

PHYSICAL CHANGES IN TAEKWONDO ATHLETES CAUSED BY STRENGTHENING THE CORE



ORIGINAL ARTICLE
ARTIGO ORIGINAL
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ALTERAÇÕES FÍSICAS NOS ATLETAS DE TAEKWONDO PROVOCADAS PELO FORTALECIMENTO DO CORE

CAMBIOS FÍSICOS EN LOS ATLETAS DE TAEKWONDO CAUSADOS POR EL FORTALECIMIENTO DEL CORE

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ABSTRACT

Introduction: Taekwondo is a complete sport with combative nature among related sports. Their athletes need a higher strike force in the legs and a body with relatively high sensitivity and stability. The center of force production, from which all movements originate, is called the core. **Objective:** The purpose of this study is to analyze possible physical changes in Taekwondo athletes caused by strengthening the core. **Methods:** Baseline data from core training was recorded using various scientific analysis methods. Rigorous methods of comparison were also employed. The six indices of athletic ability were tested in experimental and control groups in Taekwondo athletes. **Results:** The data in the athletes' strength and exercise styles before and after core strengthening showed significant differences. **Conclusion:** Strengthening the core of athletes can rapidly improve the development of physical strength. Core strengthening is an effective procedure for improving strength training in Taekwondo athletes. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Sports; Martial arts; Exercise; Physical fitness testing.

RESUMO

Introdução: O Taekwondo é o esporte mais completo com natureza combativa entre os esportes relacionados. Seus atletas precisam ter maior força de ataque nas pernas e um corpo com sensibilidade e estabilidade relativamente altas. O centro de produção de força, de onde se originam todos os movimentos é chamado de core. **Objetivo:** O objetivo deste estudo é analisar as possíveis alterações físicas nos atletas de Taekwondo provocadas pelo fortalecimento do core. **Métodos:** Dados basais do treinamento no core foram registrados usando uma variedade de métodos de análise científica. Foram empregados também, rigorosos métodos de comparação. Os 6 índices de capacidade atlética foram testados em grupos experimentais e de controle nos atletas de Taekwondo. **Resultados:** Os dados na força dos atletas e nos estilos de exercício antes e depois do fortalecimento do core mostraram grandes diferenças. **Conclusão:** O fortalecimento no core dos atletas pode melhorar rapidamente o desenvolvimento da força física. O fortalecimento do core mostrou-se um procedimento eficaz de melhora no treinamento de força nos atletas de Taekwondo. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Esportes; Artes Marciais; Exercício Físico; Testes de Aptidão Física.

RESUMEN

Introducción: El taekwondo es el deporte de naturaleza combativa más completo entre los deportes relacionados. Sus atletas necesitan tener una mayor fuerza de ataque en las piernas y un cuerpo con una sensibilidad y estabilidad relativamente altas. El centro de producción de la fuerza, desde donde se originan todos los movimientos, se llama core. **Objetivo:** El propósito de este estudio es analizar los posibles cambios físicos en los atletas de Taekwondo causados por el fortalecimiento del core. **Métodos:** Se registraron los datos de referencia del entrenamiento básico utilizando diversos métodos de análisis científico. También se emplearon métodos rigurosos de comparación. Los 6 índices de capacidad atlética se probaron en grupos experimentales y de control en atletas de Taekwondo. **Resultados:** Los datos en la fuerza de los atletas y en los estilos de ejercicio antes y después del fortalecimiento del core mostraron grandes diferencias. **Conclusión:** El fortalecimiento del core de los atletas podría mejorar rápidamente el desarrollo de la fuerza física. Se ha demostrado que el fortalecimiento del core es un procedimiento eficaz para mejorar el entrenamiento de la fuerza en los atletas de taekwondo. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptores: Deportes; Artes marciales; Ejercicio Físico; Prueba de Esfuerzo.



DOI: http://dx.doi.org/10.1590/1517-8692202228022021_0493

Article received on 11/03/2021 accepted on 12/23/2021

INTRODUCTION

Taekwondo is a skill-led antagonistic event in the same field. Athletes' physical fitness and flexible changes in skills and tactics have become the cornerstone for athletes to win. As the gap between the technical and tactical levels of high-level athletes shrinks, the competition between

the championship and the runner-up is often finalized by the athlete's physical fitness competition. Our analysis of the special characteristics of the Taekwondo project and the reasonable arrangement of the period and stage of core strength training can improve the quality and effectiveness of training.¹ This method can help athletes achieve the purpose

of physical training. Help athletes to improve and improve their specific technical capabilities so that they can obtain high-level athletic ability. According to Taekwondo's technical and tactical characteristics, the article integrates core strength training into rapid strength training. We selected Taekwondo fast strength indicators and supplemented them with experiments to verify the effectiveness of core strength training for rapid strength development. The purpose of this article is to provide a reference for taekwondo coaches and athletes' strength training.

