ABDOMINAL CORE STRENGTH TRAINING AND BODY STABILITY IN TAE KWON DO ATHLETES

TREINAMENTO DE FORÇA DO CENTRO ABDOMINAL E ESTABILIDADE CORPORAL EM ATLETAS DE TAE KWON DO

ENTRENAMIENTO DE FUERZA DEL NÚCLEO ABDOMINAL Y ESTABILIDAD CORPORAL EN ATLETAS DE TAE KWON DO

Original Article
Artigo Original
Artículo Original

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ABSTRACT

Introduction: Abdominal core strength is one of the main factors controlling body balance, helping to efficiently apply body kinetic energy to the movements of Tae Kwon Do martial arts. Objective: Explore the effects of abdominal core strength training on postural stability in Tae Kwon Do athletes. Methods: Forty Tae Kwon Do competitors were randomly selected and divided into experimental and control groups. The control group was subjected to the club's regular exercise program, while the experimental group added three months of stabilization exercise to the regular exercise program. The changes in the experiment on each index were analyzed statistically. Results: After 3 months of postural balance training, Tae Kwon Do athletes' center of gravity stability was improved. The results showed significant improvement in squatting, stretching, thoracic girdle flexibility, balance ball flexion, and ipsilateral hand extension (P<0.05). Conclusion: Abdominal core strength training can improve core muscle group strength in taekwondo athletes. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Tae Kwon Do; Abdominal Core; Resistance Training.

RESUMO

Introdução: A força do centro abdominal é um dos principais fatores de controle do equilíbrio corporal, auxiliando na aplicação eficaz da energia cinética corporal aos movimentos da arte marcial de Tae Kwon Do. Objetivo: Explorar os efeitos do treinamento de força do centro abdominal na estabilidade postural dos atletas de Tae Kwon Do. Métodos: Foram selecionados aleatoriamente 40 competidores de Tae Kwon Do, divididos em grupo experimental e grupo controle. O grupo controle foi submetido ao programa de exercício regular do clube, enquanto ao grupo experimental foram adicionados três meses de exercício de estabilização ao programa de exercício regular. As alterações do experimento em cada índice foram analisadas estatisticamente. Resultados: Após 3 meses de treinamento de equilíbrio postural, a estabilidade do centro de gravidade dos atletas de Tae Kwon Do foi aprimorada. Os resultados mostraram uma melhora significativa no agachamento, alongamento, flexibilidade de cintura torácica, flexão com bola de equilíbrio e extensão ipsilateral da mão (P<0,05). Conclusão: O treinamento de força do centro abdominal pode melhorar a força do grupo muscular central dos atletas taekwondo. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Tae Kwon Do; Centro Abdominal; Treinamento de Força.*

RESUMEN

Introducción: La fuerza del núcleo abdominal es uno de los principales factores de control del equilibrio corporal, ayudando en la aplicación eficiente de la energía cinética del cuerpo a los movimientos del arte marcial Tae Kwon Do. Objetivo: Explorar los efectos del entrenamiento de la fuerza del núcleo abdominal sobre la estabilidad postural en atletas de Tae Kwon Do. Métodos: Se seleccionaron aleatoriamente 40 competidores de Tae Kwon Do, divididos en grupo experimental y grupo de control. El grupo de control fue sometido al programa de ejercicio regular del club, mientras que al grupo experimental se le añadieron tres meses de ejercicios de estabilización al programa de ejercicio regular. Los cambios del experimento en cada índice se analizaron estadísticamente. Resultados: Después de 3 meses de entrenamiento de equilibrio postural, la estabilidad del centro de gravedad de los atletas de Tae Kwon Do mejoró. Los resultados mostraron una mejora significativa en las sentadillas, los estiramientos, la flexibilidad de la cintura torácica, la flexión de la pelota de equilibrio y la extensión de la mano ipsilateral (P<0,05). Conclusión: El entrenamiento de la fuerza del núcleo abdominal puede mejorar la fuerza del grupo muscular central en los atletas de taekwondo. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Tae Kwon Do; Núcleo Abdominal; Entrenamiento de Fuerza.*

