

EFFECT OF GYMNASTICS ON HEART RATE AND PHYSIQUE OF MALE COLLEGE STUDENTS

EFEITOS DA GINÁSTICA SOBRE A FREQUÊNCIA CARDÍACA E O FÍSICO DOS ESTUDANTES UNIVERSITÁRIOS MASCULINOS

EFFECTO DE LA GIMNASIA EN LA FRECUENCIA CARDIACA Y EL FÍSICO DE ESTUDIANTES UNIVERSITARIOS VARONES



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ABSTRACT

Introduction: People's living standards have gradually improved with rapid economic development, and physical exercise has become a viable alternative for people to relax and improve their quality of life. Among the forms of physical exercise, the most traditional and simplest is aerobics, despite few current studies on the physiological evidence of its adherence. **Objective:** Evaluate the effects of aerobic gymnastics on heart rate and physique of college students. **Methods:** 10 male college students volunteered for an experiment involving a specific aerobic gymnastics protocol over six weeks. To explore the effects of aerobic exercise on heart rate variability and physique of male college students, vital and anthropometric data were collected before and after the intervention for a statistical comparison and scientific discussion according to current literature. **Results:** There were significant differences in heart rate variability indexes SDNN, RMSSD, TP, HF, LF/hf before and after training. **Conclusion:** There were some significant differences in vital capacity, grip strength, flexion of sitting and standing posture after the intervention protocol. It is suggested that aerobic gymnastics training can improve cardiac function and fitness of its practitioners, especially among college students. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Gymnastics; Heart Rate; Body Constitution.

RESUMO

Introdução: O nível de vida das pessoas tem melhorado gradualmente com o rápido desenvolvimento econômico e o exercício físico tornou-se uma alternativa viável para as pessoas relaxarem e melhorarem sua qualidade de vida. Dentre as formas de exercício físico, o mais tradicional e simples é a ginástica aeróbica, apesar de poucos estudos atuais sobre as evidências fisiológicas de sua adesão. **Objetivo:** Avaliar os efeitos da ginástica aeróbica sobre o ritmo cardíaco e sobre o físico dos estudantes universitários. **Métodos:** 10 estudantes universitários masculinos foram voluntários para um experimento envolvendo um protocolo específico de ginástica aeróbica durante 6 semanas. No intuito de explorar os efeitos do exercício aeróbico na variabilidade do ritmo cardíaco e no físico dos estudantes universitários do sexo masculino, os dados vitais e antropométricos foram coletados antes e após a intervenção para uma comparação estatística e discussão científica segundo a bibliografia atual. **Resultados:** houve diferenças significativas nos índices de variabilidade da frequência cardíaca SDNN, RMSSD, TP, HF, LF/hf antes e depois do treinamento. **Conclusão:** Foram evidenciadas algumas diferenças significativas de capacidade vital, força de preensão, flexão da postura sentada e ortostática após o protocolo de intervenção. Sugere-se que o treinamento de ginástica aeróbica possa melhorar a função cardíaca e a condição física de seus praticantes, principalmente entre os estudantes universitários. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Ginástica; Frequência Cardíaca; Constituição Corporal.

RESUMEN

Introducción: El nivel de vida de las personas ha mejorado gradualmente con el rápido desarrollo económico y el ejercicio físico se ha convertido en una alternativa viable para que la gente se relaje y mejore su calidad de vida. Entre las formas de ejercicio físico, la más tradicional y sencilla es la gimnasia aeróbica, a pesar de los escasos estudios actuales sobre las pruebas fisiológicas de su adherencia. **Objetivo:** Evaluar los efectos de la gimnasia aeróbica sobre la frecuencia cardíaca y el físico de estudiantes universitarios. **Métodos:** 10 estudiantes universitarios varones se ofrecieron voluntarios para un experimento que incluía un protocolo específico de gimnasia aeróbica durante 6 semanas. Con el fin de explorar los efectos del ejercicio aeróbico sobre la variabilidad de la frecuencia cardíaca y el físico de estudiantes universitarios varones, se recogieron datos vitales y antropométricos antes y después de la intervención para realizar una comparación estadística y una discusión científica según la bibliografía actual. **Resultados:** Hubo diferencias significativas en los índices de variabilidad de la frecuencia cardíaca SDNN, RMSSD, TP, HF, LF/hf antes y después del entrenamiento. **Conclusión:** Se evidenciaron algunas diferencias significativas en la capacidad vital, la fuerza de prensión, la flexión de sedestación y la postura ortostática tras el protocolo de intervención. Se sugiere



Descriptor: Gimnasia; Frecuencia Cardíaca; Constitución Corporal.

