

# RESEARCH ON THE MAIN METHODS OF CORE STRENGTH TRAINING IN SPINTERS



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PESQUISA SOBRE OS PRINCIPAIS MÉTODOS DE TREINO DE FORÇA DO CORE EM VELOCISTAS

INVESTIGACIÓN SOBRE LOS PRINCIPALES MÉTODOS DE ENTRENAMIENTO DE FUERZA DEL CORE EN VELOCISTAS

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## ABSTRACT

**Introduction:** With the development of increasingly competitive sports, coaches began experimenting with new methods for training athletes. Although among the most explored training methods is core strength training, a set of muscle groups that stabilize the trunk and hips, there are few studies on the effectiveness of this training dedicated to sprinters. **Objective:** This paper investigates the training method of sprinters based on core strength training, studying the method and its influence on athletes' performance. **Methods:** Sixteen athletes with similar technical levels and physical fitness were selected, and professional coaches were invited to test the training samples. The athletes were randomly assigned to the experimental and control group (8 in each). The experimental group received core strength training for eight weeks, while the control group received general training. **Results:** Off-core training affected the ankle joint angle of the support leg and the ankle joint angle of the swing leg ( $P < 0.01$ ). After eight weeks of training, the performance of both groups improved without considerable differences. The high jump results of the athletes in the experimental group also improved compared to the previous training. **Conclusion:** The physical function of athletes can be improved through core strength training to improve the sprinters' competitive level and technical ability. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** Athletes; Physical Fitness; Strength Training.

## RESUMO

**Introdução:** Com o desenvolvimento de esportes cada vez mais competitivos, os treinadores começaram a experimentar novos métodos para a formação de atletas. Embora entre os métodos de treinamento mais explorados encontra-se o treino do core, conjunto de grupos musculares estabilizadores do tronco e quadril, há poucos estudos sobre a efetividade desse treino dedicado a atletas velocistas. **Objetivo:** Este artigo investiga o método de treino de velocistas baseado no treinamento de força do core, estudando o método e a influência no desempenho do atleta. **Métodos:** Foram selecionados 16 atletas com nível técnico e aptidão física similares, treinadores profissionais foram convidados a testar as amostras de treino. Os atletas foram aleatoriamente designados para o grupo experimental e controle (8 em cada). O grupo experimental recebeu treinamento de força do core por 8 semanas, enquanto o grupo controle recebeu treinamento geral. **Resultados:** O treinamento de fora do core teve um efeito no ângulo da articulação do tornozelo da perna de apoio e no ângulo da articulação do tornozelo da perna de balanço ( $P < 0,01$ ). Após oito semanas de treinamento, o desempenho de ambos grupos melhoraram sem diferenças consideráveis. Os resultados do salto em altura dos atletas do grupo experimental também melhoraram em relação ao treinamento anterior. **Conclusão:** A função física dos atletas pode ser aprimorada através do treinamento de força do core, de modo a melhorar ainda mais o nível competitivo e a capacidade técnica dos velocistas. **Nível de evidência II; Estudos terapêuticos - investigação dos desfechos do tratamento.**

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

## RESUMEN

**Introducción:** Con el desarrollo de deportes cada vez más competitivos, los entrenadores comenzaron a experimentar nuevos métodos para el entrenamiento de los atletas. Aunque entre los métodos de entrenamiento más explorados se encuentra el entrenamiento del core, un conjunto de grupos musculares que estabilizan el tronco y las caderas, hay pocos estudios sobre la eficacia de este entrenamiento dedicado a los atletas velocistas. **Objetivo:** Este artículo investiga el método de entrenamiento de los velocistas basado en el entrenamiento de la fuerza del core, estudiando el método y la influencia en el rendimiento del atleta. **Métodos:** Se seleccionaron dieciséis atletas con un nivel técnico y una aptitud física similares, y se invitó a entrenadores profesionales a probar las muestras de entrenamiento. Los atletas fueron asignados aleatoriamente al grupo experimental y al de control (8 en cada uno). El grupo experimental recibió un entrenamiento del core durante 8 semanas, mientras que el grupo de control recibió un entrenamiento general. **Resultados:** El entrenamiento fuera del core tuvo un efecto sobre el ángulo de la articulación del tobillo de la pierna de apoyo y el ángulo de la articulación del tobillo de la pierna de impulso ( $P < 0,01$ ). Tras ocho semanas de entrenamiento, el rendimiento de ambos grupos mejoró sin diferencias considerables. Los resultados del



