

IMPACTS OF CORE STRENGTH TRAINING ON BALANCE IN MARTIAL ARTS ATHLETES



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IMPACTOS DO TREINO DE RESISTÊNCIA DO CORE SOBRE O EQUILÍBRIO EM ATLETAS DE ARTES MARCIAIS

IMPACTO DEL ENTRENAMIENTO DE LA FUERZA DEL CORE EN EL EQUILIBRIO DE LOS ATLETAS DE ARTES MARCIALES

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ABSTRACT

Introduction: Physical conditioning is an essential component of sports skills. The main routine training methods for skill enhancement in martial arts players should be based on traditional movements. Core strength training has also been shown to be valid for the physical conditioning of martial arts players. **Objective:** This paper studies the qualitative changes in the balance of martial arts athletes caused by the insertion of core strength training. **Methods:** This paper selects 24 martial arts players by sampling and randomly divides them into control and experimental groups. The biomarkers of the volunteers were stored and processed under statistical methods to organize and display the data. **Results:** The experimental and control groups showed high statistical significance in each index after testing ($P < 0.05$). The results show that the methods used in the experimental and control groups can effectively improve their performance in core and key explosive movements during exercise. There were very significant changes in the extensor muscle peak in both groups. The experimental group showed more significant improvement than the standard group ($P < 0.05$). The experimental group's flexor peaks showed a more significant difference than the control group. In contrast, the experimental group showed a more remarkable improvement than the standard group ($P < 0.05$). **Conclusion:** Core resistance exercise can effectively promote a center of gravity balance in martial arts athletes. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Martial Arts; Reactivity-Stability; Resistance Training; Sports; Athletes

RESUMO

Introdução: O condicionamento físico é um componente essencial das habilidades esportivas. Os principais métodos de treino de rotina para aumento da habilidade dos jogadores de artes marciais devem ser baseados em movimentos tradicionais. O treinamento de resistência do core também já se mostrou válido sobre o condicionamento físico dos jogadores de artes marciais. **Objetivo:** Este artigo estuda as alterações qualitativas sobre o equilíbrio dos atletas de artes marciais provocadas pela inserção do treino de resistência do core. **Métodos:** Este artigo seleciona 24 jogadores de artes marciais por amostragem e os divide aleatoriamente em grupos controle e experimental. Os biomarcadores dos voluntários foram armazenados e processados sob métodos estatísticos para organizar e exibir os dados. **Resultados:** Os grupos experimentais e de controle apresentaram alta significância estatística em cada índice após o teste ($P < 0,05$). Os resultados mostram que os métodos utilizados nos grupos experimentais e de controle podem melhorar efetivamente seu desempenho no core e nos principais movimentos explosivos durante o exercício. Houveram mudanças muito significativas no pico dos músculos extensores em ambos os grupos. O grupo experimental apresentou melhora mais significativa do que o grupo padrão ($P < 0,05$). Em comparação com o grupo controle, os picos de flexores do grupo experimental apresentaram uma diferença mais significativa. Em contrapartida, o grupo experimental apresentou uma melhora mais notável do que o grupo padrão ($P < 0,05$). **Conclusão:** O exercício de resistência do core pode efetivamente promover a equilíbrio do centro de gravidade nos atletas de artes marciais. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Artes marciais; Reatividade-estabilidade; Treinamento de força; Esportes; Atletas.

RESUMEN

Introducción: El acondicionamiento físico es un componente esencial de las habilidades deportivas. Los principales métodos de entrenamiento rutinario para aumentar la capacidad de los jugadores de artes marciales deben basarse en los movimientos tradicionales. El entrenamiento de la fuerza del core también ha demostrado su validez en el acondicionamiento físico de los jugadores de artes marciales. **Objetivo:** Este trabajo estudia los cambios cualitativos en el equilibrio de los atletas de artes marciales causados por la inserción del entrenamiento de resistencia del core. **Métodos:** Este artículo selecciona 24 jugadores de artes marciales por muestreo y los divide aleatoriamente en grupos de control y experimental. Los biomarcadores de los voluntarios se almacenaron y procesaron con métodos estadísticos para organizar y mostrar los datos. **Resultados:** Los grupos experimental y de control mostraron una alta significación estadística en cada índice tras la prueba ($P < 0,05$). Los resultados muestran que los métodos utilizados en los grupos experimental y de control pueden mejorar eficazmente su rendimiento en los movimientos explosivos centrales y principales durante el ejercicio. Hubo cambios muy significativos en el pico muscular extensor en ambos grupos. El grupo experimental mostró una mejora más significativa que el grupo estándar ($P < 0,05$). En comparación con el



