IMPACTS OF AEROBIC EXERCISE ON CARDIOVASCULAR HEALTH IN COLLEGE STUDENTS

IMPACTOS DO EXERCÍCIO AERÓBICO NA SAÚDE CARDIOVASCULAR DOS ESTUDANTES UNIVERSITÁRIOS

IMPACTO DEL EJERCICIO AERÓBICO EN LA SALUD CARDIOVASCULAR DE LOS ESTUDIANTES UNIVERSITARIOS

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ABSTRACT

Introduction: Cardiovascular disease (CVD) is a major disease that seriously endangers human health. CVD in many adults begins in adolescence and even in childhood. The cardiovascular health of college students in China cannot be ignored. Objective: Verify the impacts of aerobic exercise (APA) on the cardiovascular health of college students. Methods: The paper uses the literature method to explore the health-promoting role of aerobic exercise in opposing and improving CVD. Also the APA exercise method of effectively improving cardiopulmonary fitness (CRF) to prevent and improve CVD. The results showed that APA can improve microcirculation by increasing microvascular reactivity. Results: Coronary blood flow in healthy adults is only 8% to 9% of cardiac bleeding, while coronary blood flow increases by 40% and oxygen intake by 2-2.5 times. Aerobic exercise can improve insulin sensitivity and reduce the risk of CVD. Some risk factors related to vascular endothelial dysfunction, such as hypertension, atherosclerosis, and coronary artery disease, are often accompanied by the phenomenon of insulin resistance in the induction of CVD. At the same time, improving IR may play an effective role in preventing and treating CVD. Conclusion: APA can reduce and suppress the occurrence and development of CVD risk factors such as atherosclerosis, hypertension, hyperlipidemia, hyperglycemia and obesity, intestinal microecological disorder, and reduce free radical oxidative damage and apoptosis by improving insulin sensitivity of vascular endothelial cells, inhibiting inflammatory reaction, improving mitochondrial function of cardiomyocytes, reducing body mass index and obesity, and maintaining gut microecological balance, and improving vascular endothelial function and reducing CVD such as myocardial infarction. ***Level of evidence II; Therapeutic studies - investigating treatment outcomes.***

Keywords: Endurance Training; Cardiovascular Diseases; Health Promotion; Students.

RESUMO

Introdução: A doença cardiovascular (DCV) é uma das principais doenças que colocam seriamente em risco a saúde humana. A DCV em muitos adultos começa na adolescência e até mesmo na infância. A saúde cardiovascular dos estudantes universitários na China não pode ser ignorada. Objetivo: Verificar os impactos do exercício aeróbico (APA) sobre a saúde cardiovascular dos estudantes universitários. Métodos: O artigo usa o método bibliográfico para explorar o papel de promoção da saúde do exercício aeróbico em oposição e melhoria da DCV. Também o método de exercício APA de melhorar efetivamente a aptidão cardiopulmonar (CRF) para prevenir e melhorar a DCV. Os resultados mostraram que a APA pode melhorar a microcirculação ao aumentar a reatividade microvascular. Resultados: O fluxo de sangue coronariano em adultos saudáveis é apenas 8% a 9% do sangramento cardíaco, enquanto o fluxo de sangue coronariano aumenta em 40% e a ingestão de oxigênio em 2-2,5 vezes. O exercício aeróbico pode melhorar a sensibilidade insulínica e reduzir o risco de DCV. Alguns fatores de risco relacionados à disfunção endotelial vascular, tais como hipertensão, aterosclerose e doença arterial coronária, são frequentemente acompanhados pelo fenômeno de resistência à insulina na indução da DCV, enquanto a melhora da IR pode desempenhar um papel eficaz na prevenção e tratamento da DCV. Conclusão: A APA pode reduzir e suprimir a ocorrência e o desenvolvimento de fatores de risco de DCV, tais como aterosclerose, hipertensão, hiperlipidemia, hiperglicemia e obesidade, distúrbio microecológico intestinal, além de reduzir os danos oxidativos radicais livres e a apoptose, melhorando a sensibilidade insulínica das células endoteliais vasculares, inibindo a reação inflamatória, melhorando a função mitocondrial dos cardiomiócitos, reduzindo o índice de massa corporal e a obesidade e mantendo o equilíbrio microecológico intestinal e melhorando a função endotelial vascular e reduzindo a DCV, como o infarto do miocárdio. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Treino Aeróbico; Doenças Cardiovasculares; Promoção da Saúde; Estudantes.*

