SPEED AND STRENGTH TRAINING METHODS IN ATHLETES

MÉTODOS DE TREINAMENTO DE VELOCIDADE E FORÇA EM ATLETAS

MÉTODOS DE ENTRENAMIENTO DE LA VELOCIDAD Y DE LA FUERZA EN LOS ATLETAS

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ABSTRACT

Introduction: In recent years, China has invested in many international athletics events, and sports development, including new training methods. Objective: Explore effective training methods for speed and strength of runners in track and field events. Methods: 20 runners from the national team were randomly selected into an experimental and control group. The 10 runners in the experimental group were trained by a combination of traditional strength training and core strength training. The control group performed traditional training. All of them were subjected to fitness indicators to perform the tests. Results: There were significant differences in the speed quality index of 60 meters, and 100 meters and the strength quality index of standing triple jump, long jump, and half squat; the experiment in the control group evidenced significant differences in the speed quality index of 30 meters, 60 meters, 100 meters, and the strength quality index of standing triple jump and standing long jump; significant differences between the experimental group and the control group were evidenced in the speed quality indexes of 60 meters, 100 meters and in the strength quality indexes of triple jump and standing half squat. Conclusion: The presented protocol can significantly improve the professional athletic ability of the national team runners, especially the indicators of strength and speed. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Field and Track; Abdominal Core; Resistance Training; Physical Fitness.

RESUMO

Introdução: Nos últimos anos, a China investiu em muitos eventos internacionais de atletismo, e o desenvolvimento esportivo, incluindo novos métodos de treinamento. Objetivo: Explorar métodos eficazes de treinamento para velocidade e força dos corredores em eventos de atletismo. Métodos: 20 corredores da equipe nacional foram selecionados aleatoriamente em grupo experimental e controle. Os 10 corredores do grupo experimental foram treinados por uma combinação de treinamento de força tradicional e treinamento de força central do abdome. O grupo de controle efetuou o treinamento tradicional. Todos eles foram submetidos a indicadores de aptidão física para realizar os testes. Resultados: Houve diferenças significativas no índice de qualidade de velocidade de 60 metros, 100 metros e no índice de qualidade de força de salto triplo em pé, salto em comprimento e meio agachamento; o experimento no grupo de controle evidenciou diferenças significativas no índice de qualidade de velocidade de 30 metros, 60 metros, 100 metros e no índice de qualidade de força de salto triplo em pé e salto em comprimento em pé. Diferenças significativas entre o grupo experimental e o grupo de controle foram evidenciadas nos índices de qualidade de velocidade de 60 metros, 100 metros e nos índices de qualidade de resistência de saltos triplos e meio agachamento em pé. Conclusão: O protocolo apresentado pode melhorar significativamente o nível da capacidade atlética profissional dos corredores da equipe nacional, especialmente os indicadores de força e velocidade. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Competições Esportivas de Pista e Campo; Centro Abdominal; Treinamento de Força; Aptidão Física.*

RESUMEN

Introducción: En los últimos años, China ha invertido en muchos eventos internacionales de atletismo y en el desarrollo del deporte, incluyendo nuevos métodos de entrenamiento. Objetivo: Explorar métodos de entrenamiento eficaces para la velocidad y la fuerza de los corredores en las pruebas de atletismo. Métodos: Se seleccionaron aleatoriamente 20 corredores del equipo nacional en el grupo experimental y en el de control. Los 10 corredores del grupo experimental fueron entrenados mediante una combinación de entrenamiento de fuerza tradicional y entrenamiento de fuerza del núcleo. El grupo de control realizó un entrenamiento tradicional. Todos ellos fueron sometidos a indicadores de aptitud para realizar las pruebas. Resultados: Hubo diferencias significativas en el índice de calidad de la velocidad de 60 metros, 100 metros y en el índice de calidad de la fuerza del triple salto de pie, el salto de longitud y la media sentadilla; el experimento en el grupo de control evidenció diferencias significativas en el índice de calidad de la velocidad de 30 metros, 60 metros, 100 metros y en el índice de calidad de la fuerza del triple salto de pie y el salto de longitud de pie. Se evidenciaron diferencias significativas entre el grupo experimental y el grupo de control en los índices de calidad de velocidad de 60 metros, 100 metros y en los índices

