

INFLUENCE OF MARTIAL ARTS ON THE PHYSIQUE OF PRACTICING COLLEGE STUDENTS

INFLUÊNCIA DAS ARTES MARCIAIS SOBRE O FÍSICO DOS ESTUDANTES UNIVERSITÁRIOS PRATICANTES

INFLUENCIA DE LAS ARTES MARCIALES EN EL FÍSICO DE LOS ESTUDIANTES UNIVERSITARIOS PRACTICANTES



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ABSTRACT

Introduction: The continuous practice of martial arts can lead to significant changes in the functioning of respiratory organs in the long term. This habit can improve the body's physical development, including the immune system. **Objective:** To investigate the influence of martial arts classes on the physical fitness of college students who practice them. **Methods:** 53 college students are evaluated. Influencing factors are martial arts dedication and training time. The experiment assesses cardiopulmonary function (cardiac function capacity, maximal oxygen consumption, blood pressure, heart rate, and other indexes). The secondary exercise stress tolerance test method was used to investigate cardiopulmonary exercise function in college students. **Results:** 90% of the cardiopulmonary function assessment of the martial arts exercise group is excellent. The practitioners' heart rate and maximum oxygen volume are significantly higher ($P < 0.05$). Systolic and diastolic blood pressure between the groups did not show significant changes ($< 120/80$ mmHg). Martial arts did not change systolic, diastolic blood pressure, or heart rate in the long term. **Conclusion:** Martial arts education has a good influence on students' physical fitness and significantly impacts students' strength and vital capacity. **Evidence Level II; Therapeutic Studies – Investigating the results.**

Keywords: Martial Arts; Cardiopulmonary Exercise Test; Heart Rate; University Health Service.

RESUMO

Introdução: A prática contínua das artes marciais pode levar a mudanças significativas no funcionamento dos órgãos respiratórios a longo prazo. Este hábito pode melhorar o desenvolvimento físico corporal, incluindo o sistema imunológico. **Objetivo:** Investigar a influência que as aulas de artes marciais provocam na aptidão física dos estudantes universitários que a praticam. **Métodos:** 53 universitários são avaliados. Os fatores de influência são a dedicação às artes marciais e o tempo de treino. O experimento avalia a função cardiopulmonar (capacidade de função cardíaca, consumo máximo de oxigênio, pressão arterial, frequência cardíaca entre outros indexadores). Foi utilizado o método de prova de tolerância ao exercício de esforço secundário para investigar a função do exercício cardiopulmonar nos universitários. **Resultados:** 90% da avaliação da função cardiopulmonar do grupo praticante de exercícios de artes marciais é excelente. A frequência cardíaca e o volume máximo de oxigênio dos praticantes são significativamente maiores ($P < 0,05$). A pressão arterial sistólica e diastólica entre os grupos não apresentaram grandes alterações ($< 120/80$ mmHg). As artes marciais não alteraram a pressão arterial sistólica, diastólica nem o ritmo cardíaco a longo prazo. **Conclusão:** O ensino de artes marciais tem uma boa influência sobre a aptidão física dos estudantes além de um impacto significativo sobre a força e a capacidade vital dos estudantes. **Nível de evidência II; Estudos Terapêuticos - Investigação de Resultados.**

Descritores: Artes Marciais; Teste de Esforço Cardiopulmonar; Frequência Cardíaca; Serviços de Saúde para Estudantes.

RESUMEN

Introducción: La práctica continuada de artes marciales puede provocar a largo plazo cambios significativos en el funcionamiento de los órganos respiratorios. Este hábito puede mejorar el desarrollo físico del cuerpo, incluyendo el sistema inmunológico. **Objetivo:** Investigar la influencia que las clases de artes marciales ejercen sobre la aptitud física de los estudiantes universitarios que las practican. **Métodos:** Se evaluaron 53 estudiantes universitarios. Los factores que influyen son la dedicación a las artes marciales y el tiempo de entrenamiento. El experimento evalúa la función cardiopulmonar (capacidad de la función cardíaca, consumo máximo de oxígeno, presión arterial, frecuencia cardíaca entre otros índices). Se utilizó el método de prueba de tolerancia al esfuerzo secundaria para investigar la función de ejercicio cardiopulmonar en estudiantes universitarios. **Resultados:** El 90% de la evaluación de la función cardiopulmonar del grupo de ejercicios de artes marciales es excelente. La frecuencia cardíaca y el volumen máximo de oxígeno de los practicantes es significativamente mayor ($P < 0,05$). La presión arterial sistólica y diastólica entre los grupos no mostró cambios importantes ($< 120/80$ mmHg). Las artes marciales no modificaron la presión arterial sistólica y diastólica ni la frecuencia cardíaca a largo plazo. **Conclusión:** La educación en artes marciales tiene una buena influencia en la aptitud física de los alumnos, además de un impacto significativo en la fuerza y la capacidad vital de los mismos. **Nivel de evidencia II; Estudios terapéuticos - Investigación de resultados.**