RESUMEN

Introducción: Las enfermedades cardiovasculares (ECV) son una de las principales enfermedades que ponen en grave peligro la salud humana. En muchos adultos, la ECV comienza en la adolescencia e incluso en la infancia. No se puede ignorar la salud cardiovascular de los estudiantes universitarios en China. Objetivo: Verificar los impactos del ejercicio aeróbico (EAA) en la salud cardiovascular de los estudiantes universitarios. Métodos: El artículo utiliza el método de la literatura para explorar el papel promotor de la salud del ejercicio aeróbico en la oposición y la mejora de la ECV. También el método de ejercicio APA para mejorar eficazmente la aptitud cardiopulmonar (CRF) para prevenir

y mejorar la ECV. Los resultados mostraron que el APA puede mejorar la microcirculación al aumentar la reactividad microvascular. Resultados: El flujo sanguíneo coronario en adultos sanos es sólo del 8% al 9% de la hemorragia cardiaca, mientras que el flujo sanguíneo coronario aumenta un 40% y el aporte de oxígeno entre 2 y 2,5 veces. El ejercicio aeróbico puede mejorar la sensibilidad a la insulina y reducir el riesgo de ECV. Algunos factores de riesgo relacionados con la disfunción endotelial vascular, como la hipertensión, la aterosclerosis y la enfermedad coronaria, suelen ir acompañados del fenómeno de la resistencia a la insulina en la inducción de la ECV, mientras que la mejora de la RI puede desempeñar un papel eficaz en la prevención y el tratamiento de la ECV. Conclusión: El APA puede reducir y suprimir la aparición y el desarrollo de factores de riesgo de ECV como la aterosclerosis, la hipertensión, la hiperlipidemia, la hiperglucemia y la obesidad, el trastorno microecológico intestinal, y reducir el daño oxidativo de los radicales libres y la apoptosis mejorando la sensibilidad a la insulina de las células endoteliales vasculares, inhibir la reacción inflamatoria, mejorar la función mitocondrial de los cardiomiocitos, reducir el índice de masa corporal y la obesidad y mantener el equilibrio microecológico intestinal, así como mejorar la función endotelial vascular y reducir las ECV, como el infarto de miocardio. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Entrenamiento Aeróbico; Enfermedades Cardiovasculares; Promoción de la Salud; Estudiantes.*

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INTRODUCTION

Cardiovascular disease (CVD) is the main disease that endangers human health, and it is also the most important cause of human death and disability. It brings heavy medical and social and economic burden to human beings. From 1990 to 2019, the total global incidence of CVD increased from 271 million to 523 million, almost doubling in 30 years; the number of CVD deaths has steadily increased from 12.1 million to 18.6 million.[1] (More than 9.6 million men and 8.9 million women), accounting for about a third of the total number of deaths worldwide. CVD is also the primary factor of disease death among urban and rural residents in China, and its fatal cases account for about 45% of various disease death factors. At present, China is not only the country with the largest number of CVD deaths, but also the prevalence of CVD and mortality in China are still on the rising stage, and the control situation of related risk factors is still not optimistic.[2] It is satisfied that about 6.1 million CVD deaths occurred between 30 and 70 years old worldwide in 2019, and there is a tendency to become younger. In fact, many adults of CVD in adolescence and even in childhood, this is due to high blood pressure, diabetes, dyslipidemia, blood lipid, air pollution, high body quality index (overweight and obesity), smoking, sleep disorders, renal dysfunction (chronic kidney disease) cardiovascular risk factors (CVRF) accumulation and development, therefore, adolescent cardiovascular health (cardiovascular health) should not be ignored.[3]

