

# EFFECT OF TAI-JI PRACTICE ON THE HEALTH OF THE ELDERLY

EFEITO DA PRÁTICA DE TAI-JI SOBRE A SAÚDE DOS IDOSOS

EFFECTO DE LA PRÁCTICA DE TAI-JI EN LA SALUD DE LAS PERSONAS MAYORES



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## ABSTRACT

**Introduction:** The practice of Tai-ji has shown a positive effect on the physical functions of the elderly and has been promoted as a recommended daily activity for middle-aged and elderly individuals. However, there is still no scientific evidence about its cardiorespiratory benefits. **Objective:** Study the effect of Tai-ji on the cardiorespiratory function and physical fitness of the elderly. **Methods:** A group of elderly people from the same community and in good health, considered suitable for sports experiments was divided into the experimental group for Tai-ji exercise and the control group for vigorous walking exercise. Each week, the Tai-ji exercise with eight steps and the vigorous walking exercise was performed three times in each group. **Results:** After six weeks of Tai-ji exercise with eight steps of five methods, the vital capacity, maximal oxygen consumption, maximal voluntary ventilation, and oxygen pulse of the experimental group were significantly increased, and the systolic and diastolic pressures were significantly reduced, evidencing an improvement in the performance of the cardiopulmonary function. **Conclusion:** Tai-ji exercise is beneficial for the cardiopulmonary function and physical health of the elderly and is scientifically useful for improving the mental health level and quality of life of the elderly. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** Tai-ji; Exercise Test, Cardiopulmonary; Health of the Elderly.

## RESUMO

**Introdução:** A prática do Tai-ji tem demonstrado um efeito positivo nas funções físicas dos idosos, tendo sido promovida como atividade diária recomendada aos indivíduos de meia-idade e idosos. Porém ainda não há evidências científicas sobre seus benefícios cardiorrespiratórios. **Objetivo:** Estudar o efeito do Tai-ji sobre a função cardiorrespiratória e a aptidão física do idoso. **Métodos:** Um grupo de idosos da mesma comunidade e boa saúde, considerados adequados para os experimentos esportivos foi dividido em grupo experimental para o exercício de Tai-ji e no grupo de controle para o exercício de caminhada vigorosa. A cada semana, o exercício de Tai-ji com oito etapas e o vigoroso exercício de caminhada foram realizados três vezes em cada grupo. **Resultados:** Após seis semanas de exercício Tai-ji com oito etapas do método de cinco, a capacidade vital, o consumo máximo de oxigênio, a ventilação voluntária máxima e o pulso de oxigênio do grupo experimental foram significativamente aumentados, e as pressões sistólica e diastólica foram significativamente reduzidas, evidenciando uma melhora no desempenho da função cardiopulmonar. **Conclusão:** O exercício de Tai-ji é benéfico para a função cardiopulmonar e a saúde física dos idosos, mostrando-se cientificamente útil para melhorar o nível de saúde mental e a qualidade de vida dos idosos. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Tai-ji; Teste Cardiopulmonar de Exercício; Saúde do Idoso.

## RESUMEN

**Introducción:** La práctica del Tai-ji ha demostrado un efecto positivo en las funciones físicas de las personas mayores, habiéndose promovido como actividad diaria recomendada a los individuos de mediana y avanzada edad. Sin embargo, aún no existen pruebas científicas sobre sus beneficios cardiorrespiratorios. **Objetivo:** Estudiar el efecto del Tai-ji sobre la función cardiorrespiratoria y la forma física de los ancianos. **Métodos:** Un grupo de ancianos de la misma comunidad y en buen estado de salud, considerados aptos para experimentos deportivos, se dividió en el grupo experimental para el ejercicio Tai-ji y el grupo de control para el ejercicio de caminata vigorosa. Cada semana, se realizaron ejercicios de Tai-ji con ocho pasos y ejercicios de caminata vigorosa tres veces en cada grupo. **Resultados:** Después de seis semanas de ejercicio Tai-ji con ocho pasos de cinco métodos, la capacidad vital, el consumo máximo de oxígeno, la ventilación voluntaria máxima y el pulso de oxígeno del grupo experimental aumentaron significativamente, y las presiones sistólica y diastólica se redujeron significativamente, lo que evidencia una mejora en el rendimiento de la función cardiopulmonar. **Conclusión:** El ejercicio Tai-ji es beneficioso para la función cardiopulmonar y la salud física de los ancianos, y está científicamente demostrado que mejora el nivel de salud mental y la calidad de vida de los ancianos. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptores:** Tai-ji; Prueba de Esfuerzo Cardiopulmonar; Salud del Anciano.



