

EFFECT OF WEIGHT TRAINING ON LOWER LIMB STRENGTH IN MARTIAL ARTS ATHLETES



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EFEITO DO TREINAMENTO COM PESOS SOBRE A FORÇA DOS MEMBROS INFERIORES EM ATLETAS DE ARTES MARCIAIS

EFFECTO DEL ENTRENAMIENTO CON PESAS EN LA FUERZA DE LAS EXTREMIDADES INFERIORES EN ATLETAS DE ARTES MARCIALES

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ABSTRACT

Introduction: It is believed that weight training on the lower limbs in martial arts athletes can contribute to a better performance of the whiplash, a specific movement that encompasses plyometry, balance and strength. **Objective:** Study the effects of weight training on lower limb strength in martial arts athletes when performing the whiplash. **Methods:** A controlled experiment was conducted involving 100 martial arts athletes, randomly divided into two groups of characteristics without statically relevant differences. The experimental group received weight training, while the control group received no additional intervention to their daily training. **Results:** The vertical jump in the experimental group increased from 31.24 ± 6.65 cm to 36.00 ± 9.62 cm; the vertical jump in horizontal standing position increased from 195.49 ± 4.16 cm to 196.51 ± 7.49 cm; the approach vertical jump varied from 32.94 ± 9.21 cm to 37.60 ± 11.50 cm; the jump from the local half squat position was from 34.55 ± 6.40 cm to 40.30 ± 8.14 cm; the maximum force of a squat with weights was from 140.81 ± 10.05 kg to 142.06 ± 10.23 kg; the maximum number of supine leg raises in one minute increased from 43.43 ± 6.15 to 48.05 ± 7.29 . **Conclusion:** Weight training positively influenced lower limb strength in martial arts athletes, whiplash performance was elevated. Weight training is recommended in the daily training of martial arts athletes. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Exercise Program, Weight-Bearing; Athletes; Martial Arts; Muscle Strength.

RESUMO

Introdução: Acredita-se que o treinamento com pesos nos membros inferiores em atletas de artes marciais possa contribuir para um melhor desempenho do whiplash, um movimento específico que engloba pliometria, equilíbrio e força. **Objetivo:** Estudar os efeitos do treinamento com pesos sobre a força dos membros inferiores em atletas de artes marciais na execução do whiplash. **Métodos:** Foi conduzida uma experiência controlada envolvendo 100 atletas de artes marciais, divididos aleatoriamente em dois grupos de características sem diferenças estaticamente relevantes. O grupo experimental recebeu treinamento com pesos, enquanto o grupo de controle não recebeu nenhuma intervenção adicional ao treino cotidiano. **Resultados:** O salto vertical no grupo experimental elevou-se de $31,24 \pm 6,65$ cm para $36,00 \pm 9,62$ cm; o salto vertical em pé horizontal elevou-se de $195,49 \pm 4,16$ cm para $196,51 \pm 7,49$ cm; o salto vertical de aproximação variou de $32,94 \pm 9,21$ cm para $37,60 \pm 11,50$ cm; o salto da posição de meio agachamento local foi de $34,55 \pm 6,40$ cm para $40,30 \pm 8,14$ cm; a força máxima de um agachamento com pesos foi de $140,81 \pm 10,05$ kg para $142,06 \pm 10,23$ kg; o número máximo de elevações de pernas supinas em um minuto elevou-se de $43,43 \pm 6,15$ para $48,05 \pm 7,29$. **Conclusão:** O treinamento com pesos influenciou positivamente na força dos membros inferiores em atletas de artes marciais, o desempenho do whiplash foi elevado. Recomenda-se o treinamento de pesos no treinamento diário dos atletas de artes marciais. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Treinamento com Pesos; Atletas; Artes Marciais; Força Muscular.

RESUMEN

Introducción: Se cree que el entrenamiento con pesas sobre los miembros inferiores en atletas de artes marciales puede contribuir para una mejor ejecución del whiplash, un movimiento específico que engloba pliometría, equilibrio y fuerza. **Objetivo:** Estudiar los efectos del entrenamiento con pesas en la fuerza de los miembros inferiores en atletas de artes marciales al realizar el whiplash. **Métodos:** Se realizó un experimento controlado con 100 atletas de artes marciales, divididos aleatoriamente en dos grupos de características sin diferencias estadísticamente relevantes. El grupo experimental recibió entrenamiento con pesas, mientras que el grupo de control no recibió ninguna intervención adicional a su entrenamiento diario. **Resultados:** El salto vertical en el grupo experimental aumentó de $31,24 \pm 6,65$ cm a $36,00 \pm 9,62$ cm; el salto vertical horizontal de pie aumentó de $195,49 \pm 4,16$ cm a $196,51 \pm 7,49$ cm; el salto vertical de aproximación varió de $32,94 \pm 9,21$ cm a $37,60 \pm 11,50$ cm; el salto desde la posición de media sentadilla local fue de $34,55 \pm 6,40$ cm a $40,30 \pm 8,14$ cm; la fuerza máxima de una sentadilla con pesas fue de $140,81 \pm 10,05$ kg a $142,06 \pm 10,23$ kg; el número máximo de elevaciones de piernas en decúbito supino en un minuto aumentó de $43,43$