METHOD

Research object

We selected 8 excellent Taekwondo athletes (numbered group A), 16 first-level athletes (numbered group B), and 30 second-level taekwondo athletes (numbered group C). The above three groups of samples are all males as the experimental group. In addition, the same exercise level, weight level, number of people, and gender numbers were selected as the A1 group, B1 group, and C1 group as the control group.² Two groups of athletes are the research objects of this subject. We conducted related physical fitness tests on the three levels of the experimental group and the control group. There was no significant difference in volunteers' relevant physical fitness indicators after statistical analysis.

Research methods

Expert survey method

According to the needs of this research, develop Taekwondo fast strength training methods and methods, Taekwondo core strength training and test-related methods and indicators, and other related questionnaires. We selected 12 experts with senior titles, senior coach titles and above, and investigated the contents of the questionnaire.³ Twelve valid questionnaires were obtained in the experiment.

Experimental method

We obtain Taekwondo core strength training programs, methods, methods, and rapid strength training methods, and evaluation indicators through expert surveys. The article conducts a 6-month experiment on the research subjects and verifies the effect of Taekwondo core strength training on the rapid strength improvement of athletes.

Mathematical Statistics

We use SPSS19.0 statistical software to sort, count and analyze the data obtained in the experiment.

Application of Banister model in training practice

The input variable in the model is training "dose" (amount and intensity), and the output variable is performance.⁴ Achievement is the result of a combination of adaptation and fatigue. This result aims to describe the effect of training load as two antagonistic functions of adaptation and fatigue. Model performance = (fitness) - K^* (fatigue), the time history of the above performance changes can be expressed and calculated by the first-order differential equation (1):

$$p_t = p_0 + k_1 \sum_{i=1}^{n-1} \omega_i e^{-(n-i)\tau_1} - k_2 \sum_{i=1}^{n-1} \omega_i e^{-(n-i)\tau_2} \quad (1)$$

P_t represents the definitive score on day t . P_0 represents the initial grade. K_1 and K_2 are the adaptation and fatigue coefficients, respectively. τ_1 and τ_2 represent the adaptation and fatigue time constants. ω_i represents the training load on day i . A simple first-order differential equation is obtained through mathematical analysis of fitness and fatigue.

$$p(t) = (e^{-t/\tau_1} - e^{-t/\tau_2}) - K e^{-t/\tau_3} + \omega(t) \quad (2)$$

P_t represents the definitive score on day t . k represents the fatigue amplitude coefficient. τ_1 and τ_2 represent the adaptation time constant. τ_3 represents the fatigue time constant. ω_i represents the training load on day t . The default initial training load of this model is zero.⁵ They simplified the two fitness factors and one fatigue factor in the Calvert model into one fitness factor and one fatigue factor, which were expressed as follows:

$$\text{Adaptation: } g(t) = g(t-i)e^{-i/\tau_1} + \omega(t)$$

$$\text{Fatigue: } h(t) = h(t-i)e^{-i/\tau_2} + \omega(t)$$

A simple linear differential equation represents the combined effect of adaptation and fatigue

$$p(t) = k_1 g(t) - k_2 h(t) \quad (3)$$

RESULTS

The training method is an application tool for coaches to carry out training work, complete training tasks, and improve athletes' competitive ability. The training method is divided into grades. It is constantly evolving. Different levels of training methods on a certain objective basis decisively produce different levels of exercise levels. It can be seen that the training method plays an important role in the training process.⁶ Training load is a "scale" in the training process of athletes, and it is the quantification process of training content. After three rounds of questionnaires were issued and collected, we used the Delphi method to obtain relevant information about the methods, means, and loads of Taekwondo special strength training.

The experimental group used traditional fast strength training as the main method and core strength training as the supplementary exercise method. According to the principles of core strength training, we divide it into two major stages. The experimental group and the control group received traditional strength training three times a week, and the experimental group performed 35min core strength training based on traditional strength training.

After a 6-month experimental period, the experimental group's exercise mobilization has undergone significant changes in the rapid strength test.⁷ Among them, the athletes in group B showed highly significant changes in the indexes of kicking 15s before and raising their legs 15s. Before the experiment, the athletes in group C (the second-level athlete group) showed highly significant changes in various indicators of fast strength (Table 1). Through experiments, it can be concluded that core strength exercises, as a supplement to traditional strength training, have a significant effect on the rapid strength development of Taekwondo athletes.

Table 1. Analysis table of rapid force change of experimental group before and after the experiment.

Fast strength indicator	Group	Before experiment (n)	After the experiment (n)	t	P
Undercut	A	28±3.76	29±2.43	1	<0.05
	B	25±4.35	27±3.73	2.123	<0.05
	C	20±6.12	23±5.06	6.517	<0.01
Forward kick	A	32±4.28	33±4.20	0.246	<0.05
	B	30±6.77	33±5.83	2.121	<0.01
	C	26±6.32	29±5.66	3.737	<0.01
Cross kick	A	31±4.31	32±3.91	0.264	<0.05
	B	29±5.0	30±4.70	0.349	<0.05
	C	24±6.31	26±7.31	2.751	<0.01
High leg up	A	49±3.67	50±3.34	0.612	<0.05
	B	46±5.34	48±4.65	0.415	<0.01
	C	40±3.45	44±5.90	3.943	<0.01

After the athletes in the control group had undergone traditional fast strength training, the athletes in group C1 (the second-level athlete group) had highly significant changes in the tests of various indicators of fast strength. Significant changes occurred in the indicators of the athletes in group B1 in the 15-second split and 15-second front kick, while other indicators remained unchanged.⁸ The athletes in group A1 had no significant changes in all indicators before and after the experiment (Table 2).