grupo de control, los picos flexores del grupo experimental mostraron una diferencia más significativa. En cambio, el grupo experimental mostró una mejora más notable que el grupo estándar ($P < 0,05$). Conclusión: El ejercicio de resistencia del core puede promover eficazmente el equilibrio del centro de gravedad en los atletas de artes marciales.

Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.

Descriptores: Artes Marciales; Reactividad-Estabilidad; Entrenamiento de Fuerza; Deportes; Atletas.

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INTRODUCTION

Martial arts are not only cultural heritage of China but also a significant sport. The sport has high demands on every player.¹ From a practical point of view, their core ability training is mainly carried out conventionally. Various factors will also limit it, so the relevant departments should formulate corresponding systems to solve the problem of the development of Chinese martial arts. This provides a guarantee for the development of martial arts.

METHOD

Subjects

This paper takes 24 martial arts players as a research sample. We randomly divided them into two groups, one was the control group, and the other was the experimental group.² Before the start of the test, the maximum workload of the heart was measured for all players.

Statistical analysis

A t-test was performed between the experimental and the control groups in this paper. In this experiment, a level comparison was made between the experimental and control groups.³ At the same time, this paper is based on the independent sample size t-test.

Correction of the landing speed and ground stability of martial arts in the air

$\partial(\eta)$ illustrates the difficulty of the high jump in martial arts. W refers to the weight of the athlete, then the bouncing and turning of the body in the air is expressed by formula (1).

$$Round = \frac{\partial(\eta) \times W}{\theta \times \beta} t \tag{1}$$

t refers to the time the player stays in the air. θ refers to the swing angle of the athlete's legs when sprinting. β is the angle between the line connecting the two legs and the straight line of the two legs when taking off. In this paper, formula (2) is used to express the rotational inertia of the athlete's action stage

$$F = \int_0^1 \begin{bmatrix} 1 & 0 \\ 0 & \beta \end{bmatrix}^T \times \alpha \{f\} dt \tag{2}$$

α represents the effect of the athlete's arm swing from left to right on the hip. $\begin{bmatrix} 1 & 0 \\ 0 & \beta \end{bmatrix}$ represents the joint-strain matrix of the hip during the athlete's take-off. $\{f\}$ represents the initial ground stress of the mobilized knee under inertia. F represents the effect of the change in the tension of the ankle joint on the floor.⁴ The drop velocity under the condition of waist and abdominal muscle strength is obtained by formula 3

$$\omega_f = \frac{\partial(\eta) \times \forall(\eta)}{\sum_0^1 [\partial(\eta) + \forall(\eta)]} L(m) \tag{3}$$

$\forall(\eta)$ represents the highest point of the center of gravity obtained by the athlete at the moment of landing in this process. $L(m)$ represents the angle of rotation of his ankle and knee while in the air.⁵

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

RESULTS

Comparative study of muscle strength at different speeds before and after different tests

The results showed no significant difference between the experimental and the control groups in each item ($P > 0.05$). (Table 1)

Differences in the measurement of isokinetic muscle strength between different experimental groups and control groups

Table 2 compares each index before and after the different experimental groups and the control test.⁶ The results showed apparent differences. The methods used in both the experimental and control groups can effectively improve their core strength and core explosiveness during exercise.

1. The tensile muscle peak torque of the experimental group was significantly improved compared with the control group. The results showed a big difference in peak flexor torque.⁷ The experimental group showed more significant improvement than the standard group. Studies have found that traditional heart muscle exercises can significantly improve the maximum muscle strength of the central flexor and extensor muscles of the body. 2. There is a significant difference between the experimental and control groups regarding stretching muscle strength. The growth rate of the experimental group was significantly higher than that of the control group.