$\pm 6,15$ a $48,05 \pm 7,29$. **Conclusión:** El entrenamiento con pesas influyó positivamente en la fuerza de las extremidades inferiores de los atletas de artes marciales y elevó el rendimiento de los whiplashes. Se recomienda el entrenamiento con pesas en el entrenamiento diario de los atletas de artes marciales. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptores: Programa de Fortalecimiento Levantando Peso; Atletas; Artes Marciales; Fuerza Muscular.

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INTRODUCTION

Wushu is a fierce fighting sport, which has many transformations, including attack and defense. Wushu athletes should not only have strong strength in the competition, but also have high stability and overall coordination of upper and lower limbs.¹ Therefore, the powerful strength of whiplash leg muscles plays an important role in balancing and supporting footwork, such as sliding step, dodge, whiplash leg and other special technical movements.² Effective weight bearing strength training is based on accurate core strength assessment. It is an important requirement for coaches to develop whip leg strength training plans to accurately test and evaluate the whip leg strength of martial arts athletes. Therefore, establishing an appropriate and accurate test and evaluation method is the key to the whip leg strength training of martial arts athletes.³ At present, the research on the test and evaluation of whip leg strength of Chinese Wushu athletes is still a new topic and the related research is not perfect. In order to further improve the whip leg strength level of high-quality martial arts athletes and promote the whip leg strength training effect of martial arts, this paper, based on data collection, logical analysis, expert interviews and training data, discusses in detail the testing and evaluation methods and specific actions and requirements of the whip leg strength of martial arts athletes, so as to provide reference for improving the competitive level of martial arts athletes and researchers in this field.⁴

Whipping leg strength is an important factor affecting martial arts strength and tactical game, and it is very important to improve the explosive force of whipping leg strength theory through effective means. The research shows that reasonable weight bearing training can effectively improve the training effect of whiplash leg strength, and on this basis, use weight bearing training to test the extent of the improvement of the whip leg strength of martial arts athletes.⁵ This paper discusses the significant improvement of weight bearing training in developing the whip leg strength of Wushu athletes under different weight lifting forms, and looks for more effective combination of weight bearing training methods to provide practical basis for improving the whip leg strength for weight bearing training.⁶ This research attempts to use the comparative experiment method to study the influence of weight bearing training methods on improving the whip leg strength of martial arts athletes.

METHOD

Research object

In this paper, 100 professional martial artists were selected as the experimental subjects, and there was no significant difference in the physical indicators of the selected experimental subjects. The study and all the participants were reviewed and approved by Ethics Committee of Inner Mongolia University (NO.INMUZ028). The average age of the subjects was 17-18 years old, the height was about 1.76m, and the average weight was 72kg. The 100 Wushu athletes were equally divided into the experimental group and the control group for five weeks of basic physical training, and the experimental group for five weeks of weight training. The control group did not carry out any weight bearing capacity

training, only daily training. During the five week experiment, 100 martial arts athletes kept their normal work and rest time and eating habits. The specific conditions of the experimental objects are shown in Table 1.

Research methods

The research methods of this paper are literature, questionnaire, experiment and mathematical statistics. The subjects of the experiment were Wushu athletes from a certain area, 100 Wushu athletes were divided into two different groups, the experimental group and the control group. The experimental group carried out reasonable weight bearing training, while the control group only carried out basic training at ordinary times.

During the experiment, the body information of Wushu athletes was recorded by professional equipment, and the information was summarized after the experiment for subsequent analysis. After the experiment, compare the experimental information of Wushu athletes with the basic information before the experiment, and at the same time compare the experimental information of Wushu athletes in the experimental group and the control group, so as to analyze the gap between Wushu athletes who have undergone weight training and those who have not undergone weight training.

RESULTS

Influence of weight bearing training on basic physical measurement data of Wushu athletes

Table 2 shows the physical test data after 5 weeks of experiment, and the changes of various indicators of weight bearing capacity of Wushu athletes.

