

# INFLUENCES OF LOWER LIMB STRENGTHENING ON MARTIAL ARTS TEACHING

INFLUÊNCIAS DO FORTALECIMENTO DE MEMBROS INFERIORES NO ENSINO DE ARTES MARCIAIS

INFLUENCIAS DEL FORTALECIMIENTO DE LOS MIEMBROS INFERIORES EN LA ENSEÑANZA DE ARTES MARCIALES



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## ABSTRACT

**Introduction:** One of the focuses of research on martial arts education is how to improve the assistance of martial arts teaching through strength training directed to sports movements. Scientific contributions about the influence of these strengths can underpin athletes' training. **Objective:** Study the influences of lower limb strength training on the abilities of martial arts students. **Methods:** 20 students from a college martial arts class were randomly selected as volunteers for the experiment. They were divided into the experimental group, which performed systematic lower limb strength training according to a specific protocol, and the control group, which performed traditional exercise, and basic physical training in the physical education institute. The experiment lasted eight weeks. The relevant data were analyzed statistically. **Results:** Left unipodal balance ability in the experimental group increased from 43.646s before training to 56.110s, with an increased rate of 22.213%; right unipodal balance ability increased from 43.845s before training to 57.126s, with an increased rate of 23.249%. **Conclusion:** It is recommended to integrate targeted training methods, such as lower limb muscle training, into the martial arts teaching process to improve the physical quality of martial arts athletes due to the benefits observed in their teaching process. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** Martial Arts; Resistance Training; Motor Skills.

## RESUMO

**Introdução:** Um dos focos de pesquisa sobre a educação nas artes marciais é como aprimorar a assistência do ensino das artes marciais pelo treinamento de força direcionada aos movimentos do esporte. Contribuições científicas sobre a influência desses fortalecimentos podem contribuir para embasar o treinamento dos esportistas. **Objetivo:** Estudar as influências do treinamento da força nos membros inferiores sobre as habilidades dos alunos de artes marciais. **Métodos:** 20 alunos da classe de artes marciais de uma faculdade foram selecionados aleatoriamente como voluntários para o experimento. Divididos em grupo experimental, que realizou o treinamento sistemático de fortalecimento dos membros inferiores segundo um protocolo específico, e grupo de controle, que realizou o exercício físico tradicional, e o treinamento físico básico no instituto de educação física. O experimento durou 8 semanas. Os dados relevantes foram analisados estatisticamente. **Resultados:** A habilidade de equilíbrio unipodal esquerdo no grupo experimental aumentou de 43.646s antes do treinamento para 56.110s, com uma taxa de aumento de 22.213%; a habilidade de equilíbrio unipodal direito aumentou de 43.845s antes do treinamento para 57.126s, com uma taxa de aumento de 23.249%. **Conclusão:** Recomenda-se integrar os métodos de treinamento direcionados como o treinamento muscular dos membros inferiores no processo de ensino das artes marciais para melhorar a qualidade física dos atletas de artes marciais devido aos benefícios observados em seu processo de ensino. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Artes Marciais; Treinamento de Força; Destreza Motora.

## RESUMEN

**Introducción:** Uno de los focos de investigación sobre la enseñanza en artes marciales es cómo mejorar la asistencia de la enseñanza de artes marciales mediante el entrenamiento de fuerza dirigido a los movimientos deportivos. Las aportaciones científicas sobre la influencia de estas fuerzas pueden contribuir a fundamentar el entrenamiento de los deportistas. **Objetivo:** Estudiar la influencia del entrenamiento de la fuerza de los miembros inferiores en las habilidades de los alumnos de artes marciales. **Métodos:** 20 estudiantes de la clase de artes marciales de un colegio fueron seleccionados al azar como voluntarios para el experimento. Se dividieron en grupo experimental, que realizó un entrenamiento sistemático de la fuerza de las extremidades inferiores según un protocolo específico, y grupo de control, que realizó ejercicio tradicional y entrenamiento físico básico en el instituto de educación física. El experimento duró 8 semanas. Los datos pertinentes se analizaron estadísticamente. **Resultados:** La capacidad de equilibrio unipodal izquierda en el grupo experimental aumentó de 43,646s antes del entrenamiento a 56,110s, con una tasa de aumento del 22,213%; la capacidad de equilibrio unipodal derecho aumentó de 43,845s antes del entrenamiento a 57,126s, con una tasa de aumento del 23,249%. **Conclusión:** Se recomienda integrar métodos de entrenamiento dirigidos, como el entrenamiento muscular de las extremidades



