MUSCLE STRENGTH TRAINING IN THE ABDOMINAL CORE IN ATHLETES

TREINAMENTO DE FORÇA MUSCULAR NO CENTRO ABDOMINAL EM ATLETAS

ENTRENAMIENTO DE LA FUERZA MUSCULAR EN EL NÚCLEO ABDOMINAL EN ATLETAS

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ABSTRACT

Introduction: Gymnastics requires high-level body coordination and control. The key to success for gymnasts is to control and adjust the center of gravity through the abdominal core muscles. Abdominal core resistance training is mainly aimed at fulfilling this purpose. Objective: Analyze the results of abdominal core resistance training on the fitness of gymnasts. Methods: 20 volunteer gymnasts were selected by random sampling. The experimental participants were tested for functional exercise capacity. The study focused on the athletes' weaknesses during exercise. After completing the abdominal core resistance training, the fitness test was performed. The data obtained were analyzed statistically. Results: The peaks of the flexor and dorsal muscles were significantly enhanced (P<0.05). There was no significant difference between the two groups before and after training of body flexors and extensors (P>0.05). Conclusion: Abdominal core resistance training plays a positive role in improving the fitness of gymnasts. Coaches can actively introduce abdominal core resistance training into their regular exercises to improve athletes' fitness. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: *Abdominal Core; Physical Fitness; Resistance Training; Athletes.*

RESUMO

Introdução: A ginástica exige coordenação e controle corporal de alto nível. A chave para o sucesso dos ginastas é controlar e ajustar o centro de gravidade através dos músculos do centro abdominal. Os exercícios de força do centro abdominal visam principalmente cumprir este propósito. Objetivo: Analisar os resultados do treinamento de força muscular no centro abdominal sobre a aptidão física dos ginastas. Métodos: 20 ginastas voluntários foram selecionados por amostragem aleatória. Os participantes experimentais foram testados quanto à capacidade de exercício funcional. O estudo focalizou os pontos fracos dos atletas durante o exercício. Após a conclusão do exercício de força do centro abdominal, efetuou-se o teste de aptidão física. Os dados obtidos foram analisados por estatisticamente. Resultados: Os picos dos flexores e músculos dorsais foram significativamente aprimorados (P<0,05). Não houve diferença significativa entre os dois grupos antes e depois do treinamento de flexores e extensores corporais (P>0,05). Conclusão: O exercício da força do centro abdominal tem um papel positivo na melhoria da aptidão física dos ginastas. Os treinadores podem introduzir ativamente o treino de força do centro abdominal nos exercícios habituais para melhorar a aptidão física dos atletas. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Centro Abdominal; Aptidão Física; Treinamento de Força; Atletas.*

RESUMEN

Introducción: La gimnasia requiere un alto nivel de coordinación y control corporal. La clave del éxito para los gimnastas es controlar y ajustar el centro de gravedad mediante los músculos del núcleo abdominal. Los ejercicios de fuerza del núcleo abdominal están dirigidos principalmente a cumplir este propósito. Objetivo: Analizar los resultados del entrenamiento de la fuerza muscular del núcleo abdominal en la aptitud física de los gimnastas. Métodos: Se seleccionaron 20 gimnastas voluntarias por muestreo aleatorio. Los participantes en el experimento fueron sometidos a pruebas de capacidad de ejercicio funcional. El estudio se centró en los puntos débiles de los atletas durante el ejercicio. Después de completar el ejercicio de fuerza del núcleo abdominal, se realizó una prueba de aptitud física. Los datos obtenidos se analizaron estadísticamente. Resultados: Los picos de los músculos flexores y dorsales aumentaron significativamente (P<0,05). No hubo diferencias significativas entre los dos grupos antes y después del entrenamiento de los flexores y extensores del cuerpo (P>0,05). Conclusión: El ejercicio de fuerza del núcleo abdominal tiene un papel positivo en la mejora de la condición física de los gimnastas. Los entrenadores pueden introducir activamente el entrenamiento de la fuerza del núcleo abdominal en los ejercicios habituales para mejorar la forma física de los deportistas. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Núcleo Abdominal; Aptitud Física; Entrenamiento de Fuerza; Atletas.*

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INTRODUCTION

Gymnasts' movement standards in competitions aren't just for the final score. In complete gymnastics set, if the movements are not standardized enough, it is likely to cause strains and sprains in athletes. It is imperative to improve the movement optimization of gymnasts. The exercise of core strength plays a crucial role in improving the movement quality of athletes. Gymnastics has developed rapidly in recent years. The technical requirements for athletes' movements are also increasing.

For this reason, many scholars at home and abroad are working hard to formulate a more scientific gymnastics training program to improve the gymnast's competitive level. The theoretical research on physical fitness training of gymnasts in China has begun. Domestic scholars have discussed the effective methods and the relationship with motor function.[1] This provides a valuable reference for us to better understand the physical training of elite athletes. However, the current domestic sports training mainly focuses on the importance of sports training, the methods, and means of improving personal physical fitness. It lacks a comprehensive inspection of the sports quality of athletes. Chinese gymnastics has performed outstandingly in world competitions in recent years. Athletes have accumulated a lot of training experience in training practice. Therefore, based on interviews and investigations, the author summarizes and summarizes the physical training methods of the current outstanding domestic gymnasts. The results of this paper have a particular reference value for gymnasts' training in China.

