

INFLUENCES OF STRENGTH TRAINING ON PERFORMANCE IN MARTIAL ARTS ATHLETES

INFLUÊNCIAS DO TREINAMENTO DE FORÇA SOBRE O DESEMPENHO NOS ATLETAS DE ARTES MARCIAIS

INFLUENCIA DEL ENTRENAMIENTO DE FUERZA EN EL RENDIMIENTO DE LOS ATLETAS DE ARTES MARCIALES



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ABSTRACT

Introduction: Strength training of martial arts athletes' movements has become the focus of current research, aiming to improve the impact of the different training methods already practiced, including strength training. **Objective:** Explore the effects of strength training on the performance of martial arts athletes in the execution of their movements. **Methods:** 20 martial arts athletes were selected as volunteers for the experiment, randomly divided into an experimental and a control group. The experimental group adopted the strength training method with load, while the control group adopted the traditional one. Functional performance tests were performed before and after the experiment for comparison and analysis. **Results:** The results of cross running in the experimental group were 11.372 ± 0.58 s before the experiment and 11.087 ± 0.62 s after the experiment, ($P < 0.05$); the left turn and ball throw was 8.89 ± 0.96 m before and 9.98 ± 0.90 m after the experiment ($P < 0.05$); the solid ball throw of the experimental resulted in 10.31 ± 2.19 m before and 15.64 ± 4.04 m after the experiment ($P < 0.05$). **Conclusion:** The strength training method can effectively improve the functional performance of martial arts athletes. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Athletes; Martial Arts; Resistance Training; Muscle Strength.

RESUMO

Introdução: O treinamento de força dos movimentos nos atletas de artes marciais tornou-se o foco de pesquisas atuais, visando aprimorar o impacto dos distintos métodos de treinamento já praticados, incluindo o treinamento de força. **Objetivo:** Explorar os efeitos do treinamento de força sobre o desempenho dos atletas de artes marciais na execução de seus movimentos. **Métodos:** 20 atletas de artes marciais foram selecionados como voluntários para o experimento, divididos aleatoriamente em grupo experimental e grupo de controle. O grupo experimental adotou o método de treinamento de força com carga, enquanto o grupo controle adotou o método de treinamento tradicional. Testes de desempenho funcional foram executados antes e após o experimento para comparação e análise. **Resultados:** Os resultados da corrida cruzada no grupo experimental foram $11,372 \pm 0,58$ s antes do experimento e $11,087 \pm 0,62$ s após o experimento, ($P < 0,05$); a volta à esquerda e o arremesso de bola foi de $8,89 \pm 0,96$ m antes e $9,98 \pm 0,90$ m após o experimento ($P < 0,05$); o lançamento de bola sólida do experimental resultou em $10,31 \pm 2,19$ m antes e $15,64 \pm 4,04$ m após o experimento ($P < 0,05$). **Conclusão:** O método de treinamento de força pode efetivamente melhorar o desempenho funcional nos atletas de artes marciais. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Atletas; Artes Marciais; Treinamento de Força; Força Muscular.

RESUMEN

Introducción: El entrenamiento de fuerza de los movimientos en atletas de artes marciales se convirtió en el foco de las investigaciones actuales, con el objetivo de mejorar el impacto de los diferentes métodos de entrenamiento ya practicados, incluyendo el entrenamiento de fuerza. **Objetivo:** Explorar los efectos del entrenamiento de fuerza en el desempeño de atletas de artes marciales en la ejecución de sus movimientos. **Métodos:** Se seleccionaron 20 atletas de artes marciales como voluntarios para el experimento, divididos aleatoriamente en grupo experimental y grupo de control. El grupo experimental adoptó el método de entrenamiento de fuerza con carga, mientras que el grupo de control adoptó el método de entrenamiento tradicional. Se realizaron pruebas de rendimiento funcional antes y después del experimento para su comparación y análisis. **Resultados:** Los resultados de la carrera cruzada en el grupo experimental fueron de $11,372 \pm 0,58$ s antes del experimento y $11,087 \pm 0,62$ s después del experimento, ($P < 0,05$); el giro a la izquierda y lanzamiento de balón fue de $8,89 \pm 0,96$ m antes y $9,98 \pm 0,90$ m después del experimento ($P < 0,05$); el lanzamiento de balón sólido del experimental resultó de $10,31 \pm 2,19$ m antes y $15,64 \pm 4,04$ m después del experimento ($P < 0,05$). **Conclusión:** El método de entrenamiento de fuerza puede mejorar eficazmente el rendimiento funcional de los atletas de artes marciales. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptor: Atletas; Artes Marciales; Entrenamiento de Fuerza; Fuerza Muscular.



