INFLUENCES OF PHYSICAL EXERCISE ON PHYSICAL FITNESS OF FEMALE UNIVERSITY STUDENTS

INFLUÊNCIAS DO EXERCÍCIO FÍSICO SOBRE A APTIDÃO FÍSICA DAS ESTUDANTES UNIVERSITÁRIAS

INFLUENCIA DEL EJERCICIO FÍSICO EN LA APTITUD FÍSICA DE LAS ESTUDIANTES UNIVERSITARIAS

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Ling Sun[1]
(Physical Education Professional)

1. Taiyuan University of Science and Technology, College of Physical Education, Taiyuan, Shanxi, China.

Correspondence:
Ling Sun
Taiyuan, Shanxi, China. 030024.
3170400120@caa.edu.cn

ABSTRACT

Introduction: Attention to the physical health of female university students has been increasing in recent years, and scientifically formulating sports plans for this public, and enhancing their fitness, has become an important topic. Objective: Explore the influences of long-term physical exercise on the physical fitness of female college students. Methods: 240 female college students in a given city were selected as volunteers, and divided into a resistance exercise group, an aerobic exercise group, and a control group. The total intervention period was ten weeks, followed by the recollection of vital data and other relevant markers for statistical analysis. Results: After ten weeks of exercise, the task performance of the resistance exercise group was improved; the task performance of the resistance exercise group was significantly superior to aerobic exercise and control. Conclusion: It was observed that the task performance of the resistance exercise group and the aerobic exercise group were positively impacted, and the positive benefits of the two types of exercise were different. ***Level of evidence II; Therapeutic studies - investigating treatment outcomes.***

Keywords: Physical Fitness; Physical Exercise; Students; Women's Health.

RESUMO

Introdução: A atenção à saúde física das estudantes universitárias femininas é crescente nos últimos anos e formular cientificamente os planos esportivos desse público, potencializando as suas aptidões tornou-se um tópico importante. Objetivo: Explorar as influências de exercícios físicos de longo prazo sobre a aptidão física das estudantes universitárias. Métodos: Foram selecionadas 240 estudantes universitárias em uma determinada cidade como voluntárias, divididas em grupo de exercícios de resistência, exercícios aeróbicos e controle. O período total de intervenção foi de 10 semanas, seguido de nova coleta de dados vitais e outros marcadores relevantes para a análise estatística. Resultados: Após 10 semanas de exercício, o desempenho de tarefa do grupo de exercício de resistência foi aprimorado; o desempenho de tarefa do grupo de exercício de resistência foi significativamente superior ao exercício aeróbico e controle. Conclusão: Observou-se que ao desempenho de tarefas do grupo de exercício de resistência e do grupo de exercício aeróbico foi positivamente impactado, e os benefícios positivos dos dois tipos de exercício foram diferentes. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Aptidão Física; Exercício Físico; Estudantes; Saúde da Mulher.*

RESUMEN

Introducción: La atención a la salud física de las estudiantes universitarias está creciendo en los últimos años y formular científicamente los planes deportivos de este público, potenciando su aptitud física se ha convertido en un tema importante. Objetivo: Explorar las influencias del ejercicio físico de larga duración en la aptitud física de las estudiantes universitarias. Métodos: Se seleccionaron como voluntarias 240 estudiantes universitarias de una ciudad determinada, divididas en grupo de ejercicio de resistencia, grupo de ejercicio aeróbico y grupo de control. El periodo total de intervención fue de 10 semanas, seguido de una nueva recogida de datos vitales y otros marcadores relevantes para el análisis estadístico. Resultados: Tras 10 semanas de ejercicio, el rendimiento en la tarea del grupo de ejercicio de resistencia mejoró; el rendimiento en la tarea del grupo de ejercicio de resistencia fue significativamente superior al ejercicio aeróbico y al control. Conclusión: Se observó que el rendimiento en la tarea del grupo de ejercicio de resistencia y del grupo de ejercicio aeróbico tenía un impacto positivo, y que los beneficios positivos de los dos tipos de ejercicio eran diferentes. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Aptitud Física; Ejercicio Físico; Estudiantes; Salud de la Mujer.*