**Descriptores:** Artes Marciales; Entrenamiento de Fuerza; Destreza Motora.

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INTRODUCTION

Strength training refers to multiple rhythmic weight bearing exercises to improve muscle group shape, muscle endurance and muscle strength.<sup>1</sup> Strength training is not only the basis of competitive sports, but also an indispensable part of the current theory of competitive sports training.<sup>2</sup> With the vigorous development of sports, Wushu, as one of the competitive sports, has become more detailed about the difficulty and quality standards of Wushu movements at this stage.<sup>3</sup> And the action quality includes the evaluation criteria of different specifications for balance action and strength action. The degree of completion of these movements depends on the balance, stability and muscle strength of the athletes.<sup>4</sup> Therefore, this paper hopes to study the effect of lower limb strength training on wushu movement skills, and explore the effect of lower limb strength training on the improvement of wushu athletes' body balance ability and movement standardization.<sup>5</sup> So as to understand the necessity of lower limb strength training and make martial arts training more professional, scientific and perfect. At the same time, I hope this study can help martial arts coaches to formulate more professional and scientific training plans and improve the content of martial arts teaching.<sup>6</sup>

METHOD

Subject of experiment

According to the influence of lower limb strength training on the teaching of movement skills, which is the focus of this study, combined with the current research on martial arts movements, and the basic situation of some martial arts schools, universities and martial arts education, this paper selects 20 martial arts students from a college physical education institute to conduct an 8-week experimental study. The study and all the participants were reviewed and approved by Ethics Committee of Yangzhou University (NO.YZUST2020T053). The screening conditions required that the subjects were similar in age, had no acute disease, fracture dislocation and other physical health problems that were not conducive to martial arts exercise within three months, and had learned martial arts for 9 years or more, and could accept most of the martial arts movement skills. The basic information of the students is shown in Table 1.

Table 1. Basic information of two groups of subjects.

Experience group	Age (age)	Height (cm)	Weight (kg)	Training years (years)	Control group	Age (age)	Height (cm)	Weight (kg)	Training years (years)
1	19.52	168.43	62.51	9.01	1	20.86	20.02	21.90	10.10
2	20.92	174.49	66.55	12.44	2	20.33	22.23	19.72	11.32
3	21.41	169.39	61.74	13.31	3	21.16	21.53	20.02	9.24
4	19.41	167.80	63.45	9.70	4	21.91	20.62	21.62	9.68
5	20.26	174.49	66.81	11.39	5	20.38	19.65	21.03	9.65
6	19.70	170.05	62.27	12.87	6	21.92	19.23	21.76	11.79
7	19.65	167.80	65.52	12.92	7	20.02	21.30	19.87	11.03
8	21.74	172.08	65.90	13.75	8	21.86	21.01	21.46	9.39
9	19.76	171.62	62.60	10.91	9	20.10	20.49	20.91	10.65
10	20.72	170.22	63.28	11.32	10	20.20	21.31	20.20	10.02

Research methods

The subjects in this paper were randomly divided into two groups, the experimental group and the control group, with 10 students in each group. Among them, the students in the experimental group carried out systematic lower limb strength training in the experimental stage, while the control group had no other physical exercise activities except daily morning exercises and basic physical fitness training in the physical education institute. Before and after 8 weeks of training, the subjects were tested on basic physical fitness index, flexibility index and martial arts movement performance.

The test methods for each index of the subject are as follows:

In the test of the basic physical indicators of the students, six indicators were selected, namely, 30s sit up, 30s prone back up, T-shaped running, flat support, side throw solid ball left and right. The six indicators were tested in the school gymnasium. The tester is required to prepare for the test to avoid injury. During the whole test process, professionals use timers and gauges to measure the scores and make complete records. For the items that were forced to interrupt during the test but could not be completed successfully, the supplementary test or the cancellation of the test results shall be carried out according to the actual situation of the subjects.

In the test of action performance indicators, the three indicators of flying feet, spinning and side somersault are selected for the test, and the professional teacher gives a comprehensive score on the degree of completion, standard and beauty of the action, which is finally converted into a decimal system for evaluation.

RESULTS

Influence of lower limb strength training on basic physical indicators

This paper first measured the basic physical fitness related indicators of the students after lower limb strength training, and the measurement results are shown in Table 2.