DOI: http://dx.doi.org/10.1590/1517-8692202329012022_0580
Article received on 28/10/2022 accepted on 11/11/2022

INTRODUCTION

Exercises that strengthen the quality of strength can promote the development of taekwondo athletes. At present, the conventional physical training cannot meet the requirements of the comprehensive quality of Taekwondo players under the current rules, and the exercise of core strength is a brand-new way of strength training. Its role in competitive sports has been generally accepted. The midline horizontal technique is the leading technical indicator in Taekwondo competitions. The results show that among the various leg techniques, the more times the lateral midline technique is used, the higher the score when attacking.[1] The results showed that during the competition, the use of the intermediate level of the horizontal leg achieved a score of 57.1%. Therefore, technically, the application and score of the mid-section lateral technique are higher than other leg techniques. In recent years, core stability training has been the focus of scholars at home and abroad, and its training methods are also widely used in competitive sports.[2] Therefore, this paper investigates and analyzes the effect of the middle lateral leg speed on the stable center of gravity of young Taekwondo players.

METHOD

General information

This paper takes 40 taekwondo players as a research sample. In this paper, 40 contestants were divided into experimental and control groups. There were no significant differences among the athletes regarding age, height, weight, the median number of kicks in the 30s, and years of training. (Table 1) The control group was performed according to the regular club exercise program, and the experimental group was added three months of core stabilization exercise to the regular exercise program.[3] In this paper, the changes in each test index before and after the test are statistically analyzed.

Table 1. Basic data of 30 test contestants.

Index	Test group	Control group	P
Age	12.28 ± 0.68	12.23 ± 0.47	P>0.05
Height (cm)	146.49 ± 13.06	148.49 ± 8.89	P>0.05
Weight (kg)	42.76 ± 12.56	39.34 ± 8.14	P>0.05
Training years	1.78 ± 0.32	1.78 ± 0.32	P>0.05
30s median cross kick (n)	39.45 ± 1.66	39.52 ± 2.47	P>0.05

Training plan

This test is based on the number of kicks in a specific time limit to assess the level. According to the "stable center of gravity" concept, it should follow the principle of gradual increase and improvement.[4] Athletes practice according to the principle of gradual increase, 15-45 seconds each time, 10-20 times each time, and the interval is 1:2. One of the essential tasks in core stability training is to keep young athletes unsteady and unbalanced. This promotes the full use of the muscle groups in their central body. According to the principle of gradual development from simple to complex and from less to more, this paper divides the learning process of the whole system into three stages: adaptation, stabilization, and improvement.

More than a month of adaptive training. This research aims to let young trainees feel the balance of muscle strength and control of the body, enhance the stability of their movements, and enhance their control and balance of the body.

More than a month of regular training. During this period, the deep muscles in the center can be fully mobilized, and the balance of young athletes in the middle transverse leg can be enhanced.

The training period for the promotion period is more than one month. This session focuses on working out in unstable situations for young athletes, doing less weight training in unstable situations, and strengthening and enhancing the balance and control of their muscle groups.[5] Under normal circumstances, follow the physical exercises formulated by the coaches of the Taekwondo Club, such as dynamic stretching, flexibility, rope ladders, kicking targets, signs, etc.