Descriptores: Artes Marciales; Prueba de Esfuerzo Cardiopulmonar; Frecuencia Cardíaca; Servicios de Salud para Estudiantes.



INTRODUCTION

Martial arts are non-cyclical sports, and the energy supply during the exercise is alternately combined with aerobic energy supply and anaerobic energy supply. Long-term systematic martial arts exercises can make greater changes in the function of the respiratory organs.¹ Good changes in the respiratory organs are one of the important conditions to ensure adequate oxygen intake. This research mainly explores the influence of long-term participation in martial arts on the related indexes of the cardiopulmonary function of college students. This enables college students to understand martial arts better and realize the benefits of martial arts. We hope that the research results can provide a reference for the development of martial arts routines in colleges and universities and better promote the promotion and dissemination of martial arts in colleges and universities.

METHOD

Research object

The study took 34 non-sports major students (irregular exercise group), social sports martial arts team students, and a total of 19 national traditional sports special enrollment students (martial arts group) as the research objects.² Among them, the martial arts group is currently engaged in training at least 3 times a week, each with a duration of more than 60 minutes and a system training time of more than 1 year. The remaining non-physical students are classified as irregular exercise groups. The specific conditions of the research subjects are shown in Table 1.

Research methods

Experimental research method

The influencing factors are "Whether to engage in martial arts" and "Martial arts training years." The dependent variables are indicators that reflect cardiopulmonary function.³ The content mainly includes cardiac function capacity (F.C.), maximum oxygen uptake (VO2max), blood pressure, heart rate, etc.

Experiments with Japanese EC-1200 power bicycles test each person's cardiac function capacity (F.C.) and maximum oxygen uptake (VO2max). The specific steps of the power bicycle experiment are as follows.

1. Ask the subject's basic health status to ensure that they meet the test conditions.
2. In this experiment, the exercise tolerance test (ETT) secondary stress test method was used to investigate the cardiopulmonary exercise function of the subjects.
3. Before the test, screen the cardiopulmonary function test program according to whether the subjects have exercise habits and wear the heart rate monitor.
4. Record the rapid heart rate after the first constant load test lasts for 3 minutes. Rest for 3 minutes for the second constant load test.⁴ The heart rate immediately after exercise was recorded after 3 minutes. The F.C. and VO2max can be obtained from the heart rate changes under two loads reflecting the individual's exercise cardiopulmonary function level.

Mathematical Statistics

We use the mean \pm standard deviation to express the various test indicators of cardiopulmonary function. Independent sample t-test and

descriptive statistics are used to reflect the influence of martial arts on cardiopulmonary function. $P < 0.05$ means there is a statistical difference.⁵ The statistical work was carried out using SPSS16.0 software.

Real-time monitoring and simulation of student physique mutation data

We constructed a paired comparison matrix of mutation data from top to bottom of college students' physical fitness monitoring data. Calculate the weight vector of the factors affecting the mutation data and check the consistency.⁶ We combine the fuzzy and analytic hierarchy processes to establish a fuzzy comprehensive monitoring model for mutation data. The calculation formula of the weight vector ω'_i of the index factor is as follows

$$\omega'_i = (\omega'_1, \omega'_2, \dots, \omega'_m) \quad (1)$$

i indicates the number of indicators that affect physical fitness data. Assuming that the mutation data influence element is expressed as b_1, b_2, \dots, b_n , the expression of the priority relation matrix of the mutation data influence element is

$$K = \{r_{ij}, i = 1, 2, \dots, m; j = 1, 2, \dots, n\} \quad (2)$$

The element r_{ij} that affects the mutation data represents the fuzzy membership degree of the comparison between the influencing element b_i and the influencing element b_j . Fuzzy and unanimous judgments are made on the priority relationship matrix K of the influencing elements of the physical fitness monitoring data of college students. Its expression is as follows