de calidad de fuerza de triple salto y media sentadilla de pie. Conclusión: El protocolo presentado puede mejorar significativamente el nivel de capacidad atlética profesional de los corredores del equipo nacional, especialmente los indicadores de fuerza y velocidad. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Competiciones Deportivas de Pista y Campo; Núcleo Abdominal; Entrenamiento de Fuerza; Aptitud Física.*

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INTRODUCTION

With the gradual improvement of my country's sprint training level, the training concept has changed, and many internationally renowned sprinters have emerged, and the sprint movement has developed rapidly. At present, my country's sprint reserve talent rate is low and the number is insufficient, and there is still a certain gap with some sports power houses. In order to speed up the construction of a sports power, improve the quality of my country's sprint reserve talents, and solve the problems existing in the training of my country's sprinters. Sprinting is a typical physical-based speed event. The training content of sprinters is mainly designed around how to improve the speed quality of athletes. Physiologically, the speed quality of the human body is mainly affected by congenital factors. To improve the speed quality, we must rely on the maximum contraction force and the fastest contraction speed of the muscles to improve the speed quality, that is, the rapid strength of the muscles. Young athletes are going through a sensitive period of physical development.[1,2] It is necessary to develop a scientific comprehensive training method for sprinters themselves. When an athlete participates in an individual track and field competition, the balance of the body will directly affect the overall performance and final result of the competition. If an athlete has better balance and physical coordination in both competitions, they are guaranteed to be able to develop better motor skills. The powerful core defense strength of the body not only enhance the battlefield confrontation of the two sides, but also make it easier to accurately grasp the battlefield initiative of this game. In track and field sprinting, different body muscle groups of sprinters often play different important roles in the competition, so that track and field sprinters can adapt more flexibly to various competitions.[3]

RESEARCH OBJECTS AND METHODS

Research objects

The content and methods of speed and strength training for national team sprinters in track and field events were taken as the research object.

Research methods

Documentary method

Retrieve and consult the relevant content about the speed and strength training of sprinters, based on the important data and literature of physiology, training science and physical training, combined with special characteristics to conduct a comprehensive analysis, to explore the speed and strength training content of sprinters in track and field events and method.

Logical analysis

Combined with the relevant data collected, the actual training situation and corresponding changes of the national team sprinters in track and field events were analyzed, and the impact of the competition environment and technical characteristics on speed and strength training was revealed.

Interviewing method

During the training with the team in the track and field, direct interviews are mainly conducted with the coaching team (Chinese physical fitness coaches, hired foreign physical fitness teachers, technical coaches, the medical team (physiotherapists, team doctors, etc.) and international and domestic referees. Obtain relevant information through interviews and exchanges.

Questionnaire survey

Questionnaire distribution and recovery

Drawing on existing research results, screen sprinters' physical fitness indicators, core strength training action indicators, core stability indicators, and core stability test indicators, and formulate interview outlines for relevant experts; issue questionnaires to experts, and the questionnaires will be distributed on-site until the answer is completed.

Questionnaire reliability and validity test

In order to improve the accuracy of this study, the validity of the questionnaires used in this survey should be evaluated by expert scoring method before the formal investigation. In order to make the questionnaire reliable, a secondary reliability test was used for the questionnaire, that is, two identical questionnaires were distributed to the original seven experts within 15 days, and filled in and received on the spot. The statistical results of the two questionnaires were then compared. Through the analysis of the correlation between the two questionnaire surveys by the expert group, the correlation coefficient is 0.83, which is higher than the standard value of 0.80, indicating that the questionnaire used in this survey is extremely reliable.

