CORE TRAINING IN MARTIAL ARTS ATHLETES

TREINAMENTO DO CORE EM ATLETAS DE ARTES MARCIAIS

ENTRENAMIENTO DEL CORE EN ATLETAS DE ARTES MARCIALES

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ABSTRACT

Introduction: Martial arts comprise skill-based fighting games whose early specialized training is essential for development. Martial arts techniques are based on body movements requiring physical coordination, body stability, and endurance. Objective: Design a specific training for the abdominal center in martial arts athletes. Methods: Twelve martial arts athletes were selected as research subjects. These athletes were submitted to experimental training for six semesters. According to the characteristics of movement and effort, this paper evaluates the capacity of athletes' abdominal center muscle groups. The content of the experimental training included stability, strength, explosiveness, and endurance. The experimental results were analyzed based on current scientific literature and mathematical statistics. Results: Compared to the test before the experiment, the stabilization strength of the abdominal core muscles in routine training was unchanged without statistical significance (P>0.05). After six weeks of experimental core strength training, core muscle stability strength was significantly increased (P<0.001). Conclusion: The abdominal core stability of martial arts athletes was improved by experience. Its positive performance was in martial arts athletes' stability, strength, explosive power, and endurance. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

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

RESUMO

Introdução: Artes marciais compreendem jogos de luta baseados em habilidades cujo treinamento especializado precoce é essencial para o seu desenvolvimento. As técnicas das artes marciais são baseadas nos movimentos corporais requerendo coordenação física, estabilidade corporal e resistência. Objetivo: Elaborar um treinamento específico para o core em atletas de artes marciais. Métodos: Doze atletas de artes marciais foram selecionados como objetos de pesquisa. Esses atletas foram submetidos ao treino experimental por seis semestres. De acordo com as características de movimento e esforço, este artigo avalia a capacidade dos grupos musculares do core dos atletas. O conteúdo do treinamento experimental incluiu estabilidade, força, explosividade e resistência. A análise dos resultados experimentais efetuou-se com embasamento da literatura científica atual e estatísticas matemáticas. Resultados: Em comparação com o teste prévio ao experimento, a força de estabilização dos músculos do núcleo abdominal no treinamento de rotina foi inalterada, sem significância estatística (P>0,05). Após seis semanas de treinamento experimental da força do core, a força da estabilidade do núcleo muscular foi significativamente aumentada (P<0,001). Conclusão: A estabilidade do core dos atletas de artes marciais foi aprimorada pela experiência. Seu desempenho positivo deu-se na estabilidade, força, poder explosivo e resistência dos atletas de artes marciais. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

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

RESUMEN

Introducción: Las artes marciales comprenden juegos de lucha basados en la habilidad, cuyo entrenamiento especializado temprano es esencial para su desarrollo. Las técnicas de las artes marciales se basan en movimientos corporales que requieren coordinación física, estabilidad corporal y resistencia. Objetivo: Diseñar un entrenamiento específico para el core en atletas de artes marciales. Métodos: Se seleccionaron doce atletas de artes marciales como sujetos de la investigación. Estos atletas fueron sometidos al entrenamiento experimental durante seis semestres. Según las características del movimiento y el esfuerzo, este artículo evalúa la capacidad de los grupos musculares del core de los atletas. El contenido del entrenamiento experimental incluía estabilidad, fuerza, explosividad y resistencia. El análisis de los resultados experimentales se basó en la literatura científica actual y en la estadística matemática. Resultados: En comparación con la prueba anterior al experimento, la fuerza de estabilización de los músculos abdominales centrales en el entrenamiento de rutina no se modificó sin significación estadística (P>0,05). Después de seis semanas de entrenamiento experimental de la fuerza del núcleo, la fuerza de estabilidad de los músculos del núcleo aumentó significativamente (P<0,001). Conclusión: La estabilidad del core de los atletas de artes marciales mejoró con el experimento. Su rendimiento positivo fue en la estabilidad, la fuerza, la potencia explosiva y la resistencia de los atletas de artes marciales. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Artes Marciales; Atletas; Entrenamiento de Fuerza; Deportes; Fuerza Muscular.*

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INTRODUCTION

Martial arts are a fighting sport based on technique. Targeted training is of great significance for improving the competitive level of martial arts athletes and improving their sports performance. We started with special strength training and applied the core strength of strength to the training of exceptional strength.[1] This strengthens the core of the athlete. At the same time, the training is also to make the unique ability better play. Athletes can better develop their abilities through core strength training. Through six-cycle experiments, it was found that core strength significantly improved the core muscle stability of martial arts athletes.[2] At the same time, athletes have also significantly improved in unique ability, special basic skills, landing stability of complicated long jump movements, and martial arts routines.