INTRODUCTION

As a sports event, martial arts has its specific rules and basic principles. The strength of athletes' movements is the key factor affecting the performance of martial arts competitions.¹ At present, the movement strength training of martial arts athletes has become the focus of many researchers. The training methods of martial arts are also constantly developing. The impact of different training methods on the movement strength of athletes is multifaceted. Wushu sports contain rich contents and various types of actions.² When athletes perform difficult exercise, the strength of action is the key factor that directly affects the effect of action completion. It is of positive significance to carry out new martial arts training according to the movement strength of martial arts athletes. The training load of martial arts changes greatly. The traditional training methods include combination training, non-combination training, set training, etc. The time, density, intensity and difficulty of training directly affect the load of martial arts.³ The long training time, high density, high intensity and high quality of movement completion determine the high training load, and vice versa. High-load training refers to the heavy workload of the athlete's body during the training process, which can be achieved through the increase of training time, training intensity and training frequency.⁴ High-load training has been applied in various sports exercises. This training method can improve the muscle strength of athletes. As a means of sports intervention, it has a certain positive effect on the improvement of the movement strength of martial arts athletes.⁵ In the selection of training methods of martial arts, using appropriate high-load training to increase the training intensity of martial arts athletes can stimulate the athletes' muscle and body metabolic ability, improve the adaptability of the body, improve the athletes' functional level, and help athletes improve their competitive level.⁶ In view of the movement rules and characteristics of martial arts, this paper carries out the research of high-load training, aiming at exploring the high-load training methods to improve the movement strength of athletes by comparing the impact of traditional martial arts training methods and high-load training methods on athletes, and providing scientific theoretical basis for martial arts athletes to improve their competitive level and promote the further development of martial arts.⁷

METHOD

In this experiment, 20 martial arts athletes were randomly selected and divided into two groups, with ten in each group. The study and all the participants were reviewed and approved by Ethics Committee of Yangzhou Polytechnic Institute (NO.YZPI21D08). The basic information of the two groups of subjects is shown in Table 1. The age, height, weight and martial arts training years of the two groups of subjects were statistically analyzed, and there was no significant difference ($P > 0.05$). All experimental subjects have no physical diseases, psychological problems, etc., and can actively cooperate with the experimental training to ensure the accuracy and scientificity of the experimental results.

The control group adopted traditional martial arts training, and the experimental group adopted martial arts high-load training. Both groups of subjects were trained for 10 weeks, 3 times a week, 70 minutes each time, 3 times a rest, 10 minutes each time. Before and after the experiment, the experimental group and the control group were tested

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

Group	Experience group	Control group	P value
Age	19.014±0.9788	19.010±0.8179	0.0758
Height	163.967±6.6730	167.623±10.8457	0.0720
Weight	61.290±7.8487	61.242±10.1575	0.0874
Years of training	8.609±1.4915	9.749±2.1572	0.0843

on the movement performance index and movement strength index. The movement performance indicators include four items, namely, eight-level lean bridge, five-level side bridge, balance crane and cross-turn running; The movement strength index includes six items, namely, left turn back throw solid ball, right turn back throw solid ball, left throw solid ball, right throw solid ball, left leg strike force and right leg strike force.

The training content of traditional martial arts training and high-load training is the same, but the training load of the two groups is different. The training contents of the two training methods designed in this paper include the training movements of upper limbs, trunk and lower limbs. The training should follow the training principles of athletes, and be arranged in a reasonable way step by step. The control group was trained with traditional martial arts, and the exercise intensity was controlled at 60-70% of the maximum heart rate. The experimental group was trained with high load, and the exercise intensity reached more than 80% of the maximum heart rate. Through the above experimental training intervention, the movement performance index and movement strength index of the experimental group and the control group were tested under different training methods.