Ischemic or hemorrhagic diseases caused by hyperlipidemia, blood viscosity, atherosclerosis, hypertension, etc., collectively referred to as CVD, are common diseases that seriously threaten human health, and are characterized by high morbidity, high morbidity and high mortality. The number of CVD deaths in China is up to 3 million each year, accounting for about 45% of the total annual deaths, and the development of CVD continues to show a trend of low age. There are about 40 million college students in China.[4] The detection rate of CVD is 1.22%~2.60%, which means that the number of CVD patients among college students can reach 500000~1 million. This does not include the potential CVD risk of overweight and obese students. Therefore, its harmfulness should not be underestimated.[5] It is reported that among young college students in China, the proportion of overweight or overtly obese individuals has exceeded 20%, the proportion of overtly obese males has even reached 28%, and the proportion of overtly obese females is slightly lower, but the incidence of covert obesity is as high as 33.18%. The detection rate of pathological cardiovascular abnormalities in overweight and obese students is not only higher than that in normal weight students, but also overweight people are twice as likely to suffer from CVD as normal weight people, and severely obese people are 10 times as likely to suffer from CVD as normal weight people.[6] Relevant research and meta analysis have found that long-term regular exercise training can help enhance the tolerance of the body to CVD, and has significant primary prevention effect on CVD.[7] The total amount of physical activity is significantly negatively correlated with the CVD mortality.[8] Aerobic exercise can reduce the CVD mortality by 35%. It can be seen from the above that there are many college students in China who are threatened by CVD. For college students who suffer from physical signs such as weight gain and obesity due to sedentary and less exercise, lack of laws, and lack of diet, and even have sub-health conditions such as hypertension, physical examination and screening should be strengthened to find out as soon as possible, effectively prevent, and sports training and supervision should be strengthened to actively reduce the risk of CVD.[9]

In recent years, sudden cardiac death of Chinese college students occurs from time to time, and the personal hygiene habits of college students have gradually formed. The health counseling and intervention implemented during this period are of positive significance to their cardiovascular health. This paper discusses the role of aerobic exercise (APA) on promoting the cardiovascular health of college students, aiming to provide a reference for college students to improve their awareness and ability of cardiovascular health protection.[10]

Research object and method

Subjects of study

Then, 20 healthy boys from the school of Physical Education were selected as the experimental subjects, with an average age of 21.2 graduate students and 1.12 years old,177.84.71cm and 75.37.07 kg.

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 Xi'an Siyuan University, China (NO. 2022011)

Research Method

Experiments were performed in the Sports Human Center Laboratory of Physical Education. Subjects were tested at 06:00 – 07:00 and, respectively. Aerobic exercise was performed at 16:00-17:00 for two time periods, ending with 60 minutes of rest, for a total of 120 minutes. No movement during the same time period was used as a control. The exercise in each time period is separated by 3 days or more respectively to ensure the subject's physical recovery and avoid strenuous exercise on the day before the exercise. Exercise mode: pedal the power bike4. Exercise time: 60min. Exercise intensity: the heart rate during exercise is

80% of the maximum heart rate, that is, (220-age) X 80%. In each blood collection, 3ml was collected in an anticoagulant tube, and 0.5ml of hemoglobin was sent for testing. After centrifugation, the serum was collected and placed in the-70 C refrigerator. The index test was conducted uniformly after the end of the experiment.

Teaching experiment

MONARK power bicycle (839E), telemetry heart rate poloar table, portable respiratory telemetry metabolic systemVO2000, exercise heart rate and blood pressure instrument, heart rate variability analysis software 1.1 (KUOPIO University, Finland), centrifuge. Low temperature refrigerator, etc.