$$\omega''_i = \frac{\sum_{j=1}^n r_{ij} + \frac{n}{2} - 1}{n(n-1)} \quad (3)$$

Suppose ω_i represents the index weight of the abrupt data influencing factors after the combination of AHP and Fuzzy AHP, and its calculation expression is

$$\omega_i = \varphi \omega''_i + (1 - \varphi) \omega'_i \quad (4)$$

φ represents the ratio of the weight of the abrupt data influencing factors calculated by the analytic hierarchy process to the combined weight. $(1 - \varphi)$ represents the ratio of the weight of the abrupt data influence factor calculated by the fuzzy analytic hierarchy process to the combined weight.⁷ Establish different levels of monitoring models for college students' physique mutation data. The calculation formulas are as follows

$$C = B \cdot (1 - \varphi) \cdot \omega_i^{(2)} = \begin{bmatrix} C_1 \\ C_2 \\ \vdots \\ C_m \end{bmatrix} = \begin{bmatrix} B_1 \cdot (1 - \varphi) \cdot \omega_i^{(2)} \\ B_2 \cdot (1 - \varphi) \cdot \omega_i^{(2)} \\ \vdots \\ B_m \cdot (1 - \varphi) \cdot \omega_i^{(2)} \end{bmatrix} \quad (5)$$

$$B = A \cdot \varphi \cdot \omega_i^{(2)} = \begin{bmatrix} B_1 \\ B_2 \\ \vdots \\ B_m \end{bmatrix} = \begin{bmatrix} A_1 \cdot \varphi \cdot \omega_i^{(1)} \\ A_2 \cdot \varphi \cdot \omega_i^{(1)} \\ \vdots \\ A_m \cdot \varphi \cdot \omega_i^{(1)} \end{bmatrix} \quad (6)$$

Table 1. Basic information on research subjects.

Group gender	n	Height (cm)	Weight (kg)
Boys	9	170.78 \pm 5.23	65.67 \pm 6.98
girl	10	160.40 \pm 6.98	51.10 \pm 6.24
Boys	10	171.50 \pm 4.74	66.20 \pm 7.74
girl	24	161.04 \pm 4.88	50.17 \pm 5.41

A represents the matrix (sub-criteria layer) composed of the membership degree of the three-level indicator evaluation set for mutation data monitoring. *B* and *C* respectively represent the fuzzy comprehensive evaluation set of the second-level (criteria level) of mutation data monitoring and the first-level (target level) of mutation data monitoring. $\omega^{(1)}_i$ and $\omega^{(2)}_i$ respectively represent the three-level indicator weight set of mutation data monitoring.

RESULTS

Comparison of the distribution of the two groups of college students’ exercise cardiopulmonary function grade evaluation

From the exercise cardiopulmonary function test results, it can be seen that nearly 90% of the martial arts exercise group cardiopulmonary function evaluation is excellent. And there is no intermediate level.⁸ The irregular exercise group showed a higher proportion of “good” and “moderate” levels (Table 2).

It can be seen that the overall level of cardiopulmonary function in the martial arts group is significantly higher than that in the irregular exercise group. This shows that martial arts can promote the improvement of the cardiopulmonary function of college students.

Comparison of the difference of cardiopulmonary function indexes between the Wushu exercise group and the non-regular exercise group

Martial arts are considered to promote the function of the cardiovascular system. This study compares the above two indicators of cardiopulmonary function between college students who have participated in martial arts for a long time and ordinary college students.⁹ From the t-test results in Table 3, it can be seen that the F.C. and VO2max of the martial arts group were significantly higher than those of the non-regular exercise group ($P<0.05$).

The influence of the degree of martial arts on the blood pressure and heart rate of college students

From Table 4, it can be seen that the systolic and diastolic blood pressures of the civil sports martial arts group and the social sports martial arts group are not much different and belong to the ideal blood pressure range (blood pressure value is lower than 120/80mmhg). The folk martial arts group’s heart rate is almost the same as that of the social martial arts group.¹⁰ This shows that martial arts exercise has no significant difference in systolic blood pressure, diastolic blood pressure, and heart rate.

Table 2. Cardiopulmonary function grade distribution of different groups of college students.

Cardiopulmonary function evaluation grade	Number of martial arts group/percentage (n/%)	Number of irregular exercise group/percentage (n/%)
excellent	17(89.5)	20(58.8)
good	2(10.5)	6(17.6)
medium	0(0.0)	8(23.6)

Table 3. Cardiopulmonary function index t-test results of college students under different exercise conditions.

