THE INDIRECT INFLUENCE OF BASKETBALL ON CARDIAC AND CEREBRAL VASCULARIZATION

A INFLUÊNCIA INDIRETA DO BASQUETEBOL SOBRE A VASCULARIZAÇÃO CARDÍACA E CEREBRAL

LA INFLUENCIA INDIRECTA DEL BALONCESTO EN LA VASCULARIZACIÓN CARDÍACA Y CEREBRAL

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ABSTRACT

Introduction: Some experimental research has proved that long-term basketball exercises can effectively improve physical fitness, promote growth and improve motor functions. However, studies exploring the specific effects of this sport on cardiac and cerebral vascularization are still scarce. Objective: We aimed to study, through experimental analysis, if the activities derived from basketball sport can have some influence on cardiac and cerebral vascularization. Methods: Twelve students with no family history of genetic diseases and in good health, who regularly practice amateur basketball, were followed for 8 weeks. Weight, height, body mass index, body fat rate, maximum oxygen consumption, hemoglobin, and indicators of lipid metabolism were analyzed. Results: After long-term basketball exercises, the body fat rate of these college students decreased significantly, and total serum cholesterol and low-density lipoprotein also show significant differences compared with the control group. Conclusion: Through the processing and analysis of the experimental data, it can be concluded that basketball can effectively reduce the human body fat rate, maintain a healthy body shape, and indirectly reduce the risk of cardiovascular and cerebrovascular diseases. ***Level of evidence II; Therapeutic studies - investigation of treatment results.***

Keywords: Basketball; Sports; Cardiovascular diseases; Cholesterol.

RESUMO

Introdução: Algumas pesquisas experimentais provaram que exercícios de basquetebol a longo prazo podem efetivamente melhorar a aptidão física, promover o crescimento e melhorar as funções motoras. Porém, ainda são escassos os estudos que exploram os efeitos específicos desse esporte na vascularização cardíaca e cerebral. Objetivo: Objetiva-se estudar, através de análise experimental, se as atividades derivadas do esporte basquete podem ter alguma influência sobre a vascularização cardíaca e cerebral. Métodos: Houve acompanhamento por 8 semanas de doze alunos sem histórico familiar com doença genética e em boa saúde com prática regular do basquete de forma amadora. Foram analisados peso, altura, índice de massa corporal, taxa de gordura corporal, consumo máximo de oxigênio, hemoglobina e indicadores de metabolismo lipídico. Resultados: Após exercícios de basquetebol de longa duração, a taxa de gordura corporal destes estudantes universitários diminuiu significativamente, e o colesterol sérico total e a lipoproteína de baixa densidade também apresentam diferenças significativas em comparação com o grupo de controle. Conclusão: Através do processamento e análise dos dados experimentais, pode-se concluir que o basquetebol pode efetivamente reduzir a taxa de gordura do corpo humano, manter uma forma corporal saudável e, indiretamente, reduzir o risco de doenças cardiovasculares e cerebrovasculares. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Basquetebol; Esportes; Doenças cardiovasculares; Colesterol.*

RESUMEN

Introducción: Algunas investigaciones experimentales han demostrado que los ejercicios de baloncesto a largo plazo pueden mejorar eficazmente la aptitud física, promover el crecimiento y mejorar las funciones motoras. Sin embargo, los estudios que exploran los efectos específicos de este deporte en la vascularización cardíaca y cerebral son todavía escasos. Objetivo: El propósito de este trabajo es estudiar, mediante un análisis experimental, si las actividades derivadas del deporte del baloncesto pueden tener alguna influencia en la vascularización cardíaca y cerebral. Métodos: Se realizó un seguimiento de 8 semanas a doce estudiantes sin antecedentes familiares de enfermedad genética y en buen estado de salud con práctica regular de baloncesto amateur. Se analizaron el peso, la altura, el índice de masa corporal, el índice de grasa corporal, el consumo máximo de oxígeno, la hemoglobina y los indicadores del metabolismo de los lípidos. Resultados: Después de realizar ejercicios de baloncesto a largo plazo, el índice de grasa corporal de estos estudiantes universitarios disminuyó significativamente, y el colesterol sérico total y la lipoproteína de baja densidad también muestran diferencias significativas en comparación con el grupo de control. Conclusión: Mediante el procesamiento y el análisis de los datos experimentales, se puede concluir que el baloncesto puede reducir eficazmente la tasa de grasa corporal del ser humano, mantener una forma corporal saludable y reducir indirectamente el riesgo de enfermedades cardiovasculares y cerebrovasculares. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Baloncesto; Deportes; Enfermedades cardiovasculares; Colesterol.*