Experimental data analysis of core stability

Before the test, this paper uses the balance plate crane vertical test method to detect the experimental and control groups' players. Table 3

Table 1. Comparison of differences in test indicators before the experiment.

Index	Test group	Control group	P
Peak extensor moment	199.88±47.96	230.68±43.06	>0.05
Extensor power	116.28±25.12	129.88±26.68	>0.05
Peak flexor moment	231.7±55.26	264.08±55.97	>0.05
Flexor power	123.6±33.28	128.15±28.94	>0.05

Table 2. Vertical comparison test between experimental group and control group.

		Before experiment	After the experiment	P
Test group	Peak extensor moment	199.88±47.96	241.68±37.42	<0.01
	Extensor power	116.28±25.12	138.75±16.03	<0.01
	Peak flexor moment	231.7±55.26	273.03±50.38	<0.01
	Flexor power	123.6±33.28	145.98±26.91	<0.05
Control group	Peak extensor moment	230.68±43.06	243.97±39.36	<0.01
	Extensor power	129.88±26.68	139.62±25.24	<0.01
	Peak flexor moment	264.08±55.97	279.25±52.68	<0.01
	Flexor power	128.15±28.94	141.67±24.58	<0.05

shows no significant difference in the test results of the athletes in the experimental group and the control group.⁸

After the end of the test, there was a difference in the measured results of the equilibrium lift between experimental group and control group.⁹ (Table 4) The experimental group showed significant improvement over the control.

DISCUSSION

Compared with other sports, martial arts test the talent and diligence of the players and have a strong interest in sports. When the talent gap is small, a person shows a strong interest in his martial arts, and then he will work harder and learn better. Athletes who want to improve their fighting skills must have solid basic skills. All fighting techniques require extensive essential practice. And players with these core strengths will perform better in actual combat. In addition, the core strength will also be comprehensively improved for the players. This is not only because their coordination has improved, but more importantly, their physical fitness will also be significantly improved. Martial arts are a physical activity that requires exceptionally high physical coordination and strength. In the game, in addition to mastering the superb basic skills, it is also necessary to have good coordination ability. The exercise of the center of gravity is essential for improving the quality of sports and improving the stability of sports.¹⁰ It is a guarantee to improve the sports level and sports stability.

This article applies the core strength training theory to traditional martial arts to find its essence. In traditional Chinese kung fu, the waist, hips, mid-plate, etc., are all matched with the body's center. The strength of the waist can make the practitioners' movements more agile. This makes it easier to transfer your power to the opponent and increase your shooting chance. This reduces your chance of being hit. A motion performed in both unstable and unstable conditions was used in this experiment.¹¹ This article uses an isokinetic muscle testing machine

Table 3. The differences in the balance plate cranes before the test.

Index	Test group	Control group	P
Balance PRE	40.94±6.88	41.41±7.73	>0.05

Table 4. The differences in the balance plate cranes after the test.

Index	Test group	Control group	P
Balance POST	75.51±6.73	71.11±8.28	<0.01

for measurement. After 12 weeks, the experimental group's extensor, flexor peak moment, and extensor strength were significantly improved compared with those before the test. And the experimental group was significantly better than the control group. The so-called "unstable" is the so-called "uncertain." The so-called "uncertainty" makes people who were exercising on the "earth" become like stepping on a "balloon." It can be seen that the core stability training of Chinese athletes' physical fitness is to break the existing traditional sports concepts and methods in China. This is an entirely new development in Chinese strength and physical fitness. At the same time, this is also an innovation in physical training for martial arts athletes. Its impact is more profound.

