

PHYSICAL ENDURANCE AND CARDIOPULMONARY CAPACITY IN COLLEGE TENNIS TRAINING

RESISTÊNCIA FÍSICA E CAPACIDADE CARDIOPULMONAR NO TREINO DE TÊNIS UNIVERSITÁRIO

RESISTENCIA FÍSICA Y CAPACIDAD CARDIOPULMONAR EN EL ENTRENAMIENTO DE TENIS UNIVERSITARIO



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ABSTRACT

Introduction: Recently, a decline in the adherence to physical exercise by college students has been observed. The physical condition of this group of individuals is declining, which is alarming in the health sector and requires a scientific response that strengthens college students' physical endurance and cardiopulmonary capacity. Tennis is a highly acceptable, low-cost sport available at many universities and colleges with potential benefits for this purpose. **Objective:** Study the impacts of tennis training on physical endurance and cardiopulmonary capacity in college students. **Methods:** The experiment was controllably conducted on a class of young college students, randomly distributed into control and experimental groups. The control group practiced athletics, while the experimental group practiced tennis training. According to the curriculum design, physical education courses were held twice a week, and the training had a consistent duration. **Results:** The experimental group's response to tennis training showed statistically relevant optimization, most notably vital capacity, which increased from 2556.19 ml to 3076.68 ml after the experiment; 50-meter running speed, which increased from 9.51 s to 8.68 s; and flat plate exercise, which was optimized from 10.02 kg to 12.85 kg after the experiment. **Conclusion:** Tennis training can improve college students' physical fitness and lung capacity. Further comparative studies are recommended for comprehensive analysis and judgment in the follow-up study. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Tennis; Physical Endurance; Exercise Test, Cardiopulmonary.

RESUMO

Introdução: Recentemente, constatou-se um declínio na adesão aos exercícios físicos pelos estudantes universitários. A condição física desse grupo de indivíduos está em declínio, fato que alarma os setores de saúde e exige uma resposta científica que fortaleça a resistência física e a capacidade cardiopulmonar dos estudantes universitários. O tênis é um esporte de alta aceitabilidade e baixo custo, disponível em muitas universidades e faculdades e com potenciais benefícios ao propósito em questão. **Objetivo:** Estudar os impactos do treino de tênis sobre a resistência física e a capacidade cardiopulmonar nos estudantes universitários. **Métodos:** A experiência foi controladamente conduzida sobre uma turma de jovens universitários, aleatoriamente distribuídos em grupos controle e experimental. O grupo controle praticou atletismo, enquanto o grupo experimental praticou o treinamento de tênis. De acordo com o desenho curricular, os cursos de educação física foram realizados duas vezes por semana, e o treinamento teve uma duração consistente. **Resultados:** A resposta do grupo experimental ao treino de tênis apresentou uma otimização estatisticamente relevante, com destaque para a capacidade vital, que se elevou de 2556.19 ml para 3076.68 ml após o experimento; a velocidade de percurso de 50 metros, que subiu de 9.51 s para 8.68 s; e o exercício de placa plana, que foi otimizado de 10.02 kg para 12.85 kg após o experimento. **Conclusão:** O treino de tênis pode melhorar a aptidão física e a capacidade pulmonar dos estudantes universitários. Recomenda-se mais estudos comparativos para uma análise e julgamento abrangente no estudo de acompanhamento. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Tênis; Resistência Física; Teste de Exercício Cardiopulmonar.

RESUMEN

Introducción: Recientemente, se ha observado un descenso en la adherencia a los ejercicios físicos por parte de los estudiantes universitarios. La condición física de este grupo de individuos está en declive, un hecho que alarma a los sectores sanitarios y exige una respuesta científica que refuerce la resistencia física y la capacidad cardiopulmonar de los universitarios. El tenis es un deporte de gran aceptación y bajo coste, disponible en muchas universidades e institutos y con beneficios potenciales para el propósito que nos ocupa. **Objetivo:** Estudiar el impacto del entrenamiento de tenis sobre la resistencia física y la capacidad cardiopulmonar en estudiantes universitarios. **Métodos:** El experimento se realizó de forma controlada en una clase de jóvenes universitarios, distribuidos aleatoriamente en grupos de control y experimental. El grupo de control practicó atletismo, mientras que el grupo experimental practicó entrenamiento de tenis. Según el diseño del plan de estudios, los cursos de educación física se impartían dos veces por semana, y la formación tenía una duración constante. **Resultados:** La respuesta del grupo experimental al entrenamiento de tenis mostró una optimización estadísticamente relevante, con énfasis en la capacidad vital, que aumentó de 2556,19 ml a 3076,68 ml después del experimento; la velocidad de carrera de 50 metros, que aumentó de 9,51 s a 8,68 s; y el ejercicio



de placa plana, que se optimizó de 10,02 kg a 12,85 kg después del experimento. Conclusión: El entrenamiento de tenis puede mejorar la forma física y la capacidad pulmonar de los estudiantes universitarios. Se recomiendan más estudios comparativos para un análisis exhaustivo y un ensayo en el estudio de seguimiento. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptores: Tenis; Resistencia Física; Prueba de Esfuerzo Cardiopulmonar.