The authors state that the research was conducted in accordance with the principles embodied in the Declaration of Helsinki. The authors also state that the participants participated in this study and signed the free and informed consent term (EHIC). The authors confirming that consent was given for publication by all participants.

Design and implementation of experiments

Taking 20 sprinters from the national team as the experimental objects, 10 athletes were randomly selected as the experimental group, and they were trained by a combination of traditional strength training and core strength training. Other athletes were included in the control group and only performed traditional strength training. Twenty sprinters before and after were tested for physical fitness indicators, and the data obtained from the test were sorted and analyzed, and the research conclusion was finally drawn.

Mathematical statistics

Use Excel form to fill in and sort out the indicators tested by the experimental subjects, use SPSS to perform independent sample T-test on the basic conditions of the experimental group and the control group, and perform the relevant sample t-test on the data information of the test indicators before and after the experiment in the experimental group. After the group experiment, the independent sample t-test was carried out to test the experimental index data information, which laid the foundation for the advancement of this research.[3,4]

Experimental subject

20 sprinters from the national team were the subjects (They signed a human rights protection agreement with the subjects and

agreed to conduct the experiment). The 20 experimental subjects will be investigated for their basic conditions, including name, age, years of training, height, weight, exercise level, and 100-meter timed running results.

Experimental grouping

This study adopts the method of random sampling, divides 20 subjects into groups, randomly selects 10 athletes as the experimental group, and the rest of the students as members of the control group, and collects the basic information of the members of the two groups, such as age, height, weight, average training years, average athletic performance.

Experimental period

From September 5, 2021 to December 20, 2021, there are 14 weeks in total. The previous month is the preparatory experiment phase. The official training time starts from the fifth week, which is recorded as the first week in the training plan. Four training sessions were performed, each session lasting 30 minutes.

Experimental location

Capital Gymnasium Track and Field.

Determination of experimental equipment

The experimental equipment includes a sponge pad, a Swiss ball, a stopwatch, a suspension, and a tape measure.

The maximum weight of the Swiss ball in the intact state is about 200 kg. According to the differences in individual factors of the trainees, a variety of diameter balls are selected, and the diameter and length are controlled within the range of 60 cm to 100 cm. Diameter length is inversely proportional.

The training time is from September 5, 2021 to December 20, 2021, a total of 14 weeks. The first 4 weeks are preparatory experiments, training 4 times a week, and the last 10 weeks are the formal training time, which are in the preparation part of the sprint training class, each training time is 30 minutes**.** A month-long preparatory experiment was added to the sprinters before the formal training program was implemented to ensure the effectiveness of the experimental intervention and the subsequent adjustment of the exercise intensity load.

Formal experiment

Basic information of experimental subjects

The average age of the sprinters in the experimental group was 20.1±0.87, the average training years (years) was 7.7±0.67, the average height (cm) was 175.2±2.67, the average weight (kg) was 66.1±1.78, and the average 100-meter sports performance (m/s) was 12.285 ±0.14. The average age of the sprinters in the control group was 19.4±0.52, the average training years (years) was 6.2±0.55, the average height (cm) was 178.5±1.85, the average weight (kg) was 66.51±1.72, and the average 100-meter sports performance (m/s) was 12.32±0.71. For the above indicators, an independent T test was performed on the athletes of the two groups, and the test results were higher than the standard value of 0.05. Based on this, it can be seen that there is no significant difference in height, weight, age and 100 m performance between the two groups of athletes, which ensures the reliability and scientificity of the results of this study.[4,5]

3.6.3.2 Screening and determination of physical fitness indexes of sprinters

By referring to the classification of physical fitness of sprinters and the relevant literature data of physical fitness indicators of sprinters, the index system was initially constructed, and then a questionnaire was compiled for expert evaluation.

The results of the speed quality indicators of sprinters show that among the six speed quality indicators, the 100-meter timed run has the highest score by experts, and the lowest score is the 300-meter timed run (Table 1). In this study, the three indicators with the highest scores were selected, namely, 100-meter timed run, the 30-meter timed run, and the 60-meter timed run are used as the speed quality test indicators for sprinters.