The coach must understand in the teaching that the athlete needs to undergo a comprehensive reinforcement on all bases. This will allow them to improve their skills and posture in the air significantly. In addition, the coach can also improve the physical coordination of the athlete.¹² This reduces the risk of injury. Secondly, the exercise of core ability can improve the athlete's body's stability and reduce the athlete's error rate. This can improve the physical fitness and competitive level of athletes. In practice, it is necessary to work out a more reasonable plan based on the specific situation of each player. Only in this way can it promote its comprehensive development.¹³ When doing physical exercise, athletes should apply the above methods to martial arts training. Only in this way can we fundamentally overcome the technical difficulties physical exercise faces. Only in this way can we lay a solid foundation for our martial arts athletes.¹⁴

CONCLUSION

There were significant differences in extensor, flexor peak moment, and extensor strength ($P < 0.01$). There was no significant difference in flexor strength between the two groups. However, the growth rate of the experimental group was significantly better than that of the control group. The results show that core strength exercises are more conducive to the rapid contraction of trunk flexors and extensors than regular exercise. In particular, improving the maximal muscle strength of the core flexor and extensor muscles is pronounced. The center of gravity balance exercise can help improve the player's center of gravity stability. At the same time, this training method lays a solid foundation for the explosive power of the lower body muscles.

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REFERENCES

- Fachrezzy F, Maslikah U, Hermawan I, Nugroho H, Jariono G, Nurulfa R. Kicking ability for the Eolgol Yoep Chagi Taekwondo Poomsae in terms of quality of physical condition, self-confidence, and comparison of leg muscle explosive power and core stability. *JPES*. 2021;21(4):2337-42.
- Green K. Communicating with Georges Bataille in the Mixed Martial Arts Gym. *Somatechnics*. 2021;11(3):376-94.
- Zhang Y, Chen Q, Zhang Y. Reflection on the inheritance and development of martial arts and national traditional sports visual measurement analysis based on Citespacev. *Jurnal Sains Sukan & Pendidikan Jasmani*. 2021;10(1):45-62.
- Benesch O. Olympic samurai: Japanese martial arts between sports and self-cultivation. *Sport Hist*. 2020;40(3):328-55.
- Nugroho H, Gontara SY, Angga PD, Jariono G, Maghribi IL. Quality of Physical Condition of Youth Pencak Silat Athletes Reviewed from Speed, Power, and Strength. *Kinestetik: Jurnal Ilmiah Pendidikan Jasmani*. 2021;5(1):154-62.
- Andrade A, Silva RB, Dominski FH. Application of Sport Psychology in Mixed Martial Arts: A Systematic Review. *Kinesiology*. 2020;52(01):94-102.
- Mickelsson TB, Shaw V. Performance increments without audience: paired data from mixed martial arts fighters during COVID-19. *RAMA*. 2020;15(2):50-8.
- Walters S, Hoffman B, MacAskill W, Johnson MA, Sharpe GR, Mills DE. The control of respiratory pressures and neuromuscular activation to increase force production in trained martial arts practitioners. *Eur J Appl Physiol*. 2021;121(12):3333-47.
- Muzaki FI. Ethical Values in Martial Arts Stories Written by Chinese Beat Generation. *JPSR*. 2022;6(3):4184-96.
- Zeng HZ, Yang Y. Participation motivations and related elements of collegiate Martial arts athletes from Central China regional. *J Phys Educ Sport*. 2021;21(3):1567-79.
- Chaari N, Frikha M, Alibrahim M, Souissi N. Fifteen-minute warm-up best assists perception, power output and subsequent fatigue in morning high-intensity exercise among physical education students. *Medicina dello Sport*. 2020;73(4):598-609.
- Mathisen TF, Rosenvinge JH, Friberg O, Vrabell K, Bratland-Sanda S, Pettersen GJ, et al. Is physical exercise and dietary therapy a feasible alternative to cognitive behavior therapy in treatment of eating disorders? A randomized controlled trial of two group therapies. *Int J Eat Disord*. 2020;53(4):574-85.
- Sonthikul C, Hadhoh N, Madeeyoh N, Ponlakarn A, Dolthamsiri N. Comparative Effect of Core Stabilization Exercise and Active Video Gaming on Dynamic Balance in Elderly Female People: a SingleBlind Randomized Controlled Clinical Trial. *JHSMR*. 2021;40(1):53-65.
- Fedosova M. Why Heroes Fail: National Identity in Jin Yong's Martial Arts Novel the Book and the Sword. *Philological Treatises*. 2021;13(1):123-30.