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INTRODUCTION

Executive function refers to the high-level cognitive process that controls and regulates various basic cognitive processes when completing complex cognitive tasks. Stroop task and N-back task are classic paradigms for evaluating executive function. Executive function is a necessary ability for physical and mental health, academic/career success, and good cognitive, social and psychological development. Some studies have pointed out that better executive function is usually associated with

higher academic achievements in mathematics and reading, while poor executive function is closely related to diseases such as diabetes, anxiety and depression.[1] Therefore, it is very important to explore methods and means to improve executive function. Physical exercise, as an effective means to improve or improve executive function, has been confirmed by some research. The existing research has a more consistent view that moderate intensity exercise is most conducive to improving executive function. However, if you want to fully understand the relationship between exercise and executive function, more research is needed to explore.[2] As a means of intervention, physical exercise mostly adopts aerobic exercise, and has obtained more positive effects, while resistance exercise involves less. Resistance exercise is an important means to improve people's health.[3] In order to understand the causal relationship between different types of exercise and executive function, it is necessary to carry out exercise for several weeks. However, in previous studies, there are few studies using long-term exercise as an intervention, and the results are not consistent. In addition, there are fewer comparative studies on resistance exercise and aerobic exercise.[4]

Both aerobic and resistance exercise are effective in improving physical health, including reducing the incidence of cancer and cardiovascular disease and are strongly associated with all-cause mortality. But these two types of exercise may play very different roles in health. Some studies have shown that these two modes of exercise are independently associated with health, but there is also evidence of potential synergistic effects on health.[5] Executive function refers to the advanced cognitive processes that control and regulate various basic cognitive processes when completing complex cognitive tasks. The Stroop task and the N-back task are exemplary models for evaluating executive function. Executive function is necessary for physical and mental health, academic/career success, and good cognitive, social, and psychological development.[6] Studies have shown that better executive function is often associated with higher academic performance such as mathematics and reading, while poor executive function is closely related to diseases such as diabetes, anxiety and depression.[7] Therefore, it is important to explore ways and means to improve executive function. Resistance exercise has the effect of strengthening muscles and bones, so the form of combining aerobic exercise with resistance exercise is currently the more recommended form of exercise, and has many advantages over pure aerobic and resistance exercise.[8] However, at present, China's exercise control is still dominated by aerobic exercise alone, and the understanding of the combination of aerobic and resistance exercise is insufficient.[9] In view of this, this study takes long-term exercise as the starting point to explore the relationship between resistance exercise, aerobic exercise and executive function, compare the difference in the influence of long-term aerobic exercise and resistance exercise on executive function, provide a theoretical basis for a comprehensive understanding of the relationship between exercise and executive function, and provide a reference for the accurate selection of exercise intervention methods.[10]

Experimental result and analysis

Subjects of study

240 ordinary female college students aged 18~19 were recruited in a university in a city by putting up posters, WeChat platforms, etc., and randomly divided the test into 80 in the resistance exercise group, aerobic exercise group and control group. The participants were enrolled as follows: a). no cardiovascular and metabolic diseases, no history of brain injury and no history of neurological system; b). Normal intelligence; c). Right-handed; d). The participant's visual acuity or corrected visual acuity is normal, and there is no color blindness or color weakness; e). No depression, anxiety and other bad emotions; f). is in normal mental condition; g). Subject consents to completing the informed consent form. Before the experiment, the participants filled in the "Depression Self-rating Scale" and "Anxiety Self-rating Scale", and according to the scoring criteria, 6 participants in the resistance exercise group with scores higher than 50 points on the depression and anxiety scale were excluded; In addition, 3 participants in the aerobic exercise group did not complete all the experiments, and 5 subjects in the control group gave up halfway, so the final determination of resistance exercise group, aerobic exercise group and control group were 74, 77 and 75 participants, respectively.

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 Taiyuan University of Science and Technology, China (NO. 20220021)

Methods of study

Executive function is usually divided into three subcomponents: inhibitory control, working memory, and cognitive flexibility, of which inhibitory control is the core component of executive function, and cognitive flexibility is developed based on two components: inhibitory control and working memory. Therefore, this study mainly focuses on the two subcomponents of inhibitory control and working memory in executive function, and uses the two classical task paradigms of Stroop task and N-back task to evaluate inhibitory control and working memory.