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INTRODUCTION

Basketball is currently one of the most popular sports on campus. With the vigorous development of the NBA, CBA, CUBA, University Basketball Super League, and other competitions, basketball is still a part of students' study and life. Some experimental researchers have proved that long-term basketball exercises can effectively enhance physical fitness, promote physical growth and improve physical functions.[1] Appropriate participation in basketball activities positively affects the functions of internal organs and receptors, the innervation ability of the central nervous system, and the development of psychological training. Therefore, this article wants to analyze the impact of basketball training on cardiovascular and cerebrovascular effects through the study of ordinary basketball enthusiasts. The purpose of the article is to provide a basis for the scientific exercise of most college students and basketball enthusiasts.

METHOD

Research object

The article selects 12 students from our school who are basketball enthusiasts. They have not received professional basketball training experience and have no other physical exercises daily, and they are in good health. The student has no family history of the genetic disease.[2] The training time is eight weeks. Did not participate in any public competitions during training. The subject did not take nutritional supplements during training and had a normal diet every day.

Research methods

Test indicators: height, weight, body mass index, body fat rate, maximum oxygen uptake, hemoglobin, and lipid metabolism indicators.

Optimized simulation of basketball players' dunk action

Based on the above-mentioned overall model construction and kinematic chain analysis, the movement parameter model analysis of dunk action in basketball is carried out. Analyze the explosive kinetic energy of the dunk action in the six-degree-of-freedom space.[3] First, the forward kinematics algorithm is used to obtain the joint angle space to obtain the force kinetic energy of the body function component in the dunk as

$$K = \frac{1}{2}\sum_{i=0}^{6}[I_i\dot{q}_i^2 + m_i(\dot{x}_i^2 + \dot{z}_i^2)] \quad (1)$$

We regard the upper body mass m_3 as a center of mass. An analytical method is used to solve the inverse kinematics of multi-degree-of-freedom. The sports potential energy of a basketball player after dunking is

$$P = \sum_{i=0}^{6} m_i g z_i \quad (2)$$

Under limited conditions, we use the Lagrange dynamics model for continuous dunk action. The equivalent motion chain structure of the equivalent pose is

$$\int_V \varepsilon_{ij} dV = \int_V \varepsilon_{ij}^* dV \quad (3)$$

Obtain the energy equivalent relationship of basketball players in dunk action as

$$\int_V \sigma_{ij}\varepsilon_{ij} dV = \int_V (\sigma_{ij}^*\varepsilon_{ij}^*) dV \quad (4)$$

Under the macro conditions, the equivalent relationship of the stress of the two-dimensional periodic structure of a basketball player dunking is:

$$\sigma_{ij}^* = \frac{1}{V}\int_V \sigma_{ij} dV \quad (5)$$

σ^*_{ij} represents the equivalent stress of the inverse kinematics of the right arm. The definition formula of the reference coordinate system of the right arm of a basketball player dunking with 7 degrees of freedom

$$\sigma_{ij}^* = C_{ijkl}\varepsilon_{ij}^* \quad (6)$$

C_{ijkl} represents the strain modulus component of the right elbow joint. ε^*_{ij} represents the corresponding pose.

Data processing method

The article uses Excel2007 and SPSS 13.0 software to process and analyze the data obtained by statistical methods.[4] All data are expressed as mean ± standard deviation. The article performs a paired-sample T-test on the test results before and after the experiment. Take $P<0.05$ as the significance level. $P<0.01$ is a very significant level.

RESULTS

Changes in body composition before and after the experiment

According to Table 1, it can be seen that the weight and body mass index of the subjects after eight weeks of training have a downward trend.[5] But there is no significant difference compared with before training. The percentage of body fat decreased significantly ($P<0.05$).

Changes in maximum oxygen uptake before and after the experiment

It can be seen from Table 2 that the subjects' maximal oxygen uptake has changed significantly after eight weeks of systematic training ($P<0.05$).

Changes in biochemical blood indicators before and after the experiment

It can be seen from Table 3 that the hemoglobin value of athletes has increased to a certain extent after system training, but there is no significant

Table 1. Body composition changes of subjects.

