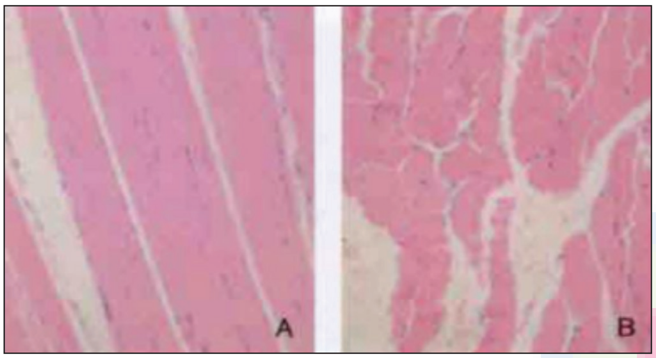

Figure 3: Muscle injury

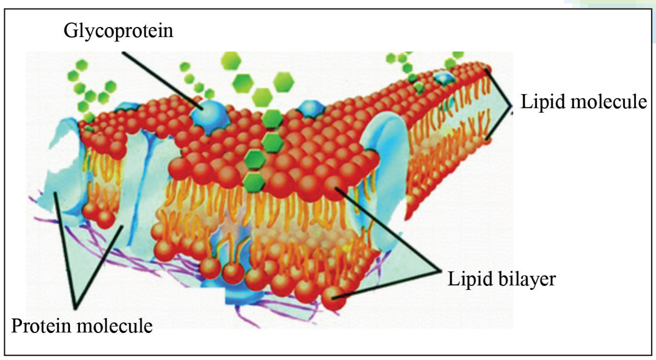

Figure 4: Structure diagram of human cell membrane

Discussion

In the course of the study, cardiac performance of the three groups of athletes was controlled with RPE. RPE, as an important index between physiology and psychology used to evaluate exercise intensity, can provide comprehensive evaluation of exercise intensity. This is also relatively complex with many signals incorporated. These signals can display joint movement and muscle as well as changes in the respiratory system.[4] With local discomfort of athletes' motor system during exercise, athletes' intensity during exercise can be effectively reflected. An athletes' body movement depends not only on simple physical exercise. In stress state of the body during exercise, there are psychological factors also, which can trigger sense of competition and passion in an athlete. These passions and motives can motivate athletes' potential under certain conditions and make corresponding stress response. In this process, some physiological and biochemical indexes of athletes' body will vary corresponding to changes in training intensity, which requires relevant personnel to identify quantity relations between RPE and specific biochemical indexes of the body. In this study, there exists inconsistencies between our observed results and physiological and biochemical indexes.[5] An athletes' subjective intensity sensation will gradually increase as athletes' exercise training intensity deepens. In this process, other indicators will show reduced adaptivity to sports training, which has a very important relationship with athletes' training level and psychological adjustment ability.[6] In this process, athletes' training intensity should be reasonably arranged so as to effectively train his/her cardiac performance. There exists inconsistency between the body's internal response and subjective sensation, which has significant link with monotony and dullness of training content. Therefore, in athletes' training stage with high intensity, in addition to timely adjustment of athletes' training load, their training content should be effectively adjusted and frequently changed to strengthen the training effect. After receiving exercise load stimulation, athletes can adjust the body so that it exists in corresponding rapid change. Under corresponding emergency situation, the body can reflect current changes in the environment based on the changes in their organ systems.[7] Under certain movement conditions, athletes' energy can be enhanced, glycogen in the body can be decomposed, with inositol decomposed into glucose and lactic acid. These can cause serious effects on athletes' cardiac performance.[8] After athletes take strenuous exercise, their skeletal muscle will suffer from micro damage (skeletal muscle injury is shown in [Figure 3] below), permeability of muscle cell membrane [Figure 4] will be significantly increased, macromolecular protein within the cell will also externally release, resulting in significant increase of muscle enzyme n the serum. During running, training load that athletes can afford will be reflected in the training process. In this process, timely adjustment of training intensity can effectively tap the potential of athletes, which can effectively improve their competitive ability.[9] With increase in athletes' training intensity, they will have maladaptive responses related to boring exercise content. Therefore, we require relevant personnel to timely change exercise content so that sports training becomes rich and colorful, avoiding strong exercise stress and pressure on athletes, and thus effectively improving the effects of exercise training.[10]

Conclusion

All in all, the paper conducts related analysis of relevance between athletes' training intensity and cardiac performance. The results show that: With the increasing intensity of training, an athletes' cardiac performance has also been found to increase significantly. This requires coaches to develop appropriate training programs based on athletes' training capacity, and set training contents appropriate for their development, so as to enhance athletes' cardiac performance, and significantly improve their interest in exercise and training. The results of this study are relatively general, which can be applied in the daily training of some professional athletes, which will have a positive effect on their sports career.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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