It can be concluded from the data in Table 2 that after the lower limb strength training, the basic physical indicators of the experimental group, except for the T-shaped running, showed a relatively significant improvement, in which the growth rate of flat support was the highest, from 9.467 ± 4.5739min before the training to 14.464 ± 5.8195min after the training, with the growth rate reaching 34.552%. In addition, the growth rate of outside solid ball throwing (left) is also relatively high, from

8.967 ± 2.0940m before training to 11.080 ± 2.3873m after training, with the growth rate reaching 19.067%. The growth rate of other indicators was below 15%, but overall, the comprehensive physical fitness of the experimental group was significantly improved after the test. In contrast, the growth rate of each indicator in the control group is low. Except for the growth rate of flat support, which is as high as 62.930%, the growth rate of other indicators is small, which is maintained below 13%.

### Influence of lower limb strength training on flexibility index

In addition to the basic physical fitness indicators, this paper also tested the flexibility indicators of the subjects, including a total of seven indicators. The results are shown in Table 3.

It can be seen from the data in Table 3 that, compared with the students in the control group, the lower limb strength training has significantly improved the cross fork and left and right leg balance ability of the students in the experimental group. The balance ability of the left and right legs in the experimental group has significantly increased from 43.646 ± 5.769s before training to 56.110 ± 9.745s, with an increase rate of 22.213%; The balance ability of the right leg increased from 43.845 ± 10.480s before training to 57.126 ± 8.199s, with an increase rate of 23.249%. In contrast, the growth rate of other indicators in the experimental group was less than 10%. The left and right FMS indexes and the right leg balance ability indexes of the control group were relatively obvious, 15.283%, 13.846% and 10.987% respectively. Other indicators The difference between the two groups is small. It shows that compared with general physical training, lower limb muscles have little effect on the flexibility index of martial arts students. Generally speaking, they can improve the flexibility index of students to varying degrees.

### Influence of lower limb strength training on martial arts performance

In this paper, after testing the basic physical strength and flexibility indicators, we tested the three basic martial arts movements of the students, and the test results are shown in Table 4.

Through the data analysis in Table 4, it can be found that both basic physical training and systematic lower limb strength training can improve the completion and performance of students' martial arts movements to varying degrees. Since martial arts movements are the comprehensive use of multiple joints and muscles of the body, only the training of lower limb muscles has limited effect on the improvement of the overall movement. Therefore, from the data in Table 4, it can be seen that lower limb strength training has improved the three basic martial arts movements to varying degrees. At the same time, general physical training also has an important impact on the improvement of basic martial arts movements, Therefore, in the training process, we should strengthen the coordination of all parts of the muscles and improve the overall physical function.

### DISCUSSION

Lower limb strength training can strengthen the cooperation and coordination control ability of muscle strength, strengthen the strength of driving muscles and deep small muscle groups, improve the body balance, and strengthen the muscle contraction conversion ability. Lower limb strength training is mainly divided into static action and dynamic action. These two kinds of training actions can help the body to strengthen the strength of the waist abdominal muscles and lower

**Table 2.** Influence of lower limb strength training on basic physical fitness indexes.

Test items	Experience group			Control group		
	Before experiment	After experiment	Growth rate	Before experiment	After experiment	Growth rate
30s crunches (each)	30.739±1.7484	35.231±1.6080	12.751%	30.907±1.382	35.577±1.756	12.128%
30s Stomach and back (one)	34.040±1.4501	37.958±1.4648	10.323%	33.711±2.101	37.448±1.664	9.978%
T-shaped running (s)	9.510±0.5720	8.579±0.5896	-10.847%	9.490±0.521	8.000±0.386	-18.629%
Plate support (minute)	9.467±4.5739	14.464±5.8195	34.552%	9.467±3.318	25.537±8.909	62.930%
Side throw solid ball left (m)	8.967±2.0940	11.080±2.3873	19.067%	8.977±1.870	10.124±1.894	11.331%
Side throw solid ball right (m)	8.530±1.8349	10.266±2.2371	14.915%	8.072±1.253	8.640±1.338	6.581%