RESULTS

The influence of high-load training of martial arts on movement performance

The subjects in the control group and the experimental group tested four performance indicators before the experiment. The basic data are shown in Table 2. Through the comparative analysis of the basic data, it can be seen that before the experiment, there was no difference between the four indicators of the two groups, such as the eight-level lean bridge, the fifth-level side bridge, the balance crane and the cross-turn running, P values were greater than 0.05.

After the experimental intervention training, the subjects in the experimental group and the control group were tested on the performance indicators of movement. The specific data are shown in Table 3. Through comparative analysis of data, it can be seen that among the four movement performance indicators, only the cross-direction running after the experiment has a P value less than 0.05, showing a significant difference. The cross-direction running result of the experimental group before the experiment is 11.372 ± 0.5857 (S), and the cross-direction running result after the experiment is 11.087 ± 0.6203 (S); The results of the control group before the experiment were 11.220 ± 0.5753 (S), and the results of the experiment were 10.962 ± 0.5955 (S). The above data

Table 2. Basic data collection of experimental group and control group before experiment.

Group	Experience group	Control group	P value
Eight-stage bridge (min)	12.117±3.4597	12.735±4.0583	0.0850
Five-stage side bridge (min)	5.471±2.2454	5.623±3.0759	0.0842
Balance Heli (S)	37.913±6.2203	37.183±7.0143	0.0826
Cross run (S)	11.372±0.5857	11.220±0.5753	0.0815

Table 3. The Influence of Routine Training and High Load Training on the Performance of Wushu.

Group	Experience group	Control group	P value
Eight-stage bridge (min)	22.818±4.6233	17.829±8.5346	0.0528
Five-stage side bridge (min)	8.953±1.8868	5.993±2.8922	0.0625
Balance Heli (S)	69.932±6.0900	53.975±7.5217	0.0647
Cross run (S)	11.087±0.6203	10.962±0.5955	0.0460

analysis shows that the high-load training has a positive effect on the movement performance of martial arts athletes in the cross-direction running, and can improve the performance of athletes.

There was no difference in the performance of the three indicators, namely, the eight-level lean bridge, the fifth-level side bridge and the balanced crane, with the P value of all lower than 0.05. Among them, the score of the experimental group was 12.117 ± 3.4597 (points) before the eight-stage dive bridge experiment, and increased to 22.818 ± 4.6233 (points) after the experiment, which was about 10 points higher; The score of the control group was 12.735 ± 4.0583 (points) before the eight-level bridge diving experiment, and increased to 17.829 ± 8.5346 (points) after the experiment, which increased by about 5 points. The improvement space of the control group was smaller than that of the experimental group. The score of the experimental group was 5.471 ± 2.2454 (points) before the five-level side bridge experiment, and increased to 8.953 ± 1.8868 (points) after the experiment, which was about 3 points higher; The score of the control group was 5.623 ± 3.0759 (points) before the experiment, and increased to 5.993 ± 2.8922 (points) after the experiment, which increased by about 0.3 points. The improvement space of the control group was smaller than that of the experimental group. The score of the experimental group was 37.913 ± 6.2203 (S) before the experiment, and increased to 69.932 ± 6.0900 (S) after the experiment, up about 32 (S); The score of the control group was 37.183 ± 7.0143 (S) before the experiment, increased to 53.975 ± 7.5217 (S) after the experiment, increased by about 16 (S), and the improvement space of the control group was smaller than that of the experimental group. For the test results of the above three indicators, the experimental group has a large space for improvement after high-load training, while the control group has a small space for improvement after traditional martial arts training, and there is no significant difference between the two groups.

Impact of high-load training of martial arts on movement dynamics

The subjects in the control group and the experimental group tested six movement strength indicators before the experiment, and the basic data are shown in Table 4. Through the comparative analysis of the basic data, it can be seen that before the experiment, there is no difference between the six indicators of the two groups, including the left turn back throw solid ball, the right turn back throw solid ball, the left turn back throw solid ball, the right throw solid ball, the left leg strike force and the right leg strike force, P values are greater than 0.05.

After the experimental intervention training, the subjects in the experimental group and the control group were tested on the movement strength index. The specific data are shown in Table 5. Through the comparative analysis of data, it can be seen that there are significant differences between the left turn back solid ball throwing and the right throw solid ball throwing in the six movement strength indicators, P value is less than 0.05, and the test results of the other four indicators do not show differences, P value is greater than 0.05. From the data analysis results in Table 5, it can be seen that after the high-load training, the athletes' movement strength has been significantly improved in throwing the solid ball after turning left and throwing the solid ball on the right, which further explains that the high-load training method has a good effect on the athletes' movement strength.

