INFLUENCES OF GYMNASTICS ON BODY COMPOSITION AND CARDIOPULMONARY FUNCTION OF ATHLETES

INFLUÊNCIAS DA GINÁSTICA NA COMPOSIÇÃO CORPORAL E NA FUNÇÃO CARDIOPULMONAR DE ATLETAS

INFLUENCIAS DE LA GIMNASIA EN LA COMPOSICIÓN CORPORAL Y EN LA FUNCIÓN CARDIOPULMONAR DE ATLETAS

Original Article
Artigo Original
Artículo Original

Wen Lei[1]
(Physical Education Professional)

1. Minjiang University, Fuzhou, Fujian, China.

Correspondence:
Wen Lei
Fuzhou, Fujian, China. 350108.
minjiangleiwen@126.com

ABSTRACT

Introduction: Aerobics is a recreational, ornamental, rhythmic, and expressive sport. It is widely used in physical education in colleges and universities because it is also believed that this sport benefits the cardiopulmonary function and the body composition of the practitioners. Objective: Study the influences of aerobic gymnastics on body composition and cardiopulmonary function in its practitioners. Methods: 40 college students volunteered for the research sample. The living conditions and learning level of the subjects were the same. The students were divided into two groups for research. There was no significant difference between the groups comparing the volunteers' age, height, and weight. The high-load group performed exercises with a maximum heart rate of 220, while the low-load group performed the same protocol under a maximum heart rate of 195 beats per minute. The intervention took place over 40 and 60 minutes of exercise, respectively, for eight weeks. The POLAR monitor was used to check the kinematic performance of the athletes. The data were processed statistically. Results: Aerobic gymnastics influenced the body composition of college students with significant differences in bust circumference, waist, hip, thigh, and skinfold thickness ($P<0.05$). The athletes' heart rate, pulmonary ventilation, and diastolic pressure increased significantly after aerobic gymnastics. The study showed that the resting heart rate of the volunteers decreased significantly after exercise, and their lung function returned to normal ($P<0.05$). Conclusion: Aerobic exercise can improve the body composition, physiology, and cardiopulmonary function of its practitioners, and its greater encouragement in colleges and universities is recommended. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: *Physical Fitness; Exercise Test; Body Composition; Gymnastics.*

RESUMO

Introdução: A ginástica aeróbica é um esporte recreativo, ornamental, rítmico e expressivo. É amplamente utilizado na educação física em faculdades e universidades pois também se acredita que esse esporte beneficie a função cardiopulmonar e a composição corporal dos praticantes. Objetivo: Estudar as influências da ginástica aeróbica sobre a composição corporal e sobre a função cardiopulmonar em seus praticantes. Métodos: 40 estudantes universitários foram voluntários para a amostra de pesquisa. As condições de vida e nível de aprendizagem das disciplinas foram as mesmas. Os estudantes foram divididos em dois grupos para pesquisa. Não houve diferença significativa entre os grupos na comparação da idade, altura e peso dos voluntários. O grupo de alta carga efetuou exercícios com um ritmo cardíaco máximo de 220 enquanto o grupo de baixa carga executou o mesmo protocolo sob ritmo cardíaco máximo de 195 batimentos por minuto. A intervenção deu-se em 40 e 60 minutos de exercício, respectivamente, durante oito semanas. O monitor POLAR foi usado para verificar o desempenho cinemático dos atletas. Os dados foram processados estatisticamente. Resultados: A ginástica aeróbica influenciou a composição corporal dos estudantes universitários com diferenças significativas na circunferência de busto, cintura, quadril, coxa e espessura de prega cutânea ($P<0,05$). A frequência cardíaca, a ventilação pulmonar e a pressão diastólica dos atletas aumentaram significativamente logo após a ginástica aeróbica. O estudo mostrou que a frequência cardíaca em repouso dos voluntários diminuiu significativamente após o exercício, e sua função pulmonar voltou ao normal ($P<0,05$). Conclusão: O exercício aeróbico aperfeiçoou a composição corporal, a fisiologia e a função cardiopulmonar de seus praticantes sendo recomendado o seu maior incentivo nas faculdades e universidades. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