salto de altura de los atletas del grupo experimental también mejoraron en relación con el entrenamiento anterior. **Conclusión:** La función física de los atletas velocistas puede mejorarse mediante el entrenamiento del core, con el fin de mejorar aún más su nivel competitivo y su capacidad técnica. **Nivel de evidencia II; Estudios terapéuticos: investigación de los resultados del tratamiento.**

**Descriptor:** Atletas; Aptitud Física; Entrenamiento de Fuerza.

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## INTRODUCTION

Core strength training is a more scientific and advanced training method in the world. It has a good effect on improving the muscle strength of athletes' basic parts.<sup>1</sup> In China, core strength training is applied to the national team (tennis, track and field, badminton, table tennis, volleyball) and other projects, and has achieved good results in the Olympic Games. Core strength training was introduced into China from abroad. The core strength training method has been adopted by foreign high-level sports teams and achieved good results, but it has just started in China. Continuous and in-depth research is needed to provide data support for the development of domestic sports.<sup>2</sup> For a long time, in China, sprint training methods mainly focus on the strength of limb muscles, mainly with the help of barbells and other equipment for armed practice, which leads to the failure of effective breakthrough in competition results, and athletes are often injured. Traditional strength training, especially for deep core muscles, is unscientific, unsystematic and not in-depth.<sup>3</sup>

With the improvement of athletes' sports level, more and more coaches find that any type of competition can not be completed only by the simple actions of some joints, but requires the complete coordination of multiple joints of the whole body to form systematic actions.<sup>4</sup> At the beginning of this century, European and American sports scientists introduced the trunk muscle rehabilitation training method into competitive sports training and put forward two concepts: core stability and core strength. Nowadays, core strength training has been more widely used in the competitive training of some competition events, and achieved good results.<sup>5</sup> By studying the impact of core strength training on Sprinters, this study paves the way for core strength training methods to enter schools and basic training teams.

## METHOD

The subjects of this project are 16 high-level sprinters from a university sports team. In the grouping of the experimental group and the control group, in order to ensure the accuracy of the experiment and the randomness of the sample as much as possible, 20 active sprinters were selected from the participating school team of a sports college. The study and all the participants were reviewed and approved by Ethics Committee of Dong-A University (NO.2018DAUNS005). In order to ensure the fairness of the grouping of the control group and the experimental group, there was almost no difference in the physical health status between the two groups. Invite professional coaches to test the samples, and refer to the results of daily training and large-scale competitions.

Select 16 athletes with the closest technical level and physical quality for the test, and randomly assign them to the experimental group and the control group according to different test conditions. Among them, 8 people in the experimental group and 8 people in the control group were tested to eliminate the sample differences to the greatest extent.

Experimental content: during the first to second weeks of core strength training, the experimental group mainly carried out some supporting static actions on the sponge pad to improve the strength quality of small muscle groups in the waist and abdomen, and preliminarily develop the control power, that is, the ability of the nervous system to control muscles, so as to prepare for the next stage of core strength training. In week 3-6, Swiss ball and suspension exercises are used for core strength training. Swiss ball and suspension exercises are used to improve difficulty and flexibility, increase movement instability and strengthen body balance and control ability. From week 7 to week 8, the Swiss ball and suspension technique were used in the core strength training to gradually increase the training difficulty, that is, reduce the support foundation, gradually increase the instability, gradually increase the number of dynamic movements and gradually increase the number of repetitions, from one-dimensional movements to multi-dimensional movements, while the control group received routine training. After the experiment, the post-test experiment and related research and analysis were carried out for 16 athletes in the experimental group and the control group.

In the research process, the survey data were collected by Excel and other software for relevant statistics, and spss22.0 was used 0 software was used to analyze the differences in height, age, weight, training years and core strength training data between the two groups.