Previous studies have shown that 8 weeks of aerobic or resistance exercise can have an effect on cognitive function. Based on previous studies of aerobic and resistance exercise interventions, as well as recommendations for exercise prescriptions in NSCA's Essentials of personal training, The aerobic exercise in this study is mainly aimed at improving individual cardiopulmonary function, and resistance exercise mainly exercises human muscles by overcoming resistance.

The aerobic exercise group took self-programmed primary and intermediate aerobic aerobics as the intervention content, and wore a telemetry heart rate monitoring system during exercise to control the heart rate at 60%~69% of the maximum heart rate (220-age) to ensure moderate intensity exercise. The resistance exercise group used 6 elastic drives of lunge squat, squat, front flat lift, arm curl, lunge oblique pull-up, and lean rowing as the intervention content, and the maximum number of repetitions corresponding to the moderate intensity resistance exercise were 6~15RM, the exercise interval was 1 minute, and each movement completed 3 sets, each set Repeat 10 times. The exercise regimen for the aerobic and resistance groups was 8 weeks, 3 sessions/week, and 50 minutes, including 5 minutes of warm-up, 40 minutes of orthogonism, and 5 minutes of relaxation.

All participants were required to complete a total of 3 tests. The first time: The participants filled in the basic information and the "informed consent form", and filled in the depression and anxiety self-rating scale to ensure the subject's mental health, and measured the height, weight, body mass index and maximum oxygen uptake through the height and weight analyzer, body composition analyzer, power bicycle and other instruments. 2nd: Complete the Stroop mission and the N-back mission pre-test.

Experimental result and analysis

Demographic Information

In order to test the homogeneity of each group of participants, one-way ANOVA was used to find that all participants had age [$F(2,55)=0.51, P=0.60$], height [$F(2,55)=0.13, P=0.88$], weight ($F(2,55)=0.17, P=0.85$), body mass index [$F(2,55)=0.28, P=0.76$], and maximum oxygen uptake There were no significant differences in [$F(2,55)=0.07, P=0.94$], indicating that the groups were homogeneous in demographic indicators.

Effects of different types of exercise on inhibitory function

The Stroop task performance of each group before and after the intervention is shown in Table 1. To understand the effect of 8 weeks of resistance exercise and aerobic exercise on Stroop task performance, a mixed design of 3 (groups: resistance exercise group, aerobic exercise group, control group) × 2 (time: before, post-intervention) × 2 (conditions: consistent, inconsistent) was used for repeated measurement ANOVA.

The results showed that the main effect of time was significant [F(1,55)=4.87, P=0.03, η2=0.08], the main effect of the group was not significant (P=0.74), the main effect of the condition was not significant (P=0.49), the interaction effect between time and group was not significant (P=0.61), and the interaction effect between conditions and groups was not significant (P=0.58). The interaction effect between time and condition was not significant (P=0.26). Post-hoc examination found that the difference in accuracy rate before and after exercise between the resistance exercise group, aerobic exercise group and control group did not reach the significant level (P>0.05). At the time of reaction, the main effect of time was not significant (P=0.88), the main effect of the group was significant [F(2,55)=3.53, P=0.04, η2=0.11], the conditional main effect was obvious [F(1,55)=11.84, P=0.001,η2=0.18], and the interaction between time and group was not significant [F(2,55)=2.99,P=0.06,η2=0.10], the interaction between conditions and groups was not significant (P=0.9), the interaction between time and conditions was not significant [F(1,55)=3.78, P=0.06, η2=0.06], and the interaction between time, group and conditions was not significant (P=0.19).The response after intervention in the resistance exercise group was significantly shorter than that of the aerobic exercise group and the control group, while there was no difference between the aerobic exercise group and the control group (P aerobic group - control group = 0.63). (Figure 1)

Table 1. Performance of Stroop tasks before and after different types of exercise.