By comparing the results of the above four indicators, it can be concluded that compared with traditional martial arts training, high-load training can improve the performance of athletes' right turn back throw solid ball, left throw solid ball, left leg strike strength and right leg strike strength. That is to say, high-load training has a positive effect on athletes' movement strength. Although there is no significant difference in the performance of the above four indicators, it also has a promoting effect.

Table 4. Basic data collection of experimental group and control group before experiment.

Group	Experience group	Control group	P value
Turn left and throw solid ball (m)	8.895±0.9694	9.001±0.7040	0.0807
Turn right and throw solid ball (m)	8.122±0.4844	8.471±0.7250	0.0785
Throw solid ball on the left side (m)	9.742±1.9825	9.788±2.0368	0.0795
Throw solid ball on the right side (m)	10.319±2.1915	9.956±2.0764	0.0839
Left leg strike force (BW)	5.742±0.3358	5.591±0.4557	0.0735
Right leg strike force (BW)	5.472±0.2329	5.682±0.3283	0.0743

Table 5. The Influence of Routine Training and High-load Training of Wushu on Movement Strength.

Group	Experience group	Control group	P value
Turn left and throw solid ball (m)	9.982±0.9038	9.020±0.6877	0.0395
Turn right and throw solid ball (m)	9.559±0.4934	8.510±0.7169	0.0536
Throw solid ball on the left side (m)	14.922±3.9274	14.342±3.6715	0.0516
Throw solid ball on the right side (m)	15.645±4.0467	14.392±3.7254	0.0467
Left leg strike force (BW)	6.826±0.8890	6.426±0.9419	0.0508
Right leg strike force (BW)	7.329±0.6077	6.259±0.5372	0.0699

DISCUSSION

The action performance of martial arts athletes can directly affect the quality of action completion and competition performance. The action performance can directly reflect the skill level and physical quality of athletes. For example, squatting requires the strength of athletes' lower limbs to ensure. At the same time, the performance of martial arts athletes will also be restricted by their physical quality. For example, when the strength of the athletes' lower limbs is defective, the squat movement cannot be completed perfectly, which will affect the performance effect of martial arts movements, resulting in the inability to achieve the best results. Therefore, for Wushu athletes, the ability of movement performance needs to be improved through scientific and reasonable training. The movement performance of martial arts athletes can be reflected by the test results of the four indicators, namely, the eight-level bend bridge, the five-level side bridge, the balance crane and the cross-turn run. After the experimental intervention, the cross-turn run performance of the experimental group showed significant differences, and the test results were significantly improved, while the other three indicators did not show significant improvement, but the improvement space of the experimental group was higher than the improvement space of the control group. Through the comparative analysis of experimental data, it can be seen that the high-load training proposed in this paper can improve the performance of martial arts athletes. High-load training is designed for the competitive needs of martial arts athletes, which is different from traditional martial arts training. High-load training increases the training intensity and difficulty of athletes, and focuses on improving the performance ability of athletes, which can effectively improve the performance ability and competitive level of athletes. It is of great significance. Therefore, for martial arts, high-load training is an important and necessary training method.

CONCLUSION

Wushu is a traditional sports event. Because of its combination of physical fitness, self-cultivation, sports performance and competition. The movement characteristics of martial arts require athletes to have enough movement strength to support a series of martial arts movements. Complex martial arts movements require athletes to have high balance and coordination, which are inseparable from the protection of movement strength. This paper proposes a new high-load training method based on the movement strength of martial arts athletes. Compared with traditional martial arts training, high-load training can help athletes improve movement performance and movement strength. After experimental intervention, the data analysis results show that

the test results of cross-turn running, left-turn back throwing solid ball, and right-turn throwing solid ball have significantly improved, P values are less than 0.05. Although the results of other test indicators did not show significant differences, the results of the experimental group were improved to a certain extent compared with the results of the control group. Through experimental analysis, it can be concluded that the high-load training proposed in this paper can effectively improve the performance and strength of martial arts athletes, and then promote the competitive level of martial arts athletes.

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