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INTRODUCTION

The improvement of college students' physical fitness is the focus of many PE teachers' research.¹ At present, college students are facing many challenges in terms of physical fitness and physique. First, the development of modern science and technology has brought a lot of convenience to people's lives.² The popularity of buses, cars and electric vehicles has reduced the number of times students walk; The popularity of elevators has reduced the number of stairs that students can use to exercise; The popularity of takeout makes students spend more time in their dorms playing video games; The application of smart phones has made students sit still for a long time.³ All kinds of superposition have led to the current lack of physical exercise and the decline of physical fitness of students. In addition, the outbreak of the COVID-19 in recent years has also made students consciously reduce the number of times they go to places where people are crowded for exercise, leading to a decline in physical fitness and weakened cardiopulmonary capacity, which is often reflected in the situation of panting after taking two steps in life.⁴ In serious cases, it will also lead to some cardiovascular and cerebrovascular diseases, even sudden death. Therefore, it is urgent to strengthen college students' physical endurance and cardiopulmonary capacity.⁵ According to the literature, the construction cost of tennis venues is low, sports equipment is easy to learn, and has a certain antagonism and interest, which is very suitable for college sports teaching.⁶ The literature studies the college students who have tennis training, and puts forward that strengthening college students' tennis training can effectively improve their physical fitness. By learning from the experience of predecessors, this paper analyzes the impact of tennis training on physical endurance and cardiopulmonary capacity of college students, selects non sports major college students as the research object, and discusses the strategies for improving the physical quality of non sports major college students.⁷

METHOD

Selection of research objects

This paper first studies the current college tennis elective class, studying its curriculum content, training plan design, as well as the changes in physical examination results over the years and other contents, so as to have a certain understanding of the improvement of college students' physique and the effect of tennis training. The study and all the participants were reviewed and approved by Ethics Committee of North China University of Water Resources and Electric Power (NO.21NUWREFZ018). Subsequently, a controlled experimental research object was designed. A tennis elective class in a university was selected as the experimental group, and a track and field class was selected as the control group. The experimental group and the control group were students of the same grade and the same college. There was little difference in curriculum design and daily learning and life between them, so as to minimize the interference of unrelated variables. The age, height and weight of the two groups of subjects are shown in Table 1. The P values of the three indicators are greater than 0.05, indicating that the basic conditions of the subjects will not cause artificial interference to the experimental results.

Table 1. Basic information of the two groups of subjects.

Test index	Experimental group (M ± SD)	Control group (M ± SD)	P value
Age (age)	17.954 ±0.432	18.297 ±0.298	>0.05
Height (cm)	164.111 ±5.563	165.104 ±4.242	>0.05
Weight (kg)	52.660 ±8.044	52.938 ±6.279	>0.05

Experimental design

The experiment was conducted in a controlled way. The control group was an optional track and field class. The main contents of the course were aerobic jogging, javelin, long jump and other common sports types in track and field. The experimental group is a tennis elective class, and its teaching contents include tennis introduction teaching, tennis movement skills teaching, basic tennis practice and dueling, etc. The experimental group and the control group conducted physical education courses twice a week according to the curriculum arrangement of the relevant grades, and the overall training duration was consistent. In order to reduce the interference requirements of irrelevant variables on the experimental results, the experimental group and the control group should reduce outdoor sports activities as much as possible in their spare time, and control the time of outdoor sports activities within a similar range, so as to make the experimental results more rigorous.

Data observation

Before and after the experiment, several indexes of the two groups of subjects were measured. The changes of central lung and physical endurance mainly included vital capacity, 50 meters, back extension test, sitting forward flexion, 1 minute leg flexion sit up, etc; The changes of muscle endurance mainly include: left hand grip strength, right hand grip strength, kneeling push up to exhaustion, 1RM flat bed push, 1RM bilateral squat, etc.

Excel and spss software are used to process the acquired data for the convenience of the following research.