The mathematical expression of attitude and discussion on solving methods

The posture data of the carrier in any coordinate system can be expressed by the quaternion method, the Euler angle method, and the azimuth cosine method. Quaternion theory is the most important one in quaternion theory.[6] It uses four different components to represent the position of the rigid body in the coordinate system. The quaternion number G can be expressed by the formula (1).

$$G = g_0 + g_1 i + g_2 j + g_3 k \tag{1}$$

(1) Each actual number in the equation represents g_0, g_1, g_2, g_3, respectively. i, j, k all represent an imaginary element vector, which are perpendicular to each other and conform to equation (2).

$$i^2 = j^2 = k^2 = i * j * k = -1 \tag{2}$$

A standard, Equation (3), can express the size of a quaternion value.

$$\|G\| = g_0^2 + g_1^2 + g_2^2 + g_3^2 \tag{3}$$

In this paper, the quaternion number is used to represent the position in the coordinate system, and its physical meaning can be regarded as the signal of rotation if a rigid object is in its starting coordinate system $OX_nY_nZ_n$. The coordinate system $OX_bY_bZ_b$ is obtained after rotating around $\vec{R}$ by a certain angle ∂. On this basis, the angles of roll θ and inclination ψ have not changed. Only the inclination φ has changed.[7] This is due to the rotation of the race around axis X. Quaternion numbers can be expressed by Equation 4.

$${}^{n}_{b}g = [g_0 g_1 g_2 g_3] = \left[\cos\frac{\partial}{2} R_X \sin\frac{\partial}{2} R_Y \sin\frac{\partial}{2} R_Z \sin\frac{\partial}{2}\right] \tag{4}$$

Therefore, the direction cosine R_X, R_Y, R_Z of the vector $\vec{R}$ in Eq. (4) in this coordinate system is used to express respectively.[8] If any two-four elements g and h satisfy $h = [h_0 h_1 h_2 h_3]$, $g = [g_0 g_1 g_2 g_3]$ respectively, three basic mathematical laws of a quaternion can be obtained.

$$h + g = [h_0 + g_0 h_1 + g_1 h_2 + g_2 h_3 + g_3] \tag{5}$$

ETHICAL COMPLIANCE

Research experiments conducted in this article with animals or humans were approved by the Ethical Committee and responsible authorities of School of Physical Education(Mailu Campus)Jiangxi University of Finance and Economics and Jiangxi Open University following all guidelines, regulations, legal, and ethical standards as required for humans or animals.

Mathematical Statistical Analysis

This paper uses SPSS and Excel software to analyze, count, and draw the collected data to obtain relevant research results and conclusions.

RESULTS

The effect of the mid-position horizontal kick on the stability of the body's center of gravity

After an adjustment period of more than one month, the experimental group improved the average horizontal kick frequency both before the test and within 30 seconds after the test. (Table 2) The lateral kicking time between the experimental groups in different adaptation periods was statistically significant within 30 seconds (P<0.05). The frequency of the median lateral leg in the experimental group increased significantly within 30 seconds, while there was no significant difference compared with the control group within 30 seconds (P>0.05).

During the acclimation period, the median number of transverse legs in the experimental group at 30 seconds increased by 30 seconds compared with the control group. (Table 3) The lateral kick time between the experimental and control groups in different periods was not statistically significant within 30 seconds (P<0.05). After more than one month of the center of the gravity stabilization period, the 30-s median frequency of lateral leg movements in the experimental group improved. Still, the difference was insignificant compared with that before the experiment (P>0.05). Therefore, 30-second exercises with a stable center of gravity are not effective in increasing the number of lateral legs.

The effect of stability on the median transverse leg speed

During the stabilization period, subjects significantly increased the frequency of lateral kicks before and within 30 seconds after the test. (Table 4) The number of lateral kicks within 30 seconds was statistically significant during the stability period compared with the control group (P<0.05). In the control group, the frequency of median kicks increased significantly within 30 seconds (P>0.05).[9]

During the stability period, the average number of kicks in the experimental group within 30 seconds was significantly improved compared with the control group. During the stability period, the number of lateral kicks in the experimental and control groups within 30 seconds was statistically significant (P<0.05).

Table 2. Average horizontal kicks before the test and 30 seconds before the test.