Task conditions		Color word consistency	Color word inconsistency	Color word consistency	Color word inconsistency
		Accuracy (%)	Accuracy (%)	Reaction time (ms)	Reaction time (ms)
Resistance exercise group	Before intervention	99±4	99±3	903.46±119.75	939.87±118.99
	After intervention	98±6	98±3	851.96±111.78	875.15±123.06
Aerobic exercise group	Before intervention	99±4	99±4	946.30±122.30	1010.67±147.58
	After intervention	98±5	98±4	998.14±201.29	995.98±184.37
control group	Before intervention	99±4	99±2	967.00±171.23	993.17±175.50
	After intervention	98±6	98±3	1002.83±138.12	1022.00±151.71

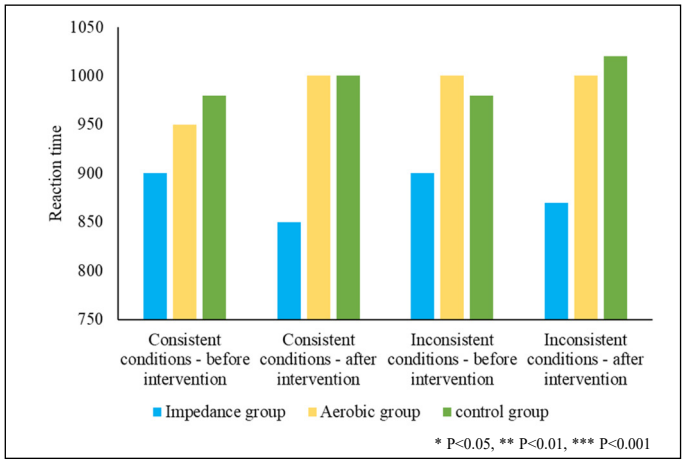

Figure 1. Response to Stroop task before and after different types of exercise intervention.

Effects of different types of exercise on working memory

The N-back task performance of each group before and after the intervention is shown in Table 2. To understand the effect of different exercise types on the N-back task, ANOVA was performed 3 (groups: resistance exercise group, aerobic exercise group, control group), ×2 (time: before and after intervention), ×3 (conditions: 0-back, 1-back, 2-back).

The results showed that in terms of accuracy, the group main effect was not significant (P=0.76), the time main effect was significant [F(1,55)=5.33, P=0.03, η2=0.09], the conditional main effect was significant [F(1,55)=213.56, P=0.00, η2=0.80], the interaction between time and group was not significant (P=0.94), and the interaction between condition and group was not significant (P= 0.61), the interaction between time and conditions was not significant (P=0.06), and the interaction between time and conditions and groups was not significant (P=0.15). At the time of reaction, the main effect of time was not significant (P=0.14), the main effect of group was not significant (P=0.33), the main effect of condition was significant [F(1,55)=109.12, P=0, η2=0.67], the interaction between time and group was not significant (P=0.62), the interaction between conditions and groups was not significant (P=0.64), and the interaction between time and conditions was significant [F(1,55)=11,P=0.002,η2=0.17], the interaction between time, conditions and groups was not significant (P=0.87). In summary, it can be seen that the effect of exercise on working memory is reflected in the correct rate and response of N-back tasks. Resistance exercise and aerobic exercise both affected the accuracy rate of N-back tasks, but the performance was different between the two groups, resistance exercise had a significant effect on the accuracy rate of 1-back tasks, and aerobic exercise had a significant effect on the accuracy rate of 2-back tasks. In terms of reaction, both resistance exercise and aerobic exercise had a significant effect on the 2-back task, but there was no significant difference between the two exercise types.

CONCLUSIONS

In this study, after 8 weeks, 3 weeks/week, 50 minutes/week of resistance exercise and aerobic exercise interventions, it was found that the performance of the resistance exercise group was optimized on both the Stroop task and the N-back task, while the performance of the aerobic exercise group was improved in the N-back task, indicating that the two different types of exercise, 8 weeks of resistance exercise and aerobic exercise, can have a positive effect on executive function. This is consistent with previous studies. Moderate-intensity resistance exercise and aerobic exercise at 8 weeks, 3 sessions/week, and 50 minutes/week selectively positively affected executive function, and 8 weeks of resistance exercise and aerobic exercise had different positive effects on executive function.

The author declare no potential conflict of interest related to this article

Table 2. N-back task accuracy rate before and after different types of exercise intervention.

Task conditions		0-back	1-back	2-back
		Accuracy (%)	Accuracy (%)	Accuracy (%)
Resistance exercise group	Before intervention	93±7	87±7	72±12
	After intervention	94±6	90±4	80±10
Aerobic exercise group	Before intervention	94±7	84±10	73±16
	After intervention	95±5	86±7	79±11
control group	Before intervention	92±10	87±9	76±10
	After intervention	95±4	88±5	78±6

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