**Table 3.** Influence of lower limb strength training on flexibility index.

Test items	Experience group			Control group		
	Before experiment	After experiment	Growth rate	Before experiment	After experiment	Growth rate
Transverse fork (m)	1.612±0.018	1.687±0.156	4.471%	1.610±0.019	1.677±0.023	4.010%
Vertical fork (m)	1.578±0.011	1.645±0.019	4.023%	1.572±0.108	1.641±0.011	4.148%
Forward bending of sitting body (cm)	9.549±0.283	10.002±0.234	4.529%	9.529±0.283	10.084±0.242	5.495%
Left FMS (min)	16.103±0.747	17.192±1.465	6.331%	16.442±1.216	19.408±1.824	15.283%
Right FMS (min)	17.096±1.382	18.805±1.026	9.089%	16.928±1.626	19.649±1.342	13.846%
Balance ability of left leg (s)	43.646±5.769	56.110±9.745	22.213%	46.237±4.762	50.621±3.177	8.661%
Balance ability of right leg (s)	43.845±10.480	57.126±8.199	23.249%	45.240±4.096	50.824±3.794	10.987%

**Table 4.** The influence of lower limb strength training on motor performance.

Test items	Experience group			Control group		
	Before experiment	After experiment	Growth rate	Before experiment	After experiment	Growth rate
Flying Feet	6.915±0.529	8.477±0.464	18.428%	6.205±0.966	7.187±0.720	13.658%
The spinners turn	7.334±0.552	8.570±0.428	14.423%	6.617±1.016	7.410±1.062	10.708%
Side somersault	7.270±0.358	8.538±0.295	14.851%	7.035±1.047	7.918±1.495	11.154%

limb muscles under the unbalanced state, stimulate the trunk muscle group and small muscle group, strengthen the strength of the muscle itself, improve the balance ability of the body, help athletes overcome the unstable state of the muscles during the action, and better complete the integrity of martial arts actions. Lower limb strength training can not only enhance the strength of the trunk muscle group, but also activate the deep muscle group of the athlete's body. Through lower limb strength training, it can enhance the nerve's control of the muscle, improve the coordination ability of the limbs and trunk muscles, so as to improve the overall balance and coordination ability of the body. Therefore, according to the research results in Table 2, lower limb strength training can significantly improve the core strength of the human body. In addition to the T-shaped running index, the basic physical fitness data of the experimental group and the control group were improved to the same extent. This is mainly due to the high requirements for people's sensitivity and strain capacity during the movement of T-shaped running, so simple lower limb muscle training cannot have a more significant impact on this indicator. In addition, both the experimental group and the control group students' basic physical strength and flexibility indicators have been significantly improved, and the effect of lower limb strength training is better than that of general physical training. Therefore, lower limb strength training should have a certain proportion in the daily teaching of martial arts students, which can comprehensively improve the basic physical quality of students.

The standard of martial arts action depends on the quality score of martial arts action. In the whole set of martial arts skill scores, the quality score of martial arts action can account for half of the total score, which means that there are different specifications and requirements for the footwork, technique, footwork type, hand type, leg method, body type, etc. of each part of martial arts action, so it is easy to deduct points due to action errors, non-standard actions, etc. Therefore, in the training process of competitive martial arts, athletes need to improve the completion standard of martial arts movements, and improve the completion and quality of their own martial arts movements as much as possible. The strength of waist and abdomen muscles and lower limb muscles affects the high-quality completion of martial arts movements. As the support part of the whole body, the lower limbs also bear the burden of connecting the waist and abdomen. Only by doing a good job of lower limb strength training, can the muscle strength of lower limbs and waist and abdomen be improved, In order to better complete martial arts movements. Through this 8-week training, it can be seen from the results of the three basic martial arts movements completed

by the experimental group athletes that the movement quality and the movement completion time have been improved. According to the comparative analysis of the test data between the experimental group and the conventional group, we believe that the athletes in the experimental group and the conventional group have the largest improvement in the quality of the flying feet movement. After the lower limb strength training, the athletes' movement completion is better, the action is more standard, the action quality is higher, the physical stability is enhanced when completing the action, and the overall consistency of the action is strengthened. This is because the flying foot movement requires higher lower limb strength, so the training effect of lower limb strength is more effective. Therefore, this study believes that lower limb strength training is of great help to the quality and skills of martial arts athletes, and can appropriately increase the length and proportion of training in teaching.

## CONCLUSION

This study explores the effect of lower limb strength training on the overall quality and action effect of Wushu athletes by studying the impact of lower limb strength training on Wushu movement skills. After 8 weeks of lower limb strength training, we can learn from the experimental results that the experimental group of students has better action completion, more standard, higher quality of action, improved physical stability when completing the action, and strengthened the overall consistency of the action. Therefore, this research believes that lower limb strength training has a great substantive help for the action quality and action skills of competitive martial arts athletes, It is more important in the teaching of martial arts movements.

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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. YAN Penglin and ZHANG Yinhang: writing and execution.

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