***Descritores*:** *Aptidão Física; Teste de Esforço; Composição Corporal; Ginástica.*

RESUMEN

Introducción: La gimnasia aeróbica es un deporte recreativo, ornamental, rítmico y expresivo. Se utiliza mucho en la educación física en colegios y universidades porque también se cree que este deporte beneficia la función cardiopulmonar y la composición corporal de los practicantes. Objetivo: Estudiar las influencias de la gimnasia aeróbica sobre la composición corporal y sobre la función cardiopulmonar en sus practicantes. Métodos: 40 estudiantes universitarios se ofrecieron como voluntarios para la muestra de la investigación. Las condiciones de vida y el nivel de aprendizaje de los sujetos eran los mismos. Los estudiantes se dividieron en dos grupos para la investigación. No hubo diferencias

significativas entre los grupos al comparar la edad, la altura y el peso de los voluntarios. El grupo de alta carga realizó los ejercicios con una frecuencia cardíaca máxima de 220, mientras que el grupo de baja carga realizó el mismo protocolo con una frecuencia cardíaca máxima de 195 pulsaciones por minuto. La intervención tuvo lugar durante 40 y 60 minutos de ejercicio, respectivamente, durante ocho semanas. El monitor POLAR se utilizó para verificar el rendimiento cinemático de los atletas. Los datos se procesaron estadísticamente. Resultados: La gimnasia aeróbica influyó en la composición corporal de los estudiantes universitarios con diferencias significativas en la circunferencia del busto, la cintura, la cadera, el muslo y el grosor de los pliegues cutáneos (P<0,05). La frecuencia cardíaca, la ventilación pulmonar y la presión diastólica de los atletas aumentaron significativamente inmediatamente después de la gimnasia aeróbica. El estudio mostró que la frecuencia cardíaca en reposo de los voluntarios disminuyó significativamente después del ejercicio, y su función pulmonar volvió a ser normal (P<0,05). Conclusión: El ejercicio aeróbico puede mejorar la composición corporal, la fisiología y la función cardiopulmonar de sus practicantes siendo recomendable su mayor fomento en colegios y universidades. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Aptitud Física; Prueba de Esfuerzo; Composición Corporal; Gimnasia.*

DOI: http://dx.doi.org/10.1590/1517-8692202329012022_0645 Article received on 01/11/2022 accepted on 11/11/2022

INTRODUCTION

Aerobics is an exercise method with beautiful musical rhythm as the primary tool. Aerobics can improve the coordination of the human body while maintaining the standard posture of the human body. Aerobics sports to fitness, heart, and bodybuilding as the primary goal. It integrates music, dance, gymnastics, and aesthetics. Aerobics is known worldwide for its intrinsic values and appeal.[1] Aerobics is a sport that is entertaining, ornamental, graceful, rhythmic, and able to express emotions. It is widely used in physical education in colleges and universities. This article focuses on college athletes. This paper uses two different aerobics exercises, high-intensity, and low-intensity, for experiments. This paper aims to analyze the effect of two different aerobics exercise methods on improving cardiopulmonary function and promoting the development of body shape.

METHOD

Subjects

This paper uses 40 people as the research sample. The living and learning conditions of the subjects were the same. In this paper, 40 students were divided into two groups for research.[2] There were no significant differences between subjects' age, height, and weight group.

Investigation method

A (high load group) designed an exercise regimen with a maximum heart rate of "220-age". Volunteers first did a 5-minute prep activity and a 20-minute body posture exercise. Finally, the volunteers did 20-30 minutes of running and jumping or step aerobics. B (low-load group) designed a "195-age" maximum heart rate as an exercise regimen. Volunteers first did a 5-minute prep and a 15-minute body bar exercise.[3] Finally, the volunteers did fifteen minutes of aerobics or running and jumping exercises. The experimental and control groups were given 40-60 minutes of exercise. The entire training cycle is eight weeks. In this paper, POLAR was used to measure the kinematic performance of athletes.