RESULTS

Changes in Cardiopulmonary and Physical Endurance of Subjects

The improvement of college students' cardiopulmonary endurance and physical endurance can effectively improve their physical fitness, reduce fatigue, asthma and other problems in daily life, and thus improve the quality of life of college students. In this section, it is studied. Table 2 shows the data expression of the change, and Table 3 shows the change rate of the two groups of college students before and after the experiment. In order to better analyze the difference between the experimental group and the control group, the concept of contrast range is introduced. The calculation method is the change rate of the experimental group/the change rate of the control group × 100%.

Table 2 shows the changes of cardiopulmonary and physical endurance of the two groups of subjects. It can be seen from Table 2 that the vital capacity of the experimental group was 2556.199 ± 471.980 (ml) before the experiment, and was optimized to 3076.686 ± 552.978 (ml)

Table 2. Changes in cardiopulmonary and physical endurance of two groups of subjects.

Test index	Time	Experimental group (M ± SD)	Control group (M ± SD)	P value
Vital capacity (ml)	Before experiment	2556.199 ±471.980	2668.881 ±459.194	>0.05
	After experiment	3076.686 ±552.978	2954.521 ±618.701	<0.05
50 m (s)	Before experiment	9.517 ±0.794	9.831 ±0.790	>0.05
	After experiment	8.688 ±0.506	9.031 ±0.912	<0.05
Back extension test (cm)	Before experiment	21.443 ±5.904	21.363 ±6.471	>0.05
	After experiment	25.134 ±5.093	21.127 ±5.775	<0.05
Forward bending of sitting body (cm)	Before experiment	21.040±4.976	19.622 ±4.546	>0.05
	After experiment	27.337 ±4.982	19.763 ±4.433	<0.05
1min leg bending sit ups (pcs.)	Before experiment	31.394 ±7.525	28.186 ±4.348	>0.05
	After experiment	35.705 ±7.366	29.362 ±3.960	<0.05

Table 3. Changes in muscle endurance of two groups of subjects.

Test index	Time	Experimental group (M ± SD)	Control group (M ± SD)	P value
Left hand grip (kg)	Before experiment	24.526 ±4.424	22.213 ±4.309	>0.05
	After experiment	24.911 ±4.246	22.252 ±4.121	<0.05
Right hand grip (kg)	Before experiment	27.033 ±5.498	25.843 ±4.186	>0.05
	After experiment	27.445 ±5.664	25.506 ±4.348	<0.05
Kneeling Push Ups to Exhaustion (piece)	Before experiment	19.117 ±5.223	19.338 ±4.337	>0.05
	After experiment	24.627 ±4.698	19.251 ±3.662	<0.05
1RM flat horizontal push (kg)	Before experiment	10.024 ±4.682	10.620 ±4.667	>0.05
	After experiment	12.858 ±4.496	10.945 ±4.216	<0.05
1RM double squat (kg)	Before experiment	17.376 ±4.319	17.170 ±4.824	>0.05
	After experiment	21.645 ±3.860	16.807 ±4.744	<0.01

after the experiment; 50 meters was 9.517 ± 0.794 (s) before the experiment, and was optimized to 8.688 ± 0.506 (s) after the experiment; The back extension test was 21.443 ± 5.904 (cm) before the experiment, and was optimized to 25.134 ± 5.093 (cm) after the experiment; The anterior flexion of sitting body was 21.040 ± 4.976 (cm) before the experiment, and it was optimized to 27.337 ± 4.982 (cm) after the experiment; One minute leg bending sit ups were 31.394 ± 7.525 before the experiment, and were optimized to 35.705 ± 7.366 after the experiment. The vital capacity of the control group was 2556.199 ± 471.980 (ml) before the experiment, and was optimized to 3076.686 ± 552.978 (ml) after the experiment; 50 meters was 9.831 ± 0.790 (s) before the experiment, and was optimized to 9.031 ± 0.912 (s) after the experiment; The back extension test was 21.363 ± 6.471 (cm) before the experiment, and was optimized to 21.127 ± 5.775 (cm) after the experiment; The anterior flexion of sitting body was 19.622 ± 4.546 (cm) before the experiment, and was optimized to 19.763 ± 4.433 (cm) after the experiment;

One minute leg bending sit ups were 28.186 ± 4.348 before the experiment, and were optimized to 29.362 ± 3.960 after the experiment. It can be seen from this that both ordinary aerobic track and field courses and tennis can significantly improve the cardiopulmonary endurance and physical endurance of college students, and promote the improvement of basic physical fitness such as their physical test results.