The results of the strength and quality indicators of sprinters show that the standing triple jump has the highest score by experts, and the hanging leg raise has the lowest score. This study selected the three indexes with the highest scores, namely, the standing triple jump, standing long jump, and Barbell squat as a test indicator of sprinters' strength quality (Table 2)

RESULTS

Test results of speed quality of sprinters before and after the experiment

It can be seen from Table 3 that after 10 weeks of core strength training + traditional strength training in the experimental group, the three selected indicators reflecting the speed quality of sprinters were compared before and after, and the time used for the speed quality index 30-meter run was 3.82 before the experiment. Reduced to 3.72, a decrease of 0.10, through the paired sample T test, P>0.05, indicating that although the performance of this indicator has improved, there is no significant difference; The time spent in the 60-meter running of the speed quality index decreased from 7.36 before the experiment to 7.11, a decrease of 0.25, through the paired sample T test, P<0.05. The T test was carried out, and the result P was less than 0.05. It was concluded that the experimental group achieved the index score of 60 meters and 100 meters presents a statistically significant difference.[6,7]

Table 1. Results of speed quality indicator.

Serial number	Speed quality indicator action name	Total value	Sort
1	30m timed run	30	2
2	60m timed run	23	3
3	10 high leg raises timed	15	4
4	60m downhill run	13	5
5	300m timed run	9	6
6	100m timed run	33	1

Table 2. Results of strength quality indicators.

Serial number	Strength quality indicator action name	Total value	Sort
1	Standing long jump	31	2
2	Standing triple jump	32	1
3	Barbell squat	26	3
4	Barbell full squat	23	4
5	Standing reach	15	5
6	Hanging leg raise	9	6

Table 3. Speed quality comparative analysis statistics table (N=10).

		30 m (s)	60 m (s)	100 m (s)
Experimental group	Before the experiment	3.82±0.05	7.36±0.02	12.28±0.14
	After the experiment	3.72±0.04	7.11±9.03	11.99±0.14
	T	7.603	22.681	12.341
	P	>0.05	<0.05	<0.05
Control group	Before the experiment	3.76±0.02	7.34±0.01	12.20±0.07
	After the experiment	3.67±0.01	7.19±0.02	12.14±0.07
	T	9.546	10.039	14.992
	P	<0.05	<0.05	<0.05

After 10 weeks of traditional strength training in the control group, the data of 3 selected indicators reflecting the speed quality of sprinters were compared before and after. It was found that whether it was 30 meters, 60 meters or 100 meters, P<0.05, indicating that there were statistically significant differences in the performance of the speed quality index 30 meters, 60 meters and 100 meters after the experiment. The results show that after 10 weeks of traditional strength training, it can promote the improvement of the speed quality of sprinters.[8]

Test results of strength and quality of sprinters before and after the experiment

It can be seen from Table 4 that after 10 weeks of core strength training + traditional strength training in the experimental group, T-test was performed before and after the selected three indicators reflecting the strength quality of sprinters. There are obvious differences before and after the experiment. The index data of standing triple jump increased from 7.49 before the experiment to 7.58, the index data of standing long jump increased from 2.43 before the experiment to 2.51, and the index data of half squat increased from 137 before the experiment. When it reaches 144, it means that after 10 weeks of training, it has a great promotion effect on the improvement of sprinters' strength quality.[8,9]

After 10 weeks of traditional strength training in the control group, the three selected indicators reflecting the strength quality of sprinters were compared before and after. T test is carried out, and the obtained result P is less than the standard value of 0.05, indicating that the two indicators in the experimental group have significant differences before and after the experiment, while Half-squatting increased from 136 before the experiment to 142, an increase of 6. Through the paired sample T test, P>0.05, although the performance of the half-squatting index improved, but there was no statistically significant difference.[7,8]

The results of the speed quality test after the experimental intervention in the experimental group and the control group

After 10 weeks of training, the selected 3 indicators that reflect the speed quality of sprinters were compared between the experimental group and the control group. As can be seen in Table 5. The T-test was performed, and the result P was less than the standard value of 0.05, indicating that there was a statistically significant difference in the 100-meter running scores between the two groups.