METHOD

Research objects

This paper focuses on the impact of core strength training on physical fitness with gymnasts as the research object.[2] The research results of this paper have particular guiding significance for scientific and rational physical exercise in the future. Twenty people from a university sports team were selected as the experimental objects in the actual research. (Table 1)

Table 1. Basic profile of students majoring in physical education in a university.

n	Height/(cm)	Weight/(kg)	Training years
20	167.81 ± 7.31	66.46 ± 10.13	3.81 ± 0.51
Female	10	155.25 ± 6.79	

These subject conducts comprehensive and in-depth research on the related books and literature on exercise physiology and sports training based on the literature data. At the same time, this paper analyzes and summarizes the research results of gymnastics training at home and abroad. (2) Expert investigation and interview. This article inspected sports teams' training plans and implementation process in various colleges and universities and conducted interviews with instructors and backbone strength training experts. This paper conducted a functional athletic ability test on a university gymnast.[3] At the same time, this paper focuses on analyzing the weaknesses of athletes in the process of exercise. This is the basis for evaluating the training effect on athletes.

Training and inspection methods

After the FMS score and core ability assessment, a university gymnastics team adopted a systematic and targeted training plan. There are six aspects of balance disc single-leg squat, side bridge support, or balancer squat.[4] Athletes also perform conventional equipment resistance training or vibration training. From August 2020 to November 2020, athletes maintained six times a day, with a frequency of 2 hours each. In this paper, Isomed2000 isokinetic strength test system and Previse vibration test bench system are used to test the physical strength of college gymnasts. Athletes must be able to withstand flexion and ankle and knee stretch. This paper adopts the Isomeday2000 ankle, knee, and joint test program.

A sampling of blurred images in motion

Firstly, this paper establishes a feature sampling model for motion-blurred images. Its goal is to restore blurred images according to the texture characteristics in motion. This paper combines feature correlation detection and template matching to enhance gymnastics motion-blurred images.[5] At this time, a training data set is constructed for pixel reconstruction of motion-blurred images;

$$Y_m = \frac{[f(z)+g_l(z)][f(z)-g_l(z)]}{2\sqrt[2]{\mu}} \quad (1)$$

μ represents the multi-dimensional pixel feature quantity distribution parameter of the motion-blurred image. $f(z)$, $G_1(z)$ represents the corresponding relationship between the gymnastic motion-blurred image and the target image and the average filter function, respectively.[6] This paper establishes a motion-blurred imaging model based on gray-scale pixels by identifying the motion-blurred images.

$$P(v(x,y)) = \begin{cases} \frac{m+1}{3}, v(x,y)\ \mathrm{p}\ 0 \\ 1-\frac{m+1}{3}, v(x,y)=0 \\ \frac{m+1}{3}, v(x,y)\ \mathrm{f}\ 0 \end{cases} \quad (2)$$

m is the characteristic component of the motion-blurred image. The algorithm uses subspace segmentation technology to filter the gymnastics motion blurred image. It combines the point matching method to obtain the feature points of the motion-blurred image with its pixels.[7] This paper obtains the corresponding motion-blurred images through multi-scale decomposition.

$$W = \omega^* x + \sigma \quad (3)$$

In the equation W represents the target image of gymnastics. ω represents the blur core of the moving object. σ represents a blurred image of a moving object. * stands for convolution operation. This paper establishes the initial cluster centers of the average clustering.[8] This paper uses the background correction algorithm to reconstruct the grayscale of gymnastics motion-blurred images. It is assumed that the gray point of the gymnastic motion-blurred image is the gray point (i, j). This paper uses this point as the centroid to segment and extract the motion-blurred image and obtain the secondary saliency map. The final result is as follows:

$$O_m = \frac{K}{N} \times \sqrt{(D-E)^2 + W^2} \quad (4)$$

In the formula N indicates that the combined total data parameter is expressed. D represents the data type information divided for the structure. E represents the image content information for the comprehensive research data. In this paper, texture feature reconstruction is used to decompose the output pixel features into:

$$F(z) = \frac{1}{\sqrt[2]{\mu}} \Sigma_m O_m \quad (5)$$

μ represents the adaptive threshold representing the average filtering of the image. In this paper, the corner points in the motion-blurred image are marked, and the feature quantities of the critical parts are extracted from the image.[9] This enhances the recognition ability of motion-blurred images.

Statistical analysis

SPSS 13.0 statistical software was used for all statistical analyses of data in this paper. This paper uses the mean ± standard deviation method to express the data.

ETHICAL COMPLIANCE

Research experiments conducted in this article with animals or humans were approved by the Ethical Committee and responsible authorities of Inner Mongolia Minzu University,Inner Mongolia TongLiao Expermental Middle School following all guidelines, regulations, legal, and ethical standards as required for humans or animals.