METHOD

Research objects

This paper takes 12 martial arts players as the research object. The average age of athletes is 18. The training period is ten years. This article strengthens the core muscle group and the deep small muscle group of athletes according to the characteristics of the movements and force-generating methods of martial arts routines.[3] The training content includes stability, strength, explosiveness, and endurance.

Inspection and evaluation

This article takes the number of times the contestants perform supine, forward shooting, inside-in-leg, and outside-swing legs as the leading indicator. This article uses the stability evaluation index for the players to do sit-ups, front shots, inside legs, and outside legs within 1 minute. This article uses the barbell weight achieved by ten weightlifting movements as the standard for evaluating core strength. This article uses the barbell limit weight achieved by lifting weights as the standard for judging core explosive power. This article is based on the standard number of forwarding shots, inward and outward leg swings within one minute, and the success rate of "720°-horse stance" and "720°-horse stance" completed by the contestant ten times. The judging indicators of the level of sports competition are the skills and project performance of the players. All experimental data were entered into the computer through SPSS11.5 for data management and statistics.

Identification and matching of martial arts sports

Before identifying the standard posture of the human body, this paper must use the homogeneous coordinate system to realize the geometric transformation of each crucial part of the human skeleton in the three-dimensional Cartesian coordinate system.[4] The specific calculation formula is:

$$m'' \quad n \quad d = \left[x + \Delta x, y + \Delta y, z + \Delta z\right]^T \tag{1}$$

In formula (1), the coordinates of the starting point of the bone are denoted as m. n represents the coordinates of the transformed human skeleton.[5] Assuming that the standard pose skeleton is Q, the set of bone nodes extracted from the pose skeleton is $p_Q = \{q_1, q_2, q_3, \mathrm{L}, q_{10}\}$. Assume that the simulated pose skeleton is W and the nodes of the bones are $p_w = \{w_1, w_2, w_3, \mathrm{L}, w_{10}\}$. In this case, the average value of the Euclidean distance between the corresponding bone nodes of p_Q and p_W was obtained.[6] Its expression is as follows:

$$d = \frac{\sum_{i=1}^{n} \left\| q_i - w_i \right\|}{n} \tag{2}$$

This paper can obtain the angle between adjacent bone joints by using the bone joint connection.[7] Assuming that a set of standard body angles and a set of simulated body angle values are set as $\lambda_Q = \{q_1, q_2, q_3, \mathrm{L}, q_9\}$ and $\lambda_W = \{w_1, w_2, w_3, \mathrm{L}, w_9\}$, respectively, the average difference of the corresponding angles between the two body positions is expressed as follows:

$$d = \frac{\sum_{j=1}^{n} | q_j - w_j |}{n} \tag{3}$$

There is no need for a code of ethics for this type of study.

RESULTS

We conducted a six-week pre-test on 12 subjects before the experiment. The results showed that the stability of core muscles during routine training was improved compared with that before the test, but the difference was not significant (P>0.05). At the same time, the players' particular ability literacy, special basic skills, the stability of completing complicated jumping movements, and routine skills have also been improved to a considerable extent. However, the gap is still not significant (P>0.05). Later, we added the core strength part to the martial arts particular strength exercise based on the previous test results.[8] After six weeks of core strength stabilization training, the stabilization strength of the core muscles was significantly improved. At the same time, the core muscle group's stability is also continuously improved. The athletes' exceptional strength quality, special basic martial arts skills, the stability of completing complicated movements, and the technical level of routines have improved to a certain extent (Table 1, 2, 3 and 4).

Table 1. Comparison of endurance test results after the experiment on martial arts athletes.

Time	Lie on your back	Front slap	In the legs	leg swing
Before experiment	56.32±5.37	86.9±3.54	46.39±3.64	58.66±4.75
After experiment	67.43±5.47	95.51±4.42	56.84±5.89	67.84±5.68
P	<0.005	<0.005	<0.005	<0.01

Table 2. Differences in Martial Arts Athletes in Post-Trial Stability Tests.

Time	From both ends	Front slap	In the legs	leg swing
Before experiment	49.69±5.37	79.01±4.99	41.8±3.19	50.6±4.29
After experiment	60.5±5.02	88.19±3.84	52.44±4.95	62.34±6.37
P	<0.01	<0.01	<0.005	<0.005

Table 3. Comparative study of core stability strength, explosive power, and high-difficulty jumping stability of martial arts athletes after the test.