Blood index: hemoglobin, cortisol, norepinephrine, aldosterone are measured by enzyme-linked immunonatridium (ELISA). The ELISA kits were all purchased from R & D, USA. The index test was assisted by Suzhou Municipal Hospital and Shanghai Ruigu Biotechnology Company respectively.

Other heart rate and blood pressure detection: the telemetry heart rate poloar meter and exercise blood pressure rhythmeter are used to detect heart rate and blood pressure in real time when the subject is quiet, during the exercise of pedal power bike and during the same time period of not exercise.

Data handling; data processing; DP

The extraordinary control group parameter comparison method is used, that is, when the basic data at a certain time in the cycle is used as the reference amount to compare the differences between the experimental data at the same time and it. Statistical analysis of the data obtained was performed with the SPSS11.5 software. The experimental data are expressed as the mean staff standard deviation (x ± s). P <0.05 was significant, and P <0.01 was extremely significant.

Experimental result and analysis

Effects of elective aerobic exercise on humoral regulators of the cardiovascular system

As can be seen from Table 1, the serum cortisol levels gradually increased in the exercise period until 60 minutes, the recovery period gradually decreased within 1 hour after exercise and tend to be quiet, and the cortisol levels differ in the morning and afternoon exercise, higher than in the morning (p <0.05). There are individual, sex, and age differences in heart rate, blood pressure, and fluctuations in the physiological range with factors such as emotional excitement, tension, labor or exercise, and posture changes .he results of this experiment confirmed the physiological phenomenon of accelerated heart rate and increased blood pressure (systolic blood pressure) during exercise, but there was no obvious difference between the upper period and in the afternoon, that is, the rhythm characteristics of heart rate and blood pressure in the exercise state disappeared recently .

The influence of elective exercise on various relevant indicators of lung function

As can be seen from Table 2, there was no difference in lung function indicators (tidal volume, respiratory rate, ventilation volume, oxygen consumption, relative ventilation, respiratory quotient and CO2 production) between morning and afternoon aerobic exercise (p> 0.05).

Table 1. Comparison of cortisol (nmoL / L) levels in upper and afternoon exercise (x soil s).

Testing time (min)	Morning (6:00-~8:00)	Afternoon (16:00~18:00)	t	P
0	457.43±136.75	307.53±105.60	2.529	0.039
30	1280.56±100.02	1010.33±108.31	2.624	0.011
60	1650.00±200.09	1321.31±189.62	2.492	0.032
90	1103.88±109.11	873.21±112.00	7.173	0.001
120	586.34±104.05	387.00±87.21	3.182	0.039

LF, HF, L / H in the morning and afternoon

According to Table 1, the difference between the frequency domain indicators between upper and afternoon exercise and quiet showed that LF was higher in the morning than in the afternoon (p <0.05), indicating that exercise was more sympathetic in the morning than in the afternoon, while there was no significant difference between HF and LF / HF (p> 0.05). As can be seen from Figure 1, there was no significant difference between HF, LF and LF and L F / HF (p> 0.05) during aerobic exercise, that is, the perirecent rhythm of heart rate variability disappeared during aerobic exercise.

The effect of aerobic exercise on improving the cardiovascular health of college students

Abnormal microcirculation function are often some diseases (such as atherosclerosis. Hardclerosis, hypertension, etc.) the occurrence of sequence, microcirculation disorder is obesity, diabetes, hypertension, ischemic heart disease and other disease pathogenesis and typical disease symptoms, and microcirculation function improvement is not only some diseases (such as diabetes, coronary heart disease, etc.), an important stage in the process of rehabilitation, but also improve the important biological basis of competitive sports performance.