The results of the strength quality test after the experimental intervention in the experimental group and the control group

After 10 weeks of training, the experimental group reflecting the strength of the sprinters and the control group were compared with the three index data after the experiment. Through the paired sample T test, P<0.05, indicating that the experimental group and the control group are trained after training. There is a statistically significant difference in the half squat index performance. (Table 6)

DISCUSSION

Analysis of the test results of speed quality of sprinters before and after the experiment

After 10 weeks of core strength training + traditional strength training, the experimental group stimulated the muscles in the core area of the sprinter's body and mobilized the relevant muscle groups, especially during core strength exercises, suspension and Swiss ball were used in core training, It is beneficial to stimulate the strength of the deep muscles and strengthen the strength of the deep small muscle groups. Adding unstable factors to core strength exercises has a good impact on the development of large core muscle groups in sprinters. At the same time, core strength training is conducive to sprinters to better stabilize their bodies during running, so that the force can be transmitted to the upper and lower limbs. Even better, and combined with traditional strength training, the sprinter's performance on the quality of speed measure improved significantly. After 10 weeks of traditional strength training in the control group, the sit-ups and sit-ups in the traditional strength training content enhanced the muscle strength of the rectus abdominis, external oblique muscles, and internal oblique muscles, so that sprinters could improve their performance during running.[6,7]

Analysis of the test results of strength and quality of sprinters before and after the experiment

After 10 weeks of combined traditional strength training and core strength training in the experimental group, unstable factors were added to the training process, and Swiss balls and suspension equipment were used to stimulate the increase in the strength of the deep small muscle groups in an unstable state, so that the strength of the deep small muscle groups is increased. Especially the back muscles and abdominal muscles of sprinters, and the improvement of the strength of this core area is reflected in the improvement of standing triple jump performance, and at the same time, it enhances the sprinter's control of body stability during running, and the ability to maintain body balance.[8-10] The effect is better, it can more effectively transmit power to the upper and lower limbs, and improve the performance of the sprinters' strength quality indicators. Combined with traditional strength training, the overall strength level of the athletes can be greatly improved. Coupled with the combination of traditional strength training, the improvement of sprinters' strength quality is even more significant.

Table 4. Strength and quality comparison analysis statistics table (N=10).

		Standing triple jump (m)	Standing long jump (m)	Barbell squat (time)
Experimental group	Before the experiment	7.49±0.023	2.43±0.013	137±1
	After the experiment	7.58±0.024	2.51±0.044	144±1
	T	-31.881	-24.333	-10.104
	P	<0.05	<0.05	<0.05
Control group	Before the experiment	7.53±0.024	2.43±0.018	136±1
	After the experiment	7.58±0.024	2.48±0.017	142±1
	T	-19.243	-18.053	-12.490
	P	<0.05	<0.05	>0.05

Table 5. Speed quality comparative analysis statistics table (N=10).

	30 m (s)	60 m (s)	100 m (s)
Experimental group after the experiment	3.72±0.04	7.11±0.30	11.99±0.14
Control group after the experiment	3.65±0.01	7.19±0.02	12.10±0.07
T	1.233	-1.926	-0.655
P	>0.05	<0.05	<0.05

Table 6. Strength and quality comparison analysis statistics table (N=10).

	Standing triple jump (m)	Standing long jump (m)	Barbell squat (time)
Experimental group after the experiment	7.61±0.02	2.51±0.01	144±1
Control group after the experiment	7.60±0.02	2.48±0.02	142±1
T	0.09	1.140	1.477
P	<0.05	>0.05	<0.05

CONCLUSIONS

In the present work, the core strength training can significantly improve the professional level of sprinters, and various key indicators related to their athletic ability have been improved to different extents, especially the indicators of strength quality and speed quality.

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

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