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INTRODUCTION

With the rapid development of economy, people's living standards gradually improve, physical exercise and fitness has become one of the ways to people recreation and improve the quality of life, various ways of physical exercise, the traditional simple way of exercise cannot meet people, the growing needs of life, most people began to seek more novel and fun fitness lifestyle.¹ In many fitness sports, aerobics has gradually become one of the ways everyone respected. Long-term aerobics exercise can enhance cardiopulmonary function, increase muscle strength and shape the body, so it is deeply loved by everyone. Aerobics originated from traditional aerobics. Aerobics was introduced into China in the early 1980s.² At that time, various aerobics training classes were held in Beijing, Guangzhou, Shanghai and other places. Through the introduction and publicity of various foreign aerobics by the news media, aerobics has been widely carried out in China. In 1984, Beijing Sport University first set up the aerobics research group and took the lead in offering aerobics courses. Then Shanghai Institute of Physical Education also established the aerobics teaching and research office. Later, some colleges and universities gradually set up aerobics general courses and elective courses according to the requirements of the National Education Commission for college students' physical education teaching. Thus the aerobics movement of our country began to move from society to school. Aerobics has become one of the most popular courses and extracurricular activities in college physical education. With the accompaniment of music, the complete set of movements shows the continuous combination of movements, the perfect flexibility, the instantaneous strength and its basic pace application, while combined with the perfect display of the difficult movements.³ Show the athletes' ability to connect with complex, intense movements, and show their creativity through all the movements and music.⁴

Generally speaking, exercise can be divided into three types: aerobic exercise, weight training and stretching exercise.⁵ The biggest difference between aerobic exercise and the other two types of exercise is that the heart beat will speed up exercise to the heart and lung function, and promote blood circulation. In addition, asthma during aerobic exercise represents a large amount of oxygen delivery, which can enhance the functions of the heart, lungs and blood vessels.⁶

For people who have no exercise habits, they always feel out of breath at the beginning of exercise, and even doubt whether their heart and lung functions are wrong. The doctor suggested that if you have doubts, you can first clarify your heart and lung conditions. There is a set of standardized tests for heart and lung functions, including the following items: cardiac ultrasound: assess whether the heart function is normal from the condition of heart contraction and relaxation. In addition, this data can also be used to convert "heart beat rate", representing the range of circulating heart per minute. If the stroke rate is very high, it means that cardiovascular function is efficient. Pulmonary function examination: to understand the pulmonary ventilation function and the exchange function of alveolar oxygen and carbon dioxide.⁷

Heart in the dominant position in the human body movement ability, autonomic nerve regulation mechanism is its main regulation mechanism, the function of the heart changes, heart electrical activity

and cardiomyocyte energy metabolism activities are associated with autonomic nerve regulation, heart rate variability (HRV) has become one of the basic means of measuring and evaluating the heart autonomic nerve function.⁸ Heart rate variability (mW) is a sensitive indicator reflecting the excitability of the sympathetic nervous system and parasympathetic nervous system, and HRV has become one of the indicators of disease diagnosis and motor function assessment. HRV is influenced by multiple factors.⁹ In order to explore the influencing factors of HRV under the increasing load exercise, it can provide a reference basis for the evaluation of competitive aerobics sports function, the selection of athletes and scientific fitness. This paper monitors and analyzes the 6-week aerobics exercise for male college students, understands the influence of aerobics exercise on the heart rate variability and physical fitness of male college students, and provides theoretical support for the promotion and popularization of aerobics exercise.¹⁰