## INTRODUCTION

With the growth of age, the physical quality and mental state of the elderly have declined compared with the young and middle-aged people, especially in terms of cardiopulmonary capacity.<sup>1</sup> The department of cardiology and respiratory medicine in the hospital also often appears the figure of the elderly. These elderly people are mostly due to the decline of viscera function, which successively leads to the decline of the whole body function, such as the influence of balance ability and body coordination.<sup>2</sup> Fibrosis occurs in originally healthy lung tissue, and cardiovascular system will gradually become fragile, affecting the health of the elderly, even endangering life in serious cases.<sup>3</sup> In view of the elderly's cardiorespiratory function and other physical health problems, from the current research status of improving the elderly's physical condition, on the whole, some exercise methods are not suitable for some elderly people with weak physical foundation.<sup>4</sup> Many research documents and clinical experiments have shown that the elderly are not suitable for more intense aerobic exercise. Only gentle exercise can safely maintain the physical function of the elderly and enhance their physical fitness to a certain extent.<sup>5</sup> Among them, Taijiquan has a significant effect on improving the cardiorespiratory function and health level of the elderly.<sup>6</sup> The intensity of Taijiquan is appropriate, the range of movement is not large, and it can regulate the human microcirculation and promote metabolism. Taijiquan combines traditional martial arts with Taoist health preserving techniques and yin and yang theories, so its exercise style is very balanced.<sup>7</sup> It can effectively move muscles of the whole body between breathing, exhaling and breathing, while protecting vulnerable joints and adjusting the overall body coordination ability.

## METHOD

### Research object

In this experiment, we collected 40 elderly people in the same community who met the experimental standards. The study and all the participants were reviewed and approved by Ethics Committee of Langfang Normal University(NO.19LFNU-PE079). The selected experimenters were all willing to participate in eight method five step Taijiquan or vigorous walking on the basis of knowing. Among them, the subjects in the experimental group participated in eight method five step Taijiquan and the subjects in the control group participated in vigorous walking. The age, height and weight of the subjects in the experimental group and the control group are shown in Table 1.

**Table 1.** Basic information of the experimental group and the control group.

	Age (age)	Height (cm)	Weight (kg)
Experience group	65.5±3.28	162.64±6.43	66.85±7.53
Control group	66.2±3.58	161.32±6.02	66.36±6.82

**Table 2.** Changes of cardiopulmonary function in two groups of elderly before and after training.

Option	Group	Before training	After training	t	P
FVC vital capacity	Experience group	2.88±0.57	3.23±0.47	7.530	0.0071
	Control group	2.82±0.66	2.92±0.54	2.716	0.0496
MW (L/min) maximum voluntary ventilation	Experience group	74.42±7.65	80.21±7.31	8.414	0.0140
	Control group	75.66±7.17	82.54±8.01	8.050	0.0196
VO <sub>2</sub> max (ml) maximum oxygen uptake	Experience group	1301.89±220.31	1456.32±189.8	2.345	0.0050
	Control group	1293.88±142.21	1331.27±132.3	3.503	0.0046
O <sub>2</sub> - pulse oxygen pulse	Experience group	11.25±1.98	12.31±2.18	1.207	0.0184
	Control group	10.89±2.23	11.52±1.96	1.075	0.0464
SBP (mmHg) Systolic blood pressure	Experience group	135.69±8.32	128.32±8.56	-2.422	0.0095
	Control group	138.88±9.21	127.69±7.57	-2.331	0.0128
DBP (mmHg) Diastolic pressure	Experience group	86.22±4.88	79.88±4.21	-7.103	0.0067
	Control group	87.01±5.11	81.33±6.01	-6.503	0.0174

Table 1 shows that there is no significant difference between the two groups in terms of age, height and weight ( $P>0.05$ ), so it conforms to the rule of single variable and has comparability, which can be analyzed and compared in this experiment.

### Research methods

Before the experiment, a one week exercise preparation period was set for the experimental group to learn eight methods and five steps of Taijiquan. For the two groups of subjects, their physical fitness was tested before and after the experiment, and their vital capacity, heart rate, diastolic pressure and systolic pressure were measured quantitatively, as well as their weight, waist circumference and BMI. The experimental group and the control group of this experiment were both conducted for 6 weeks. At the same time every week, they were conducted four regular eight method five step Taijiquan exercises and vigorous walking exercises by group. Except for the different training items, the other conditions of the two groups are the same. Before training, the two groups need to do the same and sufficient preparatory activities and warm-up exercises, and then carry out Taijiquan exercise and brisk walking exercise respectively. After exercise, the muscles are stretched and relaxed. Considering that the physical quality of the elderly is different to some extent, the total time is set as a more appropriate 1h.