Group	Before experiment	After the experiment	P
Test group	39.45 ± 1.66	40.59 ± 1.85	P<0.05
Control group	39.52 ± 2.47	39.71 ± 2.4	P>0.05

Table 3. Horizontal comparison of the number of horizontal kicks between the experimental group and the control group within 30 seconds.

Test indicators	Before experiment	After the experiment	P
30s median cross kick	40.59 ± 1.85	39.71 ± 2.4	P>0.05

Table 4. Average number of horizontal kicks before and 30 seconds after the test.

Group	Before experiment	After the experiment	P
Test group	39.45 ± 1.66	40.85 ± 1.93	P<0.05
Control group	39.52 ± 2.47	40 ± 2.45	P>0.05

The role of the median lateral leg movement in core stability training

The frequency of lateral kicks in the experimental group increased significantly 30 seconds after the test. (Table 5) During the boosting period, the number of horizontal kicks within 30 seconds of the experimenters was statistically significant compared with the control group (P<0.05). The frequency of median kicks in the experimental group increased significantly within 30 seconds, while there was no significant difference in the number of lateral kicks between the two groups within 30 seconds of the increase period (P>0.05).

During the improvement period, the average level of kicks in both the experimental group and the control group for 30 s was significantly improved. (Table 6) (P<0.05).

Table 5. Increased frequency of lateral kicks between test groups within 30 seconds before and after the test.

Group	Before experiment	After the experiment	P
Test group	39.45 ± 1.66	41.54 ± 1.75	P<0.05
Control group	39.52 ± 2.47	40.15 ± 2.18	P>0.05

Table 6. Level comparison between experimental and control groups in 30 seconds.

Test indicators	Before experiment	After the experiment	P
30s median cross kick	41.54 ± 1.75	40.15 ± 2.18	P<0.05

DISCUSSION

Solid support is critical for taekwondo players. Because it allows players to quickly adapt to the needs of the action, at the same time, a substantial body center of gravity can effectively control the body's acceleration, deceleration, and stability to enhance the body's balance and reduce sports injuries. (1) Strengthen the stability of the central area. It stabilizes the center of gravity and maintains balance. It plays an essential role in the coordination and coordination of the upper and lower legs. Athletes need to mobilize the core muscles in advance so that the center of gravity of the body is fully prepared to support the strength of the limbs. (2) Exercise the muscles to reduce the exercise's energy consumption and enhance the exercise's balance. In daily physical training, we also noticed that many coaches only emphasize the exercise of large muscle groups while ignoring small muscles, not only in taekwondo. One of the most critical aspects of core strength training is to get many muscles working together during the exercise.[10] And this is also to mobilize more muscles to complete this action. For example, shoulder pain will occur after a shoulder injury, and heavier upper body training is unsuitable for the body. (3) Core strength training has an excellent preventive effect on joint and muscle damage. The steady development of the core position of the body can promote the balanced development of muscle strength. This can reduce the body's ability to adapt to unique movements caused by particular long-term exercise. For example, the tension and tension of the shoulder and shoulder muscles are unbalanced due to long strokes. This leads to joint instability or dislocation of the joint, which leads to joint damage. In addition, pain can also cause the muscles to lose strength and thus reduce strength. It is impossible to eliminate the pain fundamentally if only relying on medical methods to treat it. Athletes can only take a comprehensive approach to prevention and prevention from multiple aspects.

CONCLUSION

The results showed that the center stabilization exercise significantly promoted the speed of the middle lateral leg of the young taekwondo

athletes. After three months of constant and stable center-of-gravity stunt practice, the median number of 30-second lateral leg movements in the experimental and control groups increased significantly. The experimental group showed significant improvement, and there was no significant improvement difference between the three stages in the control group. The results show that center of gravity stabilization exercises can effectively improve the athlete's median lateral leg movement.

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS: Each author made significant individual contributions to this manuscript. Shupeng Xiao: writing and data analysis; Jie He: article review and revising the article..

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