Changes in muscle endurance of subjects

Improving the muscle endurance of college students can not only enhance their physical quality, but also promote their growth and development, improve their mental outlook and other advantages. Therefore, as the second main research point of this paper, it is analyzed. Table 3 shows the changes of muscle endurance of the two groups of research objects, and Table 5 analyzes their change rate and contrast range.

It can be seen from Table 4 that the left hand grip strength of the experimental group was 24.526 ± 4.424 (kg) before the experiment, and was optimized to 24.911 ± 4.246 (kg) after the experiment; The grip strength of the right hand was 27.033 ± 5.498 (kg) before the experiment, and was optimized to 27.445 ± 5.664 (kg) after the experiment; The number of kneeling push ups to exhaustion was 19.117 ± 5.223 before the experiment, and it was optimized to 24.627 ± 4.698 after the experiment; 1RM flat plate horizontal push was 10.024 ± 4.682 (kg) before the experiment, and was optimized to 12.858 ± 4.496 (kg) after the experiment; 1RM bilateral squatting was 17.376 ± 4.319 (kg) before the experiment, and was optimized to 21.645 ± 3.860 (kg) after the experiment.

The left hand grip strength of the control group was 22.213 ± 4.309 (kg) before the experiment, and was optimized to 22.252 ± 4.121 (kg) after the experiment; The grip strength of the right hand was 25.843 ± 4.186 (kg) before the experiment, and was optimized to 25.506 ± 4.348 (kg) after the experiment; The number of kneeling push ups to exhaustion was 19.338 ± 4.337 before the experiment, and was optimized to 19.251 ± 3.662 after the experiment; 1RM flat plate horizontal push was 10.620 ± 4.667 (kg) before the experiment, and was optimized to 10.945 ± 4.216 (kg) after the experiment; 1RM bilateral squatting was 17.170 ± 4.824 (kg) before the experiment, and was optimized to 16.807 ± 4.744 (kg) after the experiment.

From the comparative analysis of the data, it can be seen that the experimental group has significantly improved the muscle endurance of the subjects, while the control group has only improved some indicators, and the extent of improvement is not obvious. Therefore, strengthening tennis can better improve the muscle endurance of ordinary college students.

DISCUSSION

It can be seen from the above analysis that tennis has many effects on the optimization of physical fitness of college students majoring in sports. Therefore, the proportion of tennis should be increased in college sports elective courses. Through the analysis of the actual situation of tennis, the author puts forward the following suggestions:

1. In course selection, tennis classes are further divided into tennis introductory class, tennis intermediate class and tennis advanced class according to students' proficiency in tennis. In this way, when teaching, appropriate teaching methods can be better selected according to the average situation of the class. For example, the tennis introductory class teaches the most basic tennis knowledge and tennis movements; Tennis intermediate class is to enhance the mastery of movement proficiency and practice guidance; The senior tennis class can use the form of confrontation to enhance the fun and provide a platform for tennis enthusiasts to communicate. Through grading teaching, we can

provide more targeted tennis teaching for students, and improve the effectiveness and efficiency of teaching.

2. Promote the development of tennis associations. Compared with popular sports with high popularity such as basketball and football, tennis also has a place in colleges and universities. There are special sports venues, but the popularity of tennis is not high. Many students only learn tennis skills in class and do not practice after class. Therefore, teachers should consciously promote the development of tennis associations. For example, they should give more help in borrowing venues, actively introduce tennis students or tennis teachers as coaching coaches, and use our media platform and school forums and other communication tools to enhance the promotion of tennis teaching. Through the development of relevant associations, students can effectively participate in tennis in their spare time, thus improving their enthusiasm for tennis.

CONCLUSION

Ordinary college students who are not majoring in physical education often have no habit of exercise and lack exercise opportunities in their daily study and life, so their physical fitness has declined significantly.

This paper discusses the influence of tennis as an elective course on the physical endurance and cardiorespiratory endurance of ordinary college students through the research on the elective course of physical education in colleges and universities. The research results show that compared with the track and field course, tennis can better improve the physical quality of college students and improve the level of cardiorespiratory endurance, so it is worth promoting. However, there are also many shortcomings in the research results of this paper. For example, when selecting research objects, only tennis and track and field sports were selected, which did not involve badminton, aerobics, table tennis, basketball and other sports that are also popular in the current elective courses in colleges and universities. Therefore, tennis can only be said to have a better effect on college students in all aspects than track and field sports. It cannot be said that tennis is the best choice, Therefore, more control groups need to be listed for comprehensive comparative analysis and judgment in the follow-up study.

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