CONSEQUENCES OF LOWER LIMB STRENGTH TRAINING ON JUMP PERFORMANCE IN ATHLETES OF MARTIAL ARTS

CONSEQUÊNCIAS DO TREINAMENTO DE FORÇA NOS MEMBROS INFERIORES SOBRE A CAPACIDADE DE SALTO EM ATLETAS DE ARTES MARCIAIS

CONSECUENCIAS DEL ENTRENAMIENTO DE FUERZA DE LOS MIEMBROS INFERIORES EN LA CAPACIDAD DE SALTO DE ATLETAS DE ARTES MARCIALES

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ABSTRACT

Introduction: Chinese martial art has a wide and deep history, and its routine passes are a particular artistic presentation. In exhibitions, choreography with jumping is highly appreciated. Empirically, it is believed that additional strengthening of the lower limbs may promote better results in the performances, but there are no reports in the scientific literature about such a statement. Objective: Verify the consequences of lower limb strength training on jumping ability in martial arts athletes. Methods: 30 first and second tier athletes from the professional women's team of the Wushu Sports Management Center and Sports Bureau were selected as volunteers for the experimental research. The experiment lasted for three months. The characteristics of the development and change of strength of each muscle group in the knee joint of the athletes' lower limb during the experimental training were detailed, and the commonly used means of lower limb strength training were found. Results: In strength training, the best means found were skipping steps and rapidly changing direction. The correlation coefficient between jumping and strength was 0.75. Conclusion: After the experiment, the maximum torque and the average power of the lower limb knee muscle groups of the three experimental groups increased in different ranges, which shows that the strength quality of the knee joint of the athletes increased during the suggested training. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Lower Extremity; Martial Arts; Physical Functional Performance.

RESUMO

Introdução: A arte marcial chinesa tem uma ampla e profunda história, e seus passes de rotina são uma apresentação artística em particular. Nas exibições, a coreografia com saltos é bastante apreciada. Empiricamente, acredita-se que o fortalecimento adicional de membros inferiores possa promover melhores resultados nas apresentações, porém não há relatos na literatura científica sobre tal afirmação. Objetivo: Verificar as consequências do treinamento de força nos membros inferiores sobre a capacidade de salto em atletas de artes marciais. Métodos: 30 atletas de primeira e segunda linha da equipe profissional feminina do Wushu Sports Management Center e do Sports Bureau foram selecionadas como voluntárias para a pesquisa experimental. O experimento teve duração de três meses. Foram detalhadas as características do desenvolvimento e alteração da força de cada grupo muscular na articulação do joelho do membro inferior das atletas durante o treino experimental, e foram encontrados os meios comumente utilizados de treino de força dos membros inferiores. Resultados: No treino de força, os melhores meios encontrados foram saltar passos e alterar rapidamente de direção. O coeficiente de correlação entre salto e força foi de 0,75. Conclusão: Após o experimento, o torque máximo e a potência média dos grupos musculares do joelho dos membros inferiores dos três grupos experimentais aumentaram em diferentes faixas, o que mostra que a qualidade de força da articulação do joelho das atletas aumentou durante o treino sugerido. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Extremidade Inferior; Artes Marciais; Desempenho Físico Funcional.*

RESUMEN

Introducción: El arte marcial chino tiene una amplia y profunda historia, y sus pases de rutina son una presentación artística particular. En las exhibiciones, la coreografía con saltos es muy apreciada. Empíricamente, se cree que el fortalecimiento adicional de los miembros inferiores puede promover mejores resultados en las actuaciones, pero no hay informes en la literatura científica sobre tal afirmación. Objetivo: Verificar las consecuencias del entrenamiento de la fuerza de los miembros inferiores sobre la capacidad de salto en atletas de artes marciales. Métodos: 30 atletas de primera y segunda línea del equipo profesional femenino del Centro de Gestión Deportiva de Wushu y de la Oficina de Deportes fueron seleccionados como voluntarios para la investigación experimental. El experimento duró tres meses. Se detallaron las características del desarrollo y el cambio de la fuerza de cada grupo muscular en la articulación de la rodilla de la extremidad inferior de los atletas durante el entrenamiento experimental, y se encontraron los medios utilizados habitualmente para el entrenamiento de la fuerza de la extremidad inferior. Resultados: En el entrenamiento de fuerza, los mejores medios encontrados fueron saltar pasos y cambiar rápidamente de dirección.