MOD simulation of muscle electricity and life in sports aerobics

The contribution rate of muscle EMG activity is the percentage of the total energy of each EMG to the sum of the overall EMG values of 11 muscles.[4] Its formula is as follows:

$$\frac{G_i}{\sum_{i=0}^{11} G_i} \times 100 \quad (1)$$

In this paper, the principal, side effects, and antagonistic effects E of the four experimental groups are analyzed, and the corresponding expressions are given:

$$E = \frac{A}{A+B} \times 100 \quad (2)$$

The four groups of muscles were biceps and triceps, serratus anterior and lower trapezius, pectoralis major and latissimus dorsi, anterior deltoid, and infraspinatus. This paper gives a complete body characteristic parameter.[5] The content includes the physiological cross-sectional area of the body, the maximum stress value of the most extensive tissue, and the mathematical model of the body. The effective muscle strength formula is as follows:

$$F_1 = \begin{cases} F_{\max} : if\ F_1 \geq F_{\max} \\ P_1(L_1 - L_2) + D_1(L_1 - L_2)| :\ if\ F_1 < F_{\max} \\ 0 : if\ L_1 > L_2 \end{cases} \quad (3)$$

$$F_i = F_2(F_1), 0 \leq F_2 \leq 200\% \quad (4)$$

$$F_{\max} = p_1 \times F_1 \quad (5)$$

p_1 represents the cross-section of the human body. F_1 indicates maximum tissue stress. L_1 represents a model of muscle contraction during reverse movement. L_2 represents the modality of the muscle. D_1 represents the derivative of both.[6] The preliminary design of the model can be selected based on the model's height, weight, age, and gender.

Mathematical and statistical methods

In this paper, paired and group experiments were used to conduct statistical analysis of the obtained data, and the difference value of the results was taken as 0.05. There is no need for a code of ethics for this study.[7]

There is no need for a code of ethics for this study.

Ethical Compliance

Research experiments conducted in this article with animals or humans were approved by the Ethical Committee and responsible authorities of Minjiang University following all guidelines, regulations, legal, and ethical standards as required for humans or animals.

RESULTS

The weight and waist circumference of the students in group A decreased, but there was no statistical significance. This suggests that high-intensity fitness exercises can change weight and shape.[8] The weight

and bust circumference of the students in group B decreased but was not statistically significant. This suggests that low-intensity training had no apparent effect on body shape. (Table 1)

The effects of exercise intensity on the heart and lungs were better. (Table 2) There was no significant change in the two experimental classes before and during the training of diastolic blood pressure.[9] After eight weeks of training, the athletes' heart rate decreased, blood pressure decreased, and lung function returned to normal. The resting heart rate was significantly lower in both groups than before training. This shows that eight weeks of regular exercise improves output per heartbeat. At rest, the heart rate can reach the body's regular metabolism. Reduced blood pressure is also an average change in the heart and lungs. This correlates with increased vagal tone after training.[10] There was a significant difference in lung activity between the two groups of volunteers after exercise (P<0.01). The results showed that both different calisthenics exercises could improve the patients' breathing capacity.

DISCUSSION

Aerobics is a comprehensive and dynamic sport. During exercise, the secretion of hormones increases due to the stimulation of the sympathetic nerves. At the same time, aerobics exercise can also lead to insulin secretion and significantly increase lipoprotein lipase activity.[11] This can speed up the body's metabolism by speeding up the body's consumption. One hour of aerobics can reduce the energy by about 21 kcal, 2.3 kg of heat generated by the decomposition of fat. This can reduce about a month of 1.5 kg of body weight and help people stay in shape while exercising. Aerobics exercise regularly trains all body parts, joints, and bones. Long-term aerobics can significantly reduce fat deposits. College students who regularly engage in national fitness exercises can make muscles, bones, and joints develop in harmony.