## RESULTS

### The influence of core strength training on Sprinters' technical movements

According to the different process of sprint, it can be divided into four stages: starting, accelerating after starting, running on the way and sprinting. This paper mainly studies the en route running stage, which includes three angles: the hip joint of the supporting leg at the moment of landing, the knee joint angle of the swinging leg, and the ankle joint angle formed by the lower leg and the foot surface. This section takes the ankle joint as the main research object.

It can be seen from Table 1 that there was no significant difference between the experimental group and the control group before the experiment,  $P > 0.05$ . The core strength training has a great influence

**Table 1.** Kinematic parameters of ankle joint before and after experiment.

Index	Before experiment						After the experiment			
	Experience group		Control group		T	P	Experience group		Control group	
	X	S	X	S			Variation (x±s)	P value	Variation (x±s)	P value
Earth ankle (°)	109.85	6.125	109.84	5.950	.204	.907	0.360±4.56	.901	-0.119±3.98	.465
Earth ankle (°)	130.94	6.478	130.91	6.351	.323	.889	3.272±7.59	.215	-0.103±6.47	.819
Minimum ankle (°)	89.79	4.425	89.80	4.517	.111	.987	4.920±4.30	.009	1.525±5.26	.129
Flexion extension (°)	41.15	5.780	41.16	5.859	.112	.986	-1.297±9.61	.782	-1.138±5.57	.870
Supported average ankle (°)	123.63	4.951	123.61	4.826	.212	.906	3.385±5.57	.024	0.106±7.23	.762

on the ankle angle of the supporting leg and the ankle angle of the swinging leg ( $P < 0.01$ ), indicating that the change before and after the experiment is very significant. Other kinematic parameters are  $p > 0.05$ , indicating that the difference is relatively insignificant. It can be seen that the technical development direction of athletes' ankle joint after training is unfavorable. Among them, the changes of the minimum angle of ankle and the average angle of supporting leg ankle are very obvious. Through the experiment, the minimum angle of supporting leg ankle and the average angle of ankle increase. Therefore, in the support stage, this support state has been significantly improved, which is mainly due to the difference between core strength training and conventional strength training, which will directly affect the ankle. In order to overcome the resistance of horizontal component, the body will strengthen ankle training, so the kinematic parameters of ankle have been greatly improved in this process.

### Comparison of basic sports performance between control group and experimental group before and after training

It can be seen from Table 2 that the average score of athletes before training is 266cm and 277cm after training. The long jump performance of the athletes in the experimental group is one index higher than that before training, and the maximum increase range is 15cm. After software calculation,  $P < 0.05$  shows that there are significant differences between the two groups of data, indicating that core strength training has a significant impact on Athletes' long jump performance.

It can be seen from Table 3 that the average score before training is 266cm and 269cm after training. The standing long jump performance of the athletes in the control group is also improved compared with that before training, but the improvement is only 6cm at most. The standing long jump performance before and after training is calculated by spss16 0 software after paired sample t-test,  $P < 0.05$  shows that there are significant differences between the two groups before and after the data, so no core strength training has no effect on the standing long jump performance of athletes.

**Table 2.** Comparison of standing long jump results of athletes in the experimental group before and after.

Athlete name	Pre training performance (cm)	Post training performance (cm)	t value	P
Athlete 1	277	277	-5.792	0.001
Athlete 2	260	277		
Athlete 3	257	269		
Athlete 4	280	295		
Athlete 5	274	279		
Athlete 6	256	277		
Athlete 7	255	260		
Athlete 8	269	282		
Average value	266	277		

**Table 3.** Comparison of standing long jump performance of athletes in the control group before and after.

Athlete name	Pre training performance (cm)	Post training performance (cm)	t value	P
Athlete 9	281	283	-4.756	0.002
Athlete 10	272	276		
Athlete 11	255	257		
Athlete 12	268	269		
Athlete 13	257	259		
Athlete 14	261	267		
Athlete 15	279	280		
Athlete 16	257	259		
Average value	266	269		

### Comparison of sports performance between control group and experimental group before and after training

In this paper, 16 sprinters were selected and tested more accurately. The athletes' 100m performance and standing long jump were tested before and after the experiment. The experimental data are shown in Table 4.