El coeficiente de correlación entre los saltos y la fuerza fue de 0,75. Conclusión: Tras el experimento, el par máximo y la potencia media de los grupos musculares de la rodilla de los miembros inferiores de los tres grupos experimentales aumentaron en diferentes rangos, lo que demuestra que la calidad de la fuerza de la articulación de la rodilla de los atletas aumentó durante el entrenamiento propuesto. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Extremidad Inferior; Artes Marciales; Rendimiento Físico Funcional.*

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INTRODUCTION

The techniques of Competitive Wushu routines are complex and changeable. The completion specifications and stability of action style and difficult actions put forward high requirements for the physical quality (special quality, special technology, etc.) of Wushu athletes, and the requirements for the body control and balance ability of human body can not be ignored. In terms of movement form and method, the movement mode is a whole-body movement centered on the core area. The improvement of core strength level provides a guarantee for the stability of Wushu athletes to complete fast, difficult and high-quality movements, and improves the specialized control ability of nerves to muscles. It creates favorable conditions for athletes' upper and lower limbs to work together, and has good practicability in improving the nerve and muscle conduction ability (control force) of Wushu Routine Athletes and maintaining body posture, coordination and sensitivity in sports.[1]

Solid basic skills and accurate balance ability are included in teenagers' physical quality, which is the concentrated embodiment of balance ability, special quality, special technology and general physical quality. The physical qualities related to youth Wushu routine training mainly include: special speed quality, special strength quality, special endurance quality, special sensitivity quality and special flexibility quality. These five aspects of physical fitness can directly affect the level of Wushu routine practice. Due to the characteristics of their physiological structure, young athletes are in a highly sensitive period of neural control training. The characteristics of light weight-bearing, slow speed, static and dynamic stability and neural control ability in core strength training are more in line with the physiological characteristics of young athletes and the requirements of scientific training. The use of core strength training methods in Wushu routines is based on the traditional special strength training theory, and the application of core stability or core strength is also well reflected in Chinese Traditional Wushu training. Learning from the new methods of core strength training, supplemented by new training means, will help to improve the physical stability ability of young Wushu routines athletes.[2]

METHOD

Research object

This paper selects 30 first-line and second-line athletes of women's routine team in Wushu management center of Sports Bureau as the experimental research object. Among them, there are 3 athletes, 9 first-class athletes and 18 second-class athletes. The training period is 8-13 years.[3] In this study, athletes of different sports levels were divided into three groups by random lot, with 10 people in each group (1 athlete, 3 first-class athletes and 6 second-class athletes in each group). The basic information of experimental athletes is shown in Table 1:

Experimental method

Before the experiment, the subjects were randomly divided into three groups according to the random lottery method, namely experimental group A, B and C. during the experiment, each group was asked to use the preset training methods for lower limb strength training. The training effect of the experiment was tested by isokinetic muscle strength test and the center height after difficult take-off.[4,5]

Table 1. Basic data of subjects.

Group	Average age/year	Average height/cm	Average weight/kg	Average training years
Group 1	15.9±2.3	162. 12±3.36	47.67±4.21	8.0±3.5
Group 2	15. 8±2.4	163.14±4.73	48.23±5.12	7.5±5.5
Group 3	16. 1±1.8	161.26±5.72	48.12±2.56	8.0±4.5

The experimental period was from November 2010 to January 2011, and the experimental period was three months. Upon application, the martial arts center agrees to assist the coaches of the women's martial arts team to carry out lower limb strength training for three months, twice a week for 13 weeks. Based on the results of expert interview, the training methods are divided into three groups according to the range of motion of knee joint, 450, 900 and 1350 respectively.

The content of strength training has been discussed with the coach. During the test, the training content mainly arranged by the coach is upper limb and waist and abdomen strength. The content of experimental training is arranged after the content of normal strength training, so that the intensity and load of front strength training can be consistent.[6] The double-blind experiment method is adopted to eliminate the subjective deviation or personal preference that may occur among participants and experimenters. Before and during the experiment, the research object and coaches are not told and implied any basic information about the experiment, so that the research object can be trained completely in a natural state, so as to ensure the credibility and effectiveness of the experiment.[7]

Data processing

The test results were statistically analyzed by mathematical statistics software. The mean value and standard deviation were statistically sorted out, and the paired sample t-test was performed on the data of the same group of subjects before and after the experiment. The multiple comparison method of one-way ANOVA in SPSS for Windows version 18.0 statistical software was used for comparative analysis, and Excel software was used for data processing and chart drawing.[8]