Time	Before experiment	After experiment	P
10 Crunches Completed Barbell Weights	19.06±1.79	26.95±2.93	<0.001
Maximum barbell weight that can be done in 1 sit-up	25.3±3.41	34.65±5.6	<0.05
10 Cyclone Feet 720° - Horse Step	3.49±1.29	6.96±1.66	<0.01
10 times vacant lotus 720°-horse step	2.56±1.79	6.79±2.13	<0.05

Table 4. Comparison of differences in scores of athletes' martial arts routines and related components after the experiment.

Time	A complete set of technologies	A complete set of technical block comparisons		
		Action quality	Drill level	Action Difficulty
Before experiment	9.52±0.31	5.12±0.11	2.89±0.09	1.51±0.11
After experiment	10.2±0.29	5.29±0.09	3.1±0.09	1.79±0.13
P	<0.005	<0.05	<0.001	<0.005

DISCUSSION

Core competency training is also commonly known as "core stabilization." It originated as a waist-based health treatment. It is based on the unique functions of the human body and has been widely used in physical education. The core part is the main trunk muscles.[9] It mainly includes rectus abdominis, dorsal tendon, transverse abdominis, oblique muscle, erector spine, lower back tendon, etc. Their strength and function will be effectively improved to maintain the balance of the body. Due to the difference in technology and sports methods, the way and degree of participation of the "waist" muscle groups in sports activities also have their characteristics and present their characteristics.[10] Martial arts routine is a relatively complex, comprehensive sport. It requires more muscle group strength, collective participation, and coordinated movements to achieve its goals.

Martial arts routine is a high-intensity comprehensive sports event. Athletes should complete more than 50-70 technical movements within 1 minute and 20 seconds. This requires a combination of professional skills and physical fitness.[11] In the traditional physical exercise, only strength, speed, endurance, agility, flexibility, etc., are included, but the exercise of sports stability is lacking. This is their core competency. Different sports have different requirements for the strength and quality of athletes and show their characteristics. Competitive martial arts routines are more complicated. In terms of exerting force, it can be divided into single local muscle exertion such as "bright palm" and "swing head." Most of the movements are carried out by the joint action of multiple muscle groups such as the human trunk, especially the waist and buttocks. In addition, from the point of view of human biomechanics, most martial arts routines are complex sports involving multiple joints and muscle groups.[12] The trunk-crotch muscle group of the human body plays the functions of stabilizing, balancing the center of gravity and cooperating to exert force. As far as the force exerting method of martial arts routines is concerned, its strength quality is mainly reflected in rapid force, static force, static posture, and slow force.

Core strength training is the training of strength, balance, stability, and other aspects of the core part of the body. The deep core muscles are also called local stabilization muscles. Its principal function is to increase the stability between the spines, keeping the spine in the center of the body. The large muscle groups superficial to the core are called global stabilizers. It comprises rectus abdominis, internal oblique, quadratus lumborum, and gluteal muscles.

The level of physical fitness is the essential condition that athletes need when performing various individual and combined movements. Physical fitness is an essential subject of physical education.[13] The physical quality of martial arts athletes has specific particularity. Unique qualities are an essential part of an athlete. Speed, coordination, agility, endurance, etc., are essential components of physical fitness. The strength type is the source of the body's power to resist or resist resistance. In martial arts, athletes must master the ability to combine speed and movement. How to strengthen the control of competitive martial arts routine players is a "core" problem that cannot be ignored in physical education. Most of the movement techniques of martial arts routines are carried out with the body as the main body and under the synergy of multiple muscles. Training the strength and control of the mobilized trunk and surrounding muscles is an essential part of improving the physical fitness of athletes. The sensitive period of martial arts routines can increase core exercise and strengthen the strength of deep and minor muscles. It can change the training content and load and improve the coordination of the body.

CONCLUSION

12 Martial Arts Athletes Have Increased Muscle Core Stabilization Strength after the trial. They are mainly reflected in endurance, core stability, explosive power, and stability. By improving the core muscle group's core stability, the ability of the core muscle group to participate in the coordination of movements can be effectively enhanced. In this way, the best motion trajectory and effect can be achieved. When the coaches perform specific movements for the athletes, the "kinetic chain" power transmission" is more rapid, smooth, and accurate. The article's conclusion proves that it is feasible to introduce core strength into the special strength training of Martial arts.

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