### Test method

When testing the cardiac function, Cypress color Doppler diagnostic instrument was selected to measure the systolic and diastolic blood pressure. In the analysis of lung function indicators, it is necessary to conduct quantitative measurement through the vital capacity tester. Other measures included maximal spontaneous ventilation, maximal oxygen uptake and oxygen pulse.

In the fall risk measurement, the Fall risk test mode of the balance test training instrument is adopted. During the test, the subject needs to adjust his/her body weight, relax his/her hands and naturally droop, and keep his/her body weight on the set balance center. The test time is 30s, and the test time is 3 times, with an interval of 10min. Then synthesize the test data for three times, and output the test results after software average calculation. In the balance function measurement, the quantitative evaluation method of the internationally recognized balance test scale is adopted.

## RESULTS

### The influence of Taijiquan exercise on the elderly's heart and lung function

After the 6-week experiment, the vital capacity, diastolic pressure and systolic pressure of the subjects in the experimental group and the control group were tested respectively to test the exercise effect of Taijiquan exercise and brisk walking exercise on the elderly's cardiopulmonary function. The data obtained were recorded and analyzed for the inter group control of similar items. The experimental data are shown in Table 2.

Observe the average change and T value change of each index data of the two groups before and after the experiment in Table 2. It can be seen that compared with the data before the experiment, the diastolic blood pressure and systolic blood pressure of the subjects in the two groups have significantly decreased by about 7-10, indicating that Taijiquan exercise can improve the heart function of the elderly, especially the regulation of blood pressure; At the same time, vital capacity, maximum voluntary ventilation and maximum oxygen uptake increased to varying degrees, indicating that the lung function of the elderly can be improved through the eight step five method Taijiquan exercise. It can be seen from the observation of the P value that the P value is less than 0.05, which means that the six cardiopulmonary indexes tested have statistical significance, namely, vital capacity, maximum voluntary ventilation, maximum oxygen uptake, oxygen pulse, diastolic pressure and systolic pressure have changed greatly before and after the experiment, and the data difference is significant. Therefore, after six weeks of eight method five step Taijiquan exercise and vigorous walking exercise, it is beneficial to the improvement of heart and lung function in the elderly. The vital capacity P value is 0.0071, the maximum oxygen uptake P value is 0.0050, the systolic blood pressure P value is 0.0095, and the diastolic blood pressure P value is 0.0067, both of which are less than 0.01, indicating that the vital capacity and the maximum oxygen uptake have a very significant increase, and the systolic blood pressure and diastolic blood pressure have a very significant decrease, which indicates that the eight method five step Taijiquan exercise has a very significant effect on the enhancement of the vital capacity and the maximum oxygen uptake of the elderly, and the reduction of the diastolic blood pressure and systolic blood pressure of the heart.

### The influence of Taijiquan on the body shape of the elderly

Before and after the experiment, the three body shape indexes of the subjects in the experimental group and the control group, namely, weight, waist circumference and BMI, were tested respectively to test the influence of Taijiquan exercise and vigorous walking exercise on the body shape of the elderly, and the data obtained were used for the inter group control of similar items. The experimental data are shown in Table 3.

It can be seen from Table 3 that the average body shape data of the two groups decreased, and the change of T value was negative, indicating that the weight, waist circumference and BMI of the subjects after the test were lower than those before the test. In general, the change range of body weight, waist circumference and BMI in the experimental group was 1.53, 0.53 and 0.12 respectively; The changes of the average values of body weight, waist circumference and BMI in the control group were 0.15, 0.14 and 0.14, respectively.

### Impact of Taijiquan on the physical and mental health of the elderly

Before and after the experiment, the fall risk index and Berg balance scale of the two groups of subjects were tested respectively to test the influence of Taijiquan and vigorous walking on the balance ability of the elderly. The test data of the two groups were compared, and the results are shown in Table 4.