	Before training	After training
Weight (kg)	79.5±2.42	78.1±2.66
Body mass index	22.81±3.57	21.76±1.94
Body fat percentage (%)	16.60±3.57	14.31±3.08

Table 2. Changes in subjects' maximal oxygen uptake.

	Before training	After training
Average maximum oxygen uptake (ml/kg·min)	45.63±2.60	47.60±2.46

Table 3. Changes in biochemical blood indicators of subjects.

	Before training	After training
Hemoglobin (g/L)	137.5±2.42	139.6±2.65
Total cholesterol (mmol/L)	4.921±1.04	4.556±0.62
Triglyceride (mmol/L)	1.112±0.65	0.879±0.3
High-density lipoprotein (mmol/L)	1.32±0.15	1.41±0.19
Low-density lipoprotein (mmol/L)	3.08±0.13	2.78±0.15

difference.[6] Total cholesterol, triglycerides, and low-density lipoprotein all have different degrees of reduction, among which the changes in total cholesterol have very significant differences (P<0.01), and the changes in low-density lipoproteins have significant differences (P<0.05).

DISCUSSION

Changes in body composition caused by exercise

After eight weeks of training, subjects' weight and body mass index have a downward trend. Still, there is no statistical significance, and the percentage of body fat has a significant decrease (P<0.05). Body composition is closely related to human health, which is an evaluation of one of the indicators of human health. The selected parts in this experiment are the shoulder blades and arms. Body shape is of great significance to health.[7] Because a certain body shape reflects the corresponding growth and development level, function, and athletic ability level to a certain extent. Different body shapes affect the development of sports quality to a certain extent. Confrontation is one of the characteristics of basketball. The basis of confrontation is, first of all, the confrontation of the body (mainly height and weight). Therefore, having a height advantage while maintaining a good weight is very important for improving and playing basketball.

Body fat percentage refers to the ratio of total body fat to body weight. The body fat percentage of normal adults is 15%-18% for men and 25%-28% for women. Too high body fat rate will increase the risk of high blood pressure, obesity, coronary heart disease, but too low will cause body dysfunction.[8] In this experiment, the body fat rate was reduced through basketball exercise, and the bodyweight has a tendency to decrease, but there is no significant difference. Decreased body fat rate is good for health and increases muscle mass, and improves athletic ability. The body fat rate of the subjects before and after the experiment was within the normal range.

The body mass index (BIM) is an important index used by medical authorities to measure the degree of body obesity. It is also an index to measure the degree of body obesity and whether it is healthy. Long-term systematic aerobic exercise can adjust the function of the endocrine system and improve the quality of body fat metabolism.[9] This can make the ratio of each component in blood lipids more reasonable, which has a positive effect on strengthening physical fitness, improving body shape, and adjusting body composition. In this experiment, the BMI of college students was reduced, but there was no significant difference. It is within the normal range before and after the experiment.

Changes in maximum oxygen uptake by exercise

Maximum oxygen uptake refers to the amount of oxygen that the human body can take in a unit of time. When the body's lung function and the ability of muscles to use oxygen reach their limit level during intense, long-term exercise involving a large number of muscles.[10] After eight weeks of systematic training, the subjects' maximal oxygen uptake significantly changed (P<0.05). This shows that systematic basketball training can effectively increase the maximum oxygen uptake. Because long-term systematic physical training can reduce the body's fat mass and continuously strengthen the cardiovascular function, increase the cardiac output, and improve the tissue's ability to use oxygen during the training process. This can play a role in increasing the maximum oxygen uptake.

The impact of exercise on biochemical blood indicators

The physiological function of hemoglobin is mainly to transport oxygen and carbon dioxide and to buffer acidic substances. Frequent measurement of hemoglobin value can understand the subject's nutrition, adaptation to the load, and the body's functional level. Hemoglobin also has a greater relationship with diet.[11] While adhering to physical exercise, we need to pay attention to the rationality of diet to keep the body in a healthy range. In this experiment, the subjects' hemoglobin increased slightly, but there was no significant difference.