Before the experiment, the test results of the four indicators of rapid strength in the experimental group and the control group were statistically analyzed to meet the conditions for the paired sample T-test.⁹ We conducted core strength training + traditional fast strength training for the experimental group, and the control group received the same traditional strength training as the experimental group. After the end of the 6-month experiment, we again tested the two groups of athletes (Table 3). After the experiment of group C and group C1, there was no significant change in the indicators of rapid strength. Significant changes occurred in the rapid strength indexes of the athletes in group B and group B1 before and after the experiment. A highly significant change occurred before and after the experiment in the 15s high leg raise test. Except for the 15-second front kick before and after the experiment, the athletes in groups A and A1 had significant changes in other fast-reacting strength indicators.

DISCUSSION

The traditional rapid strength training system significantly affects the rapid strength development of Taekwondo reserve talents. The intervention of core strength training for athletes in this training phase has no obvious manifestation in the rapid strength improvement. The main reason is that athletes are in the initial stages of training.¹⁰ General fitness training is greater than special fitness training. In training, attention is paid to the overall and coordinated development of athletes' physical

Table 3. Analysis table of rapid strength changes after the experiment in the experimental group and the control group.

Fast strength indicator	Group	Before experiment (n)	After the experiment (n)	t	P
Undercut	A-A1	29±2.43	28±4.76	2.753	<0.05
	B-B1	27±3.73	26±5.18	1.746	<0.05
	C-C1	23±5.06	23±6.00	5.014	>0.05
Forward kick	A-A1	33±4.20	32±5.02	1.342	<0.05
	B-B1	33±5.83	32±5.32	2	<0.05
	C-C1	29±5.66	29±4.87	2.429	>0.05
Cross kick	A-A1	32±3.91	31±4.31	0.612	>0.05
	B-B1	30±4.70	29±4.53	0.349	<0.05
	C-C1	26±7.31	26±5.67	5.129	>0.05
High leg up	A-A1	50±3.34	49±3.47	0.745	<0.05
	B-B1	48±4.65	46±4.65	0.808	<0.01
	C-C1	44±5.90	44±4.56	6.997	>0.05

AUTHORS' CONTRIBUTIONS: Each author made significant individual contributions to this manuscript. Feng Yan: writing and summarize; Tao Liu: data analysis and performing surgeries, article review and intellectual concept of the article.

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Table 2. Analysis of rapid force changes before and after the experiment in the control group.

Fast strength indicator	Group	Before experiment (n)	After the experiment (n)	t	P
Undercut	A1	28±3.85	28±4.76	3.346	>0.05
	B1	25±5.03	26±5.18	1.123	<0.05
	C1	20±5.67	23±6.00	2.457	<0.01
Forward kick	A1	32±4.13	32±5.02	0.212	>0.05
	B1	30±4.67	32±5.32	1.089	<0.01
	C1	26±6.25	29±4.87	3.004	<0.01
Cross kick	A1	31±4.01	31±4.31	1.342	>0.05
	B1	29±4.16	29±4.53	3.157	>0.05
	C1	24±6.18	26±5.67	0.231	<0.01
High leg up	A1	49±3.33	49±3.47	1.754	>0.05
	B1	46±4.12	46±4.65	0.543	>0.05
	C1	40±3.54	44±4.56	2.128	<0.01

fitness, the development of large and superficial muscle groups, the development and training of deep muscle groups, and the practice of fine movement. At this stage, athletes should focus on general physical fitness exercises, focusing on improving athletes' physical fitness.

As a supplement to traditional fast strength training and advanced training stage, outstanding athletes have undergone significant changes in fast strength after the intervention of core strength training. The main reason is that excellent athletes generally have to train for more than 5 years. It is in a high-level special training stage. After a long period of traditional physical fitness training, the athlete's body has gradually adapted to these methods.¹¹ Only by adopting innovative training techniques can the body's potential be awakened. The large muscle groups and superficial muscle groups adapt to the intensity and load of regular training.

CONCLUSION

After the six-month intervention of traditional fast strength training + core strength training for the three levels of the experimental group athletes, significant changes occurred before and after the fast strength experiment. Among them, the changes in the fast strength quality of the athletes in group C (second-level athletes) before and after the experiment Presents a highly significant change. After the athletes in the three groups of the control group received traditional fast strength training for 6 months, the changes in the fast strength quality of the C1 group (second-level athletes) before and after the experiment showed highly significant changes. In comparison, the other two groups showed no significant changes overall. The core strength training of Taekwondo is an important supplement to the traditional fast strength. It is the advanced stage of strength training.

All authors declare no potential conflict of interest related to this article