It can be seen from Table 4 that the fall risk index of the two groups has decreased, and the value of the experimental group has decreased more. Therefore, Taijiquan exercise and walking exercise will greatly reduce the fall risk of the elderly; And the Berg balance scale scores of the two groups have increased, and the value of the experimental group has increased more. Therefore, Taijiquan exercise and brisk walking exercise are helpful to improve the balance ability of the elderly. By comparing the two groups of data, it can be seen that the effect of vigorous walking on reducing the risk of falls and improving the balance ability of the elderly

is not significant. The balance ability of Taijiquan for the elderly is better than that of the vigorous walking group. (Table 5)

Compared with the walking group, the changes in psychological dimensions of the Taijiquan group have increased, with a very significant increase in average scores, and a very significant increase in various psychological indicators. More specifically, in terms of vitality, the Taijiquan group increased by 8.81 points on average, or 17.26%, compared with the walking group. In terms of social function, the average increase of Taijiquan group was 11.03 points, 16.05%, compared with the walking group; In terms of emotional role, the average increase of the Taijiquan group was 5.94 points, 9.96%, compared with the walking group; In terms of mental health, the average increase of the Taijiquan group was 3.56 points, 7.38%, compared with the walking group; In terms of the total score of mental health, the total score of the Taijiquan group increased by 31.08 points on average, or 13%, compared with the walking group.

## DISCUSSION

After six weeks of eight step five method Taijiquan exercise and vigorous walking exercise, through the comparison of the cardiopulmonary function test, balance ability test and physical and mental health data of the above experimental group and the control group, it is found that the elderly have improved their physical ability and psychological quality by practicing Taijiquan. Through the balance ability test of fall prevention training for middle-aged and elderly Taijiquan practitioners in the community, the results show that Taijiquan exercise can improve the elderly's cardiopulmonary function, and improve their vital capacity and breathing ability. And long-term practice of Taijiquan can improve the elderly's body balance ability and delay the decline of body functions.

**Table 3.** Changes of body shape indexes of the elderly in the two groups before and after training.

Option	Group	Before training	After training	t	P
Weight	Experience group	66.85±7.53	65.32±6.89	-0.356	0.553
	Control group	66.36±6.82	66.21±4.56	-1.887	0.51
Waistline	Experience group	81.55±6.01	81.02±5.11	-2.247	0.021
	Control group	82.02±4.77	81.88±5.62	-1.389	0.152
BMI	Experience group	24.81±2.11	24.69±2.02	-1.101	0.224
	Control group	24.55±2.04	24.41±2.12	-0.65	0.412

**Table 4.** Changes of balance ability of the elderly in the two groups before and after training.

Option	Group	Before training	After training
Fall Risk Index	Experience group	1.76±0.33	1.29±0.18
	Control group	1.98±0.41	1.97±0.32
Berg balance scale	Group	44.68±2.59	48.87±2.25
	Experience group	45.54±1.78	45.87±1.23

**Table 5.** Changes of psychological dimensions of the elderly in the two groups before and after training.

Option	Group	Before training	After training
Life energy	Experience group	47.62±6.52	51.02±5.79
	Control group	42.78±5.68	42.21±6.02
Social function	Experience group	54.69±7.21	68.69±11.69
	Control group	55.33±6.98	57.66±5.97
Emotional role	Experience group	51.99±18.89	59.63±20.32
	Control group	47.22±20.87	53.69±21.02
Mental health	Experience group	42.56±6.02	48.21±5.89
	Control group	43.01±5.89	44.65±5.01
Mental health	Experience group	200.21±30.22	238.97±35.65
	Control group	195.65±38.98	207.89±32.21

Taijiquan can also improve the physical stability, core strength and body balance ability of the elderly, which is of great significance in preventing falls and improving balance ability of the elderly. In addition, the exercise of Taijiquan can also improve the elderly's cardiopulmonary function. After a long time of Taijiquan exercise, the elderly's cardiopulmonary capacity has been significantly improved. Aerobic exercise can effectively improve the heart and lung capacity of the human body. Taijiquan and brisk walking are aerobic exercises with low exercise intensity, which are more suitable for the elderly. After a period of training, the blood pressure of the subjects decreased significantly, and their vital capacity also increased.

## CONCLUSION

Many experts, scholars and medical workers have been paying close attention to the health problems of the elderly, such as cardiopulmonary

function. With the growth of age, the physical function of the elderly decreases significantly, so the risk of strenuous sports is higher. The range of movements of Taijiquan is not large, and the exercise effect is good. While exercising, it will not cause additional sports damage to the body. At the same time, through the coordination of body movement and breathing, the effect of mind and spirit integration is achieved. At the same time, the exercise intensity can vary from person to person. It can adjust the breathing, movement and mental state independently according to their own introspection and physical experience. It is especially suitable for the middle-aged and elderly people with poor health or low requirements for exercise intensity.

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All authors declare no potential conflict of interest related to this article

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**AUTHORS' CONTRIBUTIONS:** The author has completed the writing of the article or the critical review of its knowledge content. This paper can be used as the final draft of the manuscript. Every author has made an important contribution to this manuscript. Dawei Liu: writing and execution. Jijie Liu: data analysis and article reviews.

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