RESULTS

Variance homogeneity test in sports research, if there is only one observation factor for more than two overall averages, the research method of one-way ANOVA should be used. In this study, the height difference of the experimental subjects was analyzed by one-way ANOVA to test the differences of three different training methods. The homogeneity test of variance is an important premise of analysis of variance. This study first tests the homogeneity of variance, and the results are shown in Table 2:

The 720° movement technique of whirlwind foot in competitive Wushu routine is composed of three stages: step jump, take-off and

Table 2. Homogeneity test of variance.

levene statistic	df1	df2	Sig
0.038	2	27	0.962

landing. Step jump is to step on the ground with force by stepping on the jumping foot and quickly push out of the ground. At the same time, the coordination and cooperation of both arms give play to the best take-off effect. When stepping on the ground, the flexion of the knee joint of the right leg must be 135. Take off at the highest point and make the action of closing the legs inside and striking. The knee joints of the hitting legs should be straight, fan-shaped from outside to inside, and the non hitting legs should be straight and vertical to the ground.[9]

Divide the subjects into three groups. Record the 720 ° height of the difficult action whirlwind foot of the subjects before and after the experiment, and calculate their mean difference. After three months of experiment, each group has changed in the 720 ° height of the difficult whirlwind foot, as shown in Table 3.

Through the height difference before and after the experiment in table 3, it can be found that the difficulty height of each group of subjects after the experiment has been improved. The first group has increased by 0.46cm, the second group has increased by 0.54cm, and the third group has increased by 0.64cm. It shows that the lower limb strength training methods of the three groups have an impact on the difficulty height of athletes,[10] and the increase range of height is the third group > the second group > the first group. The change trend is shown in Figure 1.

According to the data in Figure 1, there is no significant difference in the improvement range of the difficulty height of athletes in each group, and the athletes in each group maintain a stable growth trend during the experiment.

After 13 weeks of experimental training, the analysis showed that all groups improved. After the training experiment, the height of the difficult action whirlwind 720° was increased by 0.4cm in the first group, 0.5cm in the first group and 0.64cm in the first group. The training methods

Table 3. Height and difference of difficulty center of gravity of each group before and after the experiment (CM).

Group	Height before experiment	Post test height	Difference between post experiment and pre experiment
Group 1	18. 17±0. 54	16. 58±0.87	0. 43±0. 18
Group 2	15. 84±0.87	18.38±0. 87	0.45±0. 19
Group 3	16.86±0.61	16.60±0. 56	0. 54±0. 19

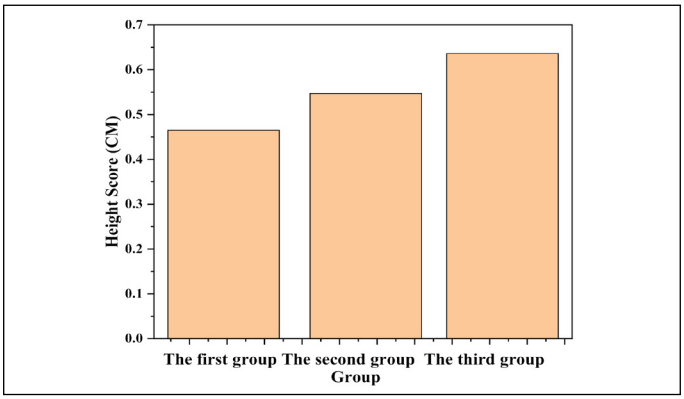

Figure 1. Increase range of difficulty center of gravity height before and after the experiment.

of the experiment mainly develop the front and rear thigh muscles, calf muscles and stepping joint strength, and the working muscle groups involved in the difficult action whirlwind feet are also consistent with the muscle groups developed by these exercises.[11]

CONCLUSION

In the leg strength training of Wushu routine athletes, the best training means should be jumping steps and changing direction. The correlation coefficient between jumping and leg strength is 0.75. The high correlation degree of leg strength also includes 30m sprint, vertical jump and high touch, load-bearing static squat, and the correlation coefficient is divided into 0.66, 0.66 and 0.63. In the leg strength training of Wushu routine athletes, we should reasonably arrange the exercise load according to personal characteristics. In the lower limb strength training of high-level Wushu routine, knee muscle strength training is particularly important. In the arrangement of training l practice, we should consider the exercise intensity and exercise load, and carry out targeted training according to the requirements of the nature of the required strength, so as to avoid athletes' fatigue.

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