Research objects and research methods

Subjects of study

Ten male students majoring in non-sports training from Nanjing University of Physical Education were randomly selected, of age (21.50 ± 1.27), height (176.80 ± 4.29) cm, and weight (66.5 ± 7.96) kg were randomly selected. All the tested college students had such neurological diseases, and no experience of aerobics exercise. The research results of heart rate variability have been widely used in clinical medicine, but the impact of sports on HRV is not completely unified. There are two methods to measure heart rate variability, namely frequency domain analysis and time domain measurement. The frequency domain analysis method decomposes the heart rate change signal into different frequency components and quantifies its relative strength as power, providing power spectrum measurement of various frequency components. The frequency domain analysis method mainly analyzes the low-frequency index and high-frequency index. HRV low frequency index (LF) reflects the activity of cardiac sympathetic nerve or is affected by the common activity of vagus nerve and sympathetic nerve. High frequency index (HF) reflects the activity of cardiac vagus nerve, while low high frequency power ratio (LF/HF) reflects the balance of cardiac sympathetic and vagus nerve activity. The time-domain method is based on the variation of RR interval and can be expressed by standard deviation, variance, range, coefficient of variation, etc. Under normal physiological conditions, sympathetic nerve and vagus nerve coordinate to control the changes of heart rhythm, so that the heart rhythm changes orderly and periodically. Once this interaction is out of balance due to diseases and other reasons, it will lead to changes in heart rate and dysfunction of cardiovascular system. The size of HRV reflects the interaction between autonomic nervous system activities and cardiovascular system, and the vagus nerve plays a decisive role in HRV.

The study is Purely observational studies which no need to registry ID of ICMJE, and all the participants were reviewed and approved by Ethics Committee of Maoming Open University, China (NO. 2022007)

Research Methods

Experimental method: the subjects had 6 weeks of aerobics intervention.⁶ Such experimental method refers to a way of conducting research

through repeated experiments. Generally, the experimental method is mainly used to discover and confirm the causal relationship between things through organizational change and control of research objects. The experimental method has the characteristics of initiative, change, control and causality.

Experiment 1: In order to explore the characteristics of heart rate variability of aerobics athletes under increasing load, the test method of electronic running platform was used to analyze the HRV time domain and frequency domain of the whole exercise process of athletes by using the Finnish heart rate telemetry (polar RS800). Methods: 31 competitive aerobics college athletes of or above level 2 were selected as the test, starting with the starting speed of 6 m/s (male) and 4 m/s (female), increasing at 2 m / min. The test time was 6m i n, and the final speed reached 16 m/s (g) and 14 m / s (female).

Experiment 2: In order to explore the characteristics of the heart rate variability of aerobics athletes in the competition situation, it provides a theoretical basis for monitoring their body function and selecting the material selection of competitive aerobics athletes. In the first 105 seconds of the complete set of movements, the first 90s of the complete set of movements were intercepted, every 30s is a period, and the change characteristics of the heart rate variability of each group in each stage of the competitive aerobics set of movements were analyzed.

Experiment 3: In order to explore the increasing load sports center rate variability characteristics of competitive aerobics college student athletes and ordinary college students and the influence of long-term competitive aerobics on the heart rate variability of college students, it provides a theoretical basis for increasing quantitative scientific exercise. With 5 long-term training aerobics college athletes for experimental group (training years over 50 months), randomly selected 5 ordinary college students as the control group, through under the guidance of sports researchers for incremental quantitative running test, running stage starting speed 6 m/s (male), 4 m/s (female), every 3s increment 0.1 m/s, the whole test is 6m i n, the final speed of 16 m/s (male), 14 m/s (female). FIRV changes during exercise with a Finnish (polarRS800) heart rate telemetry.

Experimental result and analysis

Analysis of heart rate variability indicators

The time required for the analysis is short, which is not easy to be disturbed by the external world. The objective conditions of the analysis are easy to control, and the application range is wide. As can be seen from Table 1, SDNN and RMSSD in HRV time domain index varied significantly before and after training ($P < 0.05$); while SDDSD and PNN50 increased after training, the difference was not significant ($P > 0.01$). Aerobics exercise can effectively improve the SDNN and RMSSD in the HRV time domain index.

Analysis of them were significantly different before and after the aerobics exercise ($P < 0.05$). Although other indicators also showed an upward trend, the difference was not significant ($P > 0.05$). This shows that a large number of aerobics exercises can improve the TP and HF in the HRV frequency domain indicators.

Table 1. Changes of HRV time domain index before and after aerobics exercise.

| Indicators | Before training | After training |
|------------|-----------------|----------------|
| SDNN | 32.3±14.2 | 44.3±18.2* |
| RMSSD | 26.5±12.3 | 36.2±17.1* |
| SDDSD | 27.7±16.3 | 34.6±16.8 |
| PNN50 | 5.2±2.9 | 5.4±4.3 |

Note: * indicates the significant difference before and after exercise, $P < 0.05$; ** indicates the very significant difference before and after exercise, $P < 0.01$; the same.