RESULTS

Comparative study of isokinetic muscle strength of low back muscles

In this paper, through the routine physical fitness test of gymnasts, it was found that the peaks of flexors and dorsal muscles were significantly increased ($P<0.05$) but had no significant effect on flexor strength ($P>0.05$). (Table 2)

Comparative study of isokinetic muscle strength at 60°/s

The knee joint ability of gymnasts before and after core strength training was not significantly changed ($P>0.05$), which was mainly manifested in the H/Q of the anterior and posterior knee joints and the peak torque of the flexor and extensor muscles at 60°/s of the knee joint ($P>0.05$). (Table 3)

Comparison of ankle isokinetic muscle strength at 60°/s

Gymnasts showed an evident trend of improvement in ankle strength after core strength exercise, among which the changes in the left ankle, back, and flexor muscles were the most significant ($P<0.05$), and the rest had no statistical significance. (Table 4)

DISCUSSION

Core strength training is a complete scientific system. It is divided into competitive physical strength, health care physical strength, and recovery physical strength. In daily life, the human body's adaptability to exercise and the performance of the overall quality is significant.[10] According to specific associations, it can be subdivided into functional core power training, professional core strength training, and essential core strength training. Professional training refers to the professional performance of the athlete as a standard. No matter what method is used, the ultimate goal of core strength training is to improve physical fitness. The training of core strength should adhere to the time of fitness and fitness and ensure the scientific, flexibility, speed, and flexibility of the training method. Ensuring balanced body development also develops muscle control, balance, and reflexes. The influence of various factors on bodybuilding should be considered comprehensively in the training process. This article can be considered from a single perspective. We choose combined strength exercises according to bodybuilding and muscle contraction characteristics. We need to combine the different training methods of isometric, isotonic, and concession exercises. For example, 75% of isotonic exercises and 25% of back exercises in gymnastics can be used to develop the body's core strength.

Bodybuilding strength training includes both aerobic and anaerobic. General training is the use of anaerobic training. The strength of the body's glycolytic system during exercise will directly affect the body's exercise function. Strength training can further improve muscle tolerance.[11] This allows people to adapt to better resilience under the same pressure and reduce injuries caused by exercise and training. When doing strength training, people can realize that they can complete the tasks that they could not complete before to improve their self-confidence.

When choosing sports training, you should also practice according to your joint movement and muscle strength skills. Upper limb muscle exercise mainly includes upper arm tendon energy, forearm tendon energy, limb shoulder girdle tendon energy, abdominal muscle ability, pelvic girdle tendon, thigh muscle group energy, and calf muscle group muscle energy. Athletes should use isometric and isotonic methods when developing bodybuilding abilities. This will speed up the strength of the body and thus increase the effectiveness of

Table 2. Comparison of changes in isokinetic muscle strength of low back muscles.

Training time	Back muscle peak torque PT/(%)	Maximum extensor torque PT/(%)	Maximum torque rate of flexors and extensors/(%)
Before training	130.97 ± 22.09	190.1 ± 37.41	63.61 ± 11.22
After training	150.47 ± 19.39	217.49 ± 45.41	62.87 ± 10.16

Table 3. Comparison of isokinetic muscle strength of the knee joint at 60°/s.

Training time	Before training	After training
left knee anterior flexor	111.8 ± 17.21	108.8 ± 16.34
Right knee extensor	179.45 ± 43.31	176.76 ± 45.25
left knee flexor tendon	105.85 ± 19.31	110.18 ± 18.17
Bend your right leg	172.93 ± 54.76	172.86 ± 49.62
The ratio of maximum torque in left knee flexion and flexion	57.11 ± 11.48	60.62 ± 12.08
The ratio of maximum torque to flexion and extension of the right knee	54.05 ± 14.9	59.11 ± 17.59

Table 4. Comparison of 60°/s Ankle Isokinetic Muscle Strength.

Training time	left ankle flexor tendon	left ankle plantar flexion	Left ankle dorsiflexion heel flexor peak torque ratio
Before training	30.5 ± 6.2	104.72 ± 19.77	26.43 ± 5.65
After training	27.32 ± 6.32	103.22 ± 22.11	24.62 ± 7.12

the exercise. Athletes can train by exercising different tendon targets such as upper shoulder girdle muscles, upper arm tendons, waist and abdominal muscles, and back tendons. At the same time, the athlete should also pay attention to the tendon's maximum strength and contraction mode to ensure better strength training. At the same time, when doing physical strength training, you should also pay attention to your health and your body's resistance to stress. Generally, high-load, high-endurance sports can be put at the end to ensure the safety of training and the operator's strength.

CONCLUSION

The flexor peaks and dorsal peaks of gymnasts increased significantly after core strength training ($P<0.05$), and there was no significant change in the isokinetic muscle strength of the knee joint at 60°/s ($p>0.05$), but at 60° In terms of isokinetic muscle strength of /s, left ankle dorsiflexor ($P<0.05$), the rest had no statistical significance ($P<0.05$).

The authors declare that they have no competing interests.

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