The density of microvascular opening and vasodilatability are the two major factors of measuring microvascular reactive MR). It is reported that the number of open capillaries in quiet condition does not exceed 270 / 2 mm2, and 2500~3 000 / mm2. In normal condition, coronary blood flow in healthy adults is only 8% to 9% of cardiac bleeding, while coronary blood flow increases by 40% and oxygen intake by 2-2.5 times.

Aerobic exercise can improve insulin sensitivity and reduce CVD risk. It has been reported that some risk factors related to vascular endothelial dysfunction (ED), such as hypertension, atherosclerosis and coronary artery disease, are often accompanied by insulin resistance (IR) phenomenon in inducing CVD, while the improvement of IR can play an effective role in preventing and treating CVD. The so-called IR

Table 2. Test results of each indicator of pulmonary function during exercise at different time. periods.

	Morning (6:00-~7:00)	Afternoon (16:00~17:00)	P
Tidal volume (L)	1.30±0.47	1.16±0.42	0.365
Respiratory rate (times)	22.13±7.56	21.92±8.75	0.928
Ventilation volume per minute (L)	26.80±9.74	23.94±10.71	0.463
Relative oxygen consumption (L)	15.91±13.92	11.36±8.15	0.246
Oxygen consumption per minute (ml)	1085.33±787.96	797.20±553.18	0.245
CO2 generation volume (ml)	754.67±775.96	562.67±549.20	0.442
Respiratory Quotient (RQ)	0.64±0.10	0.66±0.15	0.610

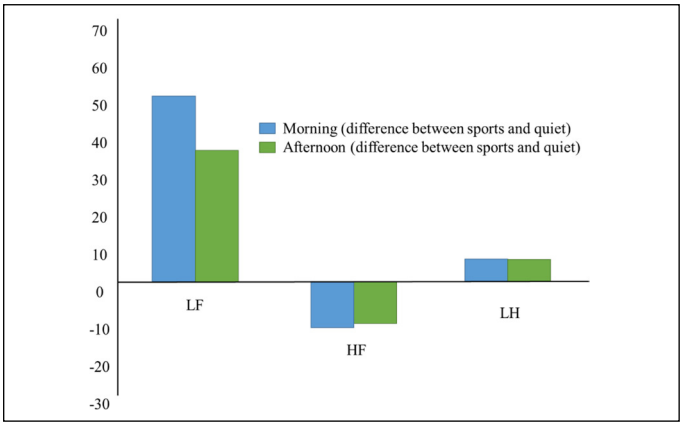

Figure 1. Shows the comparison results between aerobic exercise and quiet at different time periods.

is the phenomenon that when insulin promotes glucose uptake and utilization efficiency decreases, the body compensatory secretion produces excessive insulin to produce hyperinsulinemia, and to maintain the stability of blood glucose. APA can reduce the degree of myocardial ischemia / reperfusion injury by promoting cell glucose metabolism, inhibiting oxidative stress and myocardial cell apoptosis induced by ischemia/reperfusion after myocardial infarction.

CONCLUSIONS

CVD is a major disease that seriously endangers human health and causes human death due to disease. The primary cause of the disability. China is not only the country with the largest number of CVD deaths, but also the incidence of younger people. CVD prevalence and mortality and total physical activity are negatively related, long-term regular APA helps to enhance the tolerance of CVD, can indeed improve the prognosis of CVD patients, is an important means and method of effective prevention and adjuvant treatment of CVD. Improving cardiorespiratory fitness (CRF) is an effective way to improve individual survival rate, while APA is the most direct, effective and safe way to improve CRF. Young college students need to perform at least 150-300 m i n of moderate intensity or 75-150 min of high intensity physical activity, or some equivalent combination of the two, the minimum energy expenditure is about 1 000 kcal / w; for greater fitness benefits, the exercise dose is doubled. Compared with moderate-intensity continuous exercise (MICT), high-intensity intermittent exercise (HIT) mode is more efficient, which is not only easy for practitioners to accept and adhere to, but also more safe.

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