Analysis of the change of physical index before and after aerobics exercise

Physical fitness test is a test of physical indicators status, exercise ability level and cardiopulmonary function status. Test, it includes indicators of body fat percentage, flexibility, explosive force, balance ability, response ability, muscle strength and muscle endurance.⁹ As can be seen from Table 2, the lung capacity, grip strength and sit-up varied before and after aerobics exercise ($P < 0.01$), and the anterior flexion test was very different after exercise ($P < 0.01$), better than before training; other physical indicators improved to different degrees, but the difference before and after the experiment ($P > 0.05$).

DISCUSSION

Cardiovascular system diseases are here. Figure 1 shows the change of cardiovascular disease mortality among urban and rural college students in China from 1990 to 2018. Through the potential necessary connection of HRV indicators and the cardiovascular system, the quantitative evaluation of cardiac and vascular capacity can be conducted, which has important clinical significance for the occurrence and outcome of cardiovascular system-related diseases. In recent years, the influence of exercise on HRV is more and more research, but quantity and exercise content and project, the results also exist, difference, also need more researchers into the study of heart rate variability, promote the development of research in the field.

CONCLUSIONS

After 6 weeks of aerobics training, the cardiopulmonary function of male college students was improved to a certain extent, and the heart function reserve was increased. The SDNN, RMSSD, TP, HF, and LF

Table 2. Changes of physical indicators before and after aerobics exercise.

| Test index | Pre-experiment | After the experiment |
|---------------------------------------|----------------|----------------------|
| Body fat percentage (%) | 22.30±2.30 | 21.92±3.53 |
| Sitting forward bend (cm) | 8.97±8.96 | 10.12±8.89** |
| One-legged stand with eyes closed (s) | 40.6±20.41 | 44.33±30.39 |
| When reacting (s) | 0.37±0.12 | 0.36±0.13 |
| Grip strength (N) | 33.10±4.53 | 35.58±4.32* |
| vertical jump (cm) | 45.00±2.49 | 47.21±2.27 |
| Sit-ups (times/min) | 24.10±10.92 | 29.66±10.30* |
| Step Index | 52.68±6.73 | 50.45±8.06 |
| Spirometry (ml) | 3607±397.17 | 3921±369.72* |
| Quiet heart rate (times/min) | 69.42±7.13 | 68.18±6.40 |

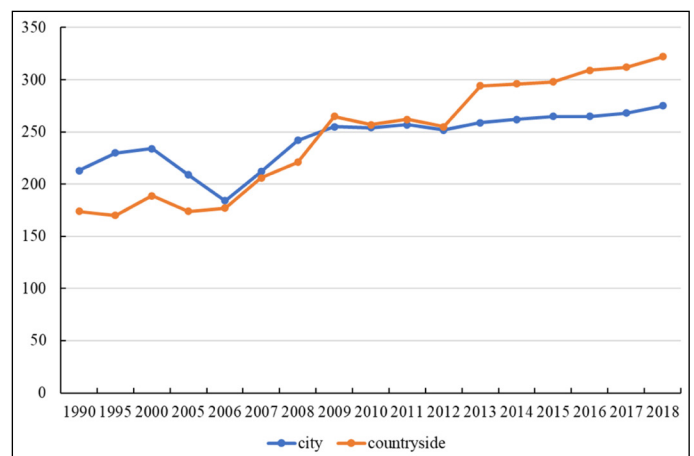


Figure 1. Changes in cardiovascular mortality among urban and rural college students in China from 1990 to 2018.

/ HF the exercise, and the aerobics training can improve the heart rate variability index. Aerobics exercise can improve the physical condition of male college students, and the handgrip strength, 1 min sit-ups and lung capacity performance is significantly improved. A certain intensity of exercise intervention helped to improve heart rate variability. Aerobics to the perfect integration of music, dance and gymnastics, practitioners after long-term systematic training, their cardiopulmonary function, muscle

strength, body will be improved to varying degrees. This experiment also showed that a certain intensity of aerobics exercise can improve the heart rate and variability index of the athletes, and also improve the physical condition of the subjects to a certain extent.

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