Cardiopulmonary function index	n	$\bar{x} \pm s$	t	p
Martial Arts Group	19	17.26±2.77	4.286	0.000
Irregular exercise group	34	13.55±3.14		
Martial Arts Group	19	3.53±0.96	3.521	0.001
VO2max Irregular Exercise Group	34	2.63±0.86		

Table 4. T-test results of blood pressure and heart rate between different martial arts levels.

index	Training level	n	$\bar{x} \pm s$	t	P
Systolic blood pressure	National Martial Arts Group	9	106.89±10.22	-1.455	0.164
	Social Martial Arts Group	10	114.20±11.54		
Diastolic blood pressure	National Martial Arts Group	9	66.67±6.84	-0.573	0.574
	Social Martial Arts Group	10	68.70±8.43		
Heart rate	National Martial Arts Group	9	71.11±9.73	0.003	0.998
	Social Martial Arts Group	10	71.10±7.08		

DISCUSSION

In 2015, the Ministry of Education identified martial arts as one of the “Seven Campus Educational Sports Programs.”The development of martial arts on campus is more extensive. Researches on the martial arts in improving the physical and mental quality of college students have gradually increased. Still, there are not many studies on the impact of martial arts on the specific indicators of the cardiopulmonary function of students. Some scholars are studying the effects of Taekwondo on the cardiorespiratory fitness, flexibility, and body composition of college students. The results of the study showed that after 24 weeks of Taekwondo training, the vital capacity and forward bending of the sitting position of college students were significantly improved compared with before training ($P<0.05$), and the body fat rate was significantly lower than before training ($P<0.01$). This suggests that Taekwondo training has a certain effect on improving college students’ cardiopulmonary fitness, flexibility, and body composition. Most studies have shown that the cardiopulmonary function of college students who regularly take martial arts exercises has different degrees of increase compared with the comparison group. The cardiopulmonary function of the students has also been improved and improved. This is consistent with the study results that long-term participation in martial arts exercises makes their cardiopulmonary function indexes F.C. and VO2max significantly higher than those in the non-regular exercise group. This shows that martial arts can improve the body’s cardiopulmonary function and improve the body’s aerobic work capacity.

Athletes participate in different martial arts routine competitions by learning martial arts. Martial arts routines are short-term, intermittent, high-intensity sports. Some scholars have studied the effects of Chen’s and Yang’s Taijiquan training after 36 weeks, showing that college students’ cardiac function and blood vessel function have improved to varying degrees compared with those before training. Some scholars have studied the effect and mechanism of high-intensity interval exercise on pathological cardiac hypertrophy in spontaneous hypertension model rats. The results show that the interaction between exercise load and cardiac compensatory capacity determines the cardiac effect of high-intensity intermittent exercise. Eight weeks of high-intensity interval exercise can improve heart function. Some scholars have studied the effects of eight-style Taijiquan exercise on the blood pressure level, vascular endothelial function, and quality of life in patients with essential hypertension. The results show that the eight-style Taijiquan exercise can effectively improve the blood pressure and blood sugar levels of patients with essential hypertension and promote the recovery of vascular endothelial function. At the same time, it can significantly improve the quality of life of patients. In this regard, the study only compared the effects of martial arts exercises on heart rate and blood pressure. The results show that the degree of martial arts exercise has no significant difference in the effects of systolic blood pressure, diastolic blood pressure, and heart rate among college students. Still, the blood pressure of the martial arts group is within the ideal blood pressure range.

CONCLUSION

Long-term participation in martial arts has a significant impact on college students' F.C. and VO2max. Martial arts can promote the improvement of the cardiopulmonary function of college students. There is no significant difference in the effects of training years on systolic blood pressure, diastolic blood pressure, and heart rate in the martial arts group. Still, the blood pressure of the long-term participants in martial arts is within the ideal blood pressure range. The promotion and dissemination of simple martial arts routines in colleges and universities have

certain positive significance. It is recommended that college students extensively develop simple martial arts routines and fitness martial arts such as Tai Chi, Tai Chi sword, and Baduan Jin. For college students in the Internet age, martial arts can play a role in strengthening physique, increasing knowledge, and defending themselves in actual combat and can effectively cultivate patriotism and national spirit.

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