Aerobics improves the ability of the central nervous system to regulate the circulatory system and enhances the elasticity and tension of the arterioles. This lowers blood pressure.[12] The athlete's heart rate increases by 150 beats after doing aerobics, in which case the strength of the respiratory muscles can be increased, and the maximum oxygen intake can be increased. Increasing the hemoglobin level in the process also increases the speed of aerobic exercise. Aerobics has a more significant impact on the heart muscle. Prolonged and moderate physical activity can increase contractile strength and improve coronary blood flow and capillary proliferation. Before and after the experiment, the heart rate of the aerobics training group increased significantly. Some people present with sinus arrhythmia. This shows that long-term aerobics does have a specific effect on improving people's physiological functions. After a period of aerobics, the body's breathing becomes more profound. This is one of the most beneficial and effective breathing methods. This process allows the breathing muscles to get plenty of rest. Therefore, the body's metabolism is more powerful. Aerobics activities have moderate intensity, moderate density, and long training periods. Aerobics athletes can effectively exercise students' heart and lung function.[13] It can effectively enhance the circulation of the human body and promote the metabolism of the respiratory system and digestive systems. This exercise is conducive to the healthy development of the body. College students' self-awareness and initiative awareness are outstanding in aerobics. During training, the student's heart rate is 150-160 beats per minute. Aerobics exercise for a long time can strengthen the respiratory muscles' elasticity and improve the respiratory system's oxygen exchange. This can improve the cardiac function of college students. Aerobics is great for the heart and lungs.

Especially after aerobics, the heart rate is lower in the resting state, and the lung capacity is significantly increased. The heart rate was significantly lower between both groups compared to before training. This shows that regular training improves every output of the heart and lungs. At rest, the heart rate can reach the body's regular metabolism. Reduced blood pressure is also an average change in the heart and lungs. This correlates with increased vagal tone after training. There was a significant difference between the two groups in lung function before and after exercise (P<0.01). This shows that physical exercise has a significant effect on improving breathing ability. The effect of aerobics exercise on cardiopulmonary function is mainly due to the expansion

Table 1. Comparative analysis of experimental data of group A and group B.

Index	A (high-intensity group)		
	Forward	Back	P
Height (cm)	172.65±0.54	173.07±5.29	> 0.05
Weight (kg)	58.32±8.09	57.32±7.17	> 0.05
Waist (cm)	71.82±6.26	70.7±4.86	> 0.05
Index	**B (low-intensity group)**		
	Forward	**Back**	**P**
Height (cm)	172.34±5.58	172.8±5.51	> 0.05
Weight (kg)	56.47±9.72	56.4±7.67	> 0.05
Waist (cm)	70.16±7.28	69.93±5.78	> 0.05

Table 2. Comparative analysis of heart rhythm and pulmonary function parameters before and after exercise in groups A and B.

Index	A (high-intensity group)		
	Forward	Back	P
Heart rate (times/min)	89.21±6.91	89.1±6.8	> 0.5
Systolic blood pressure (mmHg)	114.7±8.21	108.32±11.56	< 0.001
Diastolic blood pressure (mmHg)	73.44±7.56	70.42±8.86	> 0.05
Lung capacity (ml)	2756.7±525.2	2872.8±463	< 0.001
Index	**B (low-intensity group)**		
	Forward	**Back**	**P**
Heart rate (times/min)	91.15±6.05	89.86±7.78	> 0.05
Systolic blood pressure (mmHg)	117.18±10.04	108.97±7.67	< 0.001
Diastolic blood pressure (mmHg)	75.38±7.56	68.26±7.02	< 0.05
Lung capacity (ml)	2632.5±440.42	2961.9±401.54	< 0.001

of blood vessels during exercise, which reduces the resistance of the heart's blood to the organs. The result is a reduced load on the heart. Aerobics can increase the heart muscle's volume and strengthen the heart muscle's contraction. The final result is to increase the output power of the heart.