It can be seen from Table 4 that the performance of athletes who have undergone eight weeks of core strength training has been effectively improved to a certain extent. The average score before training was 11.79 seconds, after training was 11.64 seconds, and the highest progress value was 0.3 seconds. The decrease of athlete No. 7's score was probably due to his injury. He had a slight thigh muscle strain in another exercise before the test. The first and second 100 meter scores were performed with spss16 0 paired test,  $P < 0.05$ , so it is considered that there are significant differences between the two groups of data, indicating that there are significant differences before and after training, which indicates that core strength training has an impact on the performance of sprinters and can improve their performance.

It can be seen from Table 5 that the performance of athletes in the control group has improved after 8 weeks of normal training. The average performance before training was 11.71 seconds and after training was 11.60 seconds. However, the improvement range is not very large, and there are still athletes with declining performance, which is also related to the physical condition of athletes. The time period of the test also has a specific impact. For example, winter will reduce the test results. Adopt spss16 0 paired t-sample test was conducted for the first and second 100m tests,  $P > 0.05$ , indicating that there was no significant difference between the two groups, indicating that the difference without core strength training was not significant.

### DISCUSSION

As we all know, sprint is a form of high-intensity competitive competition. In this process, sports injuries often occur due to athletes' improper force or non-standard technical actions. And such sports injuries often

**Table 4.** Comparison of results of athletes in the experimental group before and after 100m training.

Athlete number	100 meters before training	100 scores after training	t value	P
Athlete 1	11.69	11.39	2.418	0.049
Athlete 2	11.92	11.76		
Athlete 3	11.35	11.27		
Athlete 4	11.39	11.13		
Athlete 5	11.70	11.54		
Athlete 6	11.91	11.69		
Athlete 7	12.17	12.42		
Athlete 8	12.14	11.83		
Average value	11.79	11.64		

**Table 5.** Comparison of performance of athletes in the control group before and after 100m training.

Athlete number	100 meters before training	100 meters after training	t value	P
Athlete 9	11.84	11.73	2.341	0.055
Athlete 10	11.75	11.65		
Athlete 11	11.70	11.72		
Athlete 12	11.84	11.64		
Athlete 13	11.47	11.57		
Athlete 14	11.58	11.32		
Athlete 15	11.81	11.68		
Athlete 16	11.64	11.56		
Average value	11.71	11.60		

occur in the knee, ankle and low back, which is located in the center of the trunk. Only when athletes enhance their core strength quality in daily training can they effectively maintain the body balance and physical strength retention in the process of sports, and reasonably control the target muscles and joints during sports, so as to avoid the phenomenon of body imbalance caused by improper force and excessive load. By stimulating core muscle strength, it can effectively link various parts of the body, such as muscle groups, joints, skin, etc., so as to avoid falling. Moreover, training core strength can not only help sprinters improve strength and speed, but also effectively activate deep muscles, so that athletes can maintain the best physical state in the process of sprinting and avoid sports injury.

Only when athletes have good core muscle strength and fully master technical movements can they achieve satisfactory results in the field. In the acceleration stage of sprinters, the core muscle can play a pivotal role, effectively connect the upper and lower limbs and coordinate to distribute energy reasonably. The physical function of athletes can be improved through core strength training, so as to further improve their competitive level and technical ability. By training core muscle strength,

sprinters can effectively enhance their physical coordination ability, strengthen their ability to control energy distribution, and strengthen their technical action performance in the competition.

## CONCLUSION

As a sport with strong competitive spirit and testing athletes' competitive level, sprint has attracted the attention and favor of many athletes all over the world. As a unique training form combined with traditional strength training, core strength training has been widely proved to be conducive to improving athletes' competitive ability. Therefore, for sprinters, core strength training has gradually been paid attention to and selected. Based on the literature and experimental methods, this paper tests the influence of core strength practice on sprinters. The results show that core strength training has a great positive help to sprinters. I hope this article can play an auxiliary role to sprinters.

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

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