The martial arts athletes in the control group only had significant differences in the maximum number of supine leg lifts (times), run-up vertical jump, maximum strength of a barbell squat, and vertical jump in situ in one minute, while the rest did not have significant differences. At the same time, the change rate of standing jump is the smallest, and the change rate of run-up jump is the most obvious. During normal martial arts training, the maximum number of supine leg lifts (times), run-up vertical jump, maximum strength of barbell squat, and vertical jump in situ of martial arts athletes in one minute will be significantly improved. But at the same time, it will also lead to a decline in the data of standing long jump and standing squat jump.

Table 3 shows the changes of various indicators of weight bearing capacity of Wushu athletes before and after the experiment.

The changes of Wushu athletes in the experimental group in the vertical jump in situ are very obvious. The change rate of standing long jump is the smallest, while that of standing squat jump is the largest. It is worth mentioning that after carrying out the weight bearing ability

Table 1. Summary of basic information of Wushu athletes.

Test index	Experience group	Control group	P
Age (y)	18.58±0.8338	17.78±0.9320	0.6425
Height (cm)	175.51±3.2924	177.58±5.9222	0.5239
Weight (kg)	70.10±7.7330	74.10±12.5332	0.6873
Training years (years)	4.95±1.5180	4.76±0.6382	0.6588

Table 2. Changes of basic physical test data of wushu athletes in the control group.

Option	Pretest	Posttest	Rate of change	P
Vertical jump in situ (cm)	28.94±9.6437	29.69±8.1598	2.5266%	0.0268
Standing long jump (cm)	196.80±5.1931	192.27±6.1707	-2.3574%	0.0114
Run up jump (cm)	32.41±5.1917	34.07±7.6380	4.8901%	0.0086
Jump in situ squatting position (cm)	33.90±8.2713	33.86±8.3190	-0.1050%	0.0361
Maximum strength of one barbell squat (kg)	140.05±9.3014	144.06±8.9076	2.7856%	0.0364
Maximum number of supine leg lifts in 1 minute (times)	42.21±4.4541	43.88±4.2140	3.7865%	0.0359

Table 3. Changes of basic physical test data of wushu athletes in experimental group.

Option	Pretest	Posttest	Rate of change	P
Vertical jump in situ (cm)	31.24±6.6554	36.00±9.62	13.2355%	0.0379
Standing long jump (cm)	195.49±4.1645	196.51±7.4937	0.5206%	0.0197
Run up jump (cm)	32.94±9.2120	37.60±11.5076	12.3839%	0.0363
Jump in situ squatting position (cm)	34.55±6.4029	40.30±8.1492	14.2733%	0.0051
Maximum strength of one barbell squat (kg)	140.81±10.0558	142.06±10.2306	0.8840%	0.0120
Maximum number of supine leg lifts in 1 minute (times)	43.43±6.1518	48.05±7.2935	9.6132%	0.0100

training, martial arts athletes have been fully improved in terms of the maximum strength of a barbell squat and the maximum number of supine leg lifts in one minute, among which, the experimental group martial arts athletes' in-situ half squat position jump is the most significant.

Effect of weight bearing training on the strength of whip leg of martial arts athletes

Table 4 shows that 100 Wushu athletes in the control group have made reference to the maximum number of whips after 5 weeks of experiment.

The martial arts athletes in the control group only had significant differences in the right low whip leg, the right middle whip leg, and the left high whip leg. Among them, the change rate of the right low whiplash leg is the most obvious, and the change rate of the maximum number of whiplash legs around 1 minute is the smallest. In the normal martial arts training, the right low whip leg, the right middle whip leg, and the left high whip leg of martial arts athletes will be significantly improved. However, the data of left middle whip leg and left low whip leg will also decrease.

Table 5 shows the changes in the comprehensive data of the maximum number of leg whips of 100 martial arts loose athletes in the experimental group after 5 weeks of experiments.

By comparing the data of whip leg strength options of 100 martial arts athletes in the experimental group before and after the experiment, it can be found that after five weeks of training intervention, the change rate of the right middle whip leg and the left high whip leg of martial arts athletes has significantly improved. Compared with the data of 100 Wushu athletes before and after the experiment in the control group, the data of Wushu athletes in the control group before and after the experiment had no significant difference, and the data of right high whip leg and left middle whip leg had no significant improvement. Comparing the various data of the experimental group and the control group of martial arts athletes after the experiment, it can be found that 1000 martial arts athletes in the experimental group who are carrying out whip leg strength training are obviously better than the control group after the experiment, especially the data of the right middle whip leg is better than the control group, there is a significant difference.