CONCLUSION

The test subjects selected an 8-week aerobics training program according to the training intensity and volume. Studies have found that aerobic exercise can significantly improve resting heart rate, blood pressure, and lung capacity. And high-load aerobics training has a good effect on improving body shape and reducing weight. Aerobics is a relaxing and enjoyable way of exercise. The athlete can mobilize students' sports enthusiasm. Aerobics can strengthen the body and encourage students to develop a correct posture. Aerobics can fully develop the body and mind.

The author declares no potential conflict of interest related to this article.

AUTHORS' CONTRIBUTIONS: The author made significant contributions to this manuscript. Wen Lei: writing, data analysis, article review and intellectual concept of the article.

REFERENCES

1. Mohamed AA, Alawna M. Role of increasing the aerobic capacity on improving the function of immune and respiratory systems in patients with coronavirus (COVID-19): A review. Diabetes Metab Syndr Clin Res Rev. 2020;14(4):489-96.
2. Nikniaz L, Ghojazadeh M, Nateghian H, Nikniaz Z, Farhangi MA, Pourmanaf H. The interaction effect of aerobic exercise and vitamin D supplementation on inflammatory factors, anti-inflammatory proteins, and lung function in male smokers: a randomized controlled trial. BMC Sports Sci Med Rehabil. 2021;13(1):1-8.
3. Alyafei A. Aerobic Capacity and Regular Physical Exercise among Tobacco Smokers. Research International Journal of Community Medicine and Public Health. 2021;2(1):1-4.
4. Duke JW, Lovering AT. Respiratory and cardiopulmonary limitations to aerobic exercise capacity in adults born preterm. J Appl Physiol. 2020;129(4):718-24.
5. Naik KE. Influence of aerobic exercises on cognitive abilities among children. Inter J Health, Physc Educ Computer Sci Sports. 2020;38(2):75-7.
6. Alqahtani AS, Alajam R, Eickmeyer SM, Vardey R, Liu W. Feasibility and trend of pulmonary function in a pilot trial of aerobic walking exercise in non-ambulatory stroke survivors. Top Stroke Rehabil. 2020;27(3):190-8.
7. Alawna M, Amro M, Mohamed AA. Aerobic exercises recommendations and specifications for patients with COVID-19: a systematic review. Eur Rev Med Pharmacol Sci. 2020;24(24):13049-55.
8. Wickerson L, Brooks D, Granton J, Reid WD, Rozenberg D, Singer LG, et al. Interval aerobic exercise in individuals with advanced interstitial lung disease: a feasibility study. Physiother Theory Pract. 2021;37(9):1034-42.
9. Kampert M, Singh T, Finet JE, Van Iterson EH. Impact of wearing a facial covering on aerobic exercise capacity in the COVID-19 era: is it more than a feeling?. Clin Res Cardiol. 2020;109(12):1595-6.
10. İşleyen G, Dağlioğlu Ö. The effect of aerobic exercise on pulmonary function and aerobic capacity in sedentary men. IJSETS. 2020;6(3):80-7.
11. Park K, Lee S. Changes in Respiratory Function Due to Differences in Mask Blocking Grade and Effects on Cardiovascular Function during Aerobic Exercise with Mask. Phys Ther Rehabil Sci. 2021;10(3):289-96.
12. Hedlund E, Lundell B. Endurance training may improve exercise capacity, lung function and quality of life in Fontan patients. Acta Paediatr. 2022;111(1):17-23.
13. Abdelbasset WK, Osailan A. Sleep quality and ventilatory efficiency in elderly heart failure patients: a pilot study on the short-term effect of 4-week low-intensity aerobic exercise. Kardiologiia. 2020;60(6):102-6.