Triglycerides are an important fuel for tissue cells, especially skeletal muscles, for long-term exercise. Many studies have shown that exercise can reduce the content of plasma triglycerides to improve lipid metabolism disorders. High-density lipoprotein is a lipoprotein with the highest density and the smallest particles in the blood. It is the basic substance of blood lipid metabolism and removes excess blood lipids in the body, and cleans blood vessels. Excessive levels of triglycerides in serum can cause adverse health effects and lead to diseases such as atherosclerosis.

Cholesterol in the blood is divided into high-density cholesterol and low-density cholesterol. Cholesterol is an important component of cell membranes, and it can also form cholic acid and hormones. It is also one of the important causes of cardiovascular and cerebrovascular diseases. Therefore, keeping the lipid metabolism index within the normal range is one of the important conditions to ensure the health of the body. Some results have also been achieved through the research of this experiment. The subjects' total cholesterol and low-density lipoprotein have been significantly reduced. This shows that a certain intensity of exercise can improve the metabolism of lipids in the body.

CONCLUSION

The processing and analysis of the experimental data show that insisting on basketball exercise can reduce the body fat rate of ordinary college students. Exercise helps maintain a healthy body shape and reduces the risk of cardiovascular and cerebrovascular diseases. (Through basketball exercise to increase the maximum oxygen uptake of ordinary college students and improve cardiopulmonary function. Basketball exercise can also improve the lipid metabolism of ordinary college students and help maintain their health. Basketball exercise has a positive fitness significance. Schools should guide and urge college students to be active Participate in physical exercise regularly. It is necessary to vigorously promote the importance of scientific fitness to improve students' fitness awareness. The school should develop basketball as an effective fitness method on university campuses and the general population.

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AUTHORS' CONTRIBUTIONS: The author made significant contributions to this manuscript. Bingyang Wang: writing and summarize; data analysis and summarize; article review and intellectual concept of the article.

REFERENCES

1. Nabli MA, Ben Abdelkrim N, Fessi MS, DeLang MD, Moalla W, Chamari K. Sport science applied to basketball refereeing: A narrative review. The Physician and sportsmedicine. 2019;47(4):365-74.
2. Scanlan AT, Sitko S, Vaquera-Jiménez A. Influence of the Game Context and Levels of Physical Activity on the Behavior of Basketball Coaches. Revista de Psicología del Deporte (Journal of Sport Psychology). 2021;30(2):240-5.
3. Suárez-Iglesias D, Dehesa R, Scanlan AT, Rodríguez-Marroyo JA, Vaquera A. Defensive Strategy and Player

Sex Impact Heart-Rate Responses During Games-Based Drills in Professional Basketball. International Journal of Sports Physiology and Performance. 2020;16(3):360-6.

4. Mahardika RH, Kartiko DC, Siantoro G. Interval and Continuous Training for Resting Pulse and Cardiovascular Enhancement of Students. Budapest International Research and Critics in Linguistics and Education. 2020;3(2):837-44.
5. Seron BB, De Carvalho EMO, Greguol M. Analysis of physiological and kinematic demands of wheelchair basketball games—A review. The Journal of Strength & Conditioning Research. 2019;33(5):1453-62.
6. Indris AH. The Effects of Circuit Training On Selected Physical Fitness Components: With Specific Reference to Dessie Town Basketball Project Players. Indiana Journal of Humanities and Social Sciences. 2021;2(1):21-6.
7. García-Santos D, Gómez-Ruano MA, Vaquera A, Ibáñez SJ. Systematic review of basketball referees' performances. International Journal of Performance Analysis in Sport. 2020;20(3):495-533.
8. Logan-Sprenger HM, Mc Naughton LR. Characterizing thermoregulatory demands of female wheelchair basketball players during competition. Research in sports medicine. 2020;28(2):256-67.
9. Ramadan AM, El-Ruby AERA. The effect of a Proposed Program of Modified Tae Bo Exercises on the level of Some Physical Fitness, Physiological and Skillful Elements of Basketball Players. Assiut Journal of Sport Science and Arts. 2019;119(1):1-20.
10. Suárez Iglesias D, Leicht AS, Pojskić H, Vaquera A. Impact of contextual factors on match demands experienced by elite male referees during international basketball tournaments. Journal of sports sciences. 2021;39(8):936-43.
11. Williams MN, Dalbo VJ, Fox JL, O'Grady CJ, Scanlan AT. Comparing Weekly Training and Game Demands According to Playing Position in a Semiprofessional Basketball Team. International Journal of Sports Physiology and Performance. 2021;16(6):772-8.