Table 4. Changes of whip leg data of wushu athletes in the control group.

Option	Pretest	Posttest	Rate of change	P
Maximum number of leg whips in about 1 minute	109.06±13.6551	111.70±12.6666	2.3657%	0.0193
Right High Whip Leg	2.70±0.2796	2.88±0.8180	6.0468%	0.0367
Right middle whip leg	2.68±0.5063	3.10±0.9016	13.5532%	0.0122
Right Low Whip Leg	3.30±0.2222	3.86±0.7890	14.6085%	0.0341
Left High Whip Leg	2.17±0.3276	2.47±0.6565	12.1183%	0.0217
Left Middle Whip Leg	2.81±0.2597	3.07±0.8914	8.4690%	0.0238
Left Low Whip Leg	2.89±0.2727	3.14±0.7544	8.1091%	0.0366

Table 5. Changes of whip leg data of wushu athletes in experimental group.

Option	Pretest	Posttest	Rate of change	P
Maximum number of leg whips in about 1 minute	108.26±7.4050	118.36±10.9492	8.5388%	0.0370
Right High Whip Leg	2.67±0.8888	3.90±0.8382	31.4496%	0.0343
Right middle whip leg	2.66±0.6452	4.63±1.1548	42.6805%	0.0323
Right Low Whip Leg	3.32±0.3030	5.48±0.9587	39.5006%	0.0295
Left High Whip Leg	2.18±0.6552	3.77±0.8685	42.1533%	0.0256
Left Middle Whip Leg	2.78±0.8888	4.38±0.8003	36.5581%	0.0136
Left Low Whip Leg	2.83±0.6666	4.76±0.7346	40.5844%	0.0124

DISCUSSION

The main function of whiplash leg strength is to stabilize the core part of the human body, control the movement of the center of gravity, and also transmit the strength of the upper and lower limbs. The explosive inspection of whiplash leg strength is to select the action of martial arts as a dynamic activity. In this way, the maximum strength of barbell squatting and the maximum strength of supine leg lifting are selected for testing, and their relative strength is selected for testing.

Stability - Wushu is a war sport with fierce confrontation and reversible attack and defense. The body posture of Wushu athletes is often unbalanced. Therefore, the whiplash leg strength of the lower limbs plays an important role in stabilizing the core. The strength of the lower limb muscles reflects the control ability of the core muscles, so the strength level of the whip leg of Wushu athletes can be indirectly evaluated through the core stability test. Whiplash leg action is to choose the stability of decomposition action, so as to measure the test result of core stability. Because whip leg strength is one of the most representative actions in martial arts, the decomposition action of whip leg can fully express the core stable strength level of martial arts athletes. There should be strict standardization to ensure the reliability of measurement results and evaluation results of whip leg strength.

Whiplash leg technique can be divided into three parts: knee lifting, body rotation and leg bouncing. Take the left whip foot as an example, first stand in a real combat posture, lift the knee, press the ground with the left foot, move the body's center of gravity to the right leg, while firmly holding the knee joint of the left leg, lift it straight forward, and then turn around to look back. The requirements for turning the body are as follows: turn the heel with the front of the right leg as the axis, and turn the body to the right. When turning, the left calf is almost horizontal, the thigh is roughly in a straight line with the upper body, and the upper body is slightly tilted, then try to maintain this position, and then start timing. When the subject cannot maintain this posture and his feet and body shake, the timer will stop timing immediately. Then each leg should be checked twice, so that the average value of the evaluation indicators can be accurate.

To sum up, there are few specific research results on the testing and evaluation of whiplash leg strength, so the strength level of whiplash leg

is indirectly evaluated mainly by testing the weight bearing capacity of martial arts athletes and kinematic evaluation methods. The researchers have different views on the methods of measuring and evaluating the whip leg strength of martial arts athletes. Their standards have not been formulated yet, which may be because the whip leg strength has not been tested in a direct and accurate way in the arena for a short time.

CONCLUSION

Based on the previous research results, this paper points out that the measurement and evaluation of whip leg strength in martial arts should include general core strength test and special core strength test. General core strength testing and evaluation methods mainly include core stability measurement and kinematics evaluation methods.

Among them, the core stability measurement includes static stability and dynamic stability, and the martial arts kinematics evaluation methods include endurance, strength, motion control ability and flexibility. The strength test of Wushu special whip leg should include three aspects: core stability test, core explosive force test and core endurance test. The whip leg strength of the martial arts athletes in the experimental group has been significantly improved, which can more stably control the whip leg strength. It shows that weight training can effectively improve the whiplash strength of Wushu athletes.

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