EFFECTS OF SPRINT INTERVAL TRAINING ON ATHLETES' SPEED

EFEITOS DO TREINAMENTO INTERVALADO DE ARRANQUE SOBRE A VELOCIDADE DOS ATLETAS

EFECTOS DEL ENTRENAMIENTO DE ARRANQUE POR INTERVALOS EN LA VELOCIDAD DE LOS ATLETAS

Original Paper
Artigo Original
Artículo Original

Xinghua Wang[1]
(Physical Education Professional)

1. Sports Department, Changzhou Vocational Institute of Mechatronic Technology, Changzhou, Jiangsu, China..

Correspondence:
Xinghua Wang
Changzhou, Jiangsu, China.
213164.
wangxinghuacz@126.com

ABSTRACT

Introduction: The sprint is a track and field event that combines strength and speed. It has a cyclical nature. Each muscle group involved in the starter completes hundreds of contractions. Maximum strength and the fastest muscle contraction are the best combinations. This is the explosive power of runners. Objective: Analyze the effects of sprint interval training on the speed of track and field athletes. Methods: In a random sampling, 30 college athletes were selected for the investigation. These runners were divided into experimental and control groups. The experimental group adopted the sprint interval training method with tire traction. The control group did not engage in this physical exercise. The speed training load of the athlete was gradually increased during the experimental period, lasting 10 weeks. Competitors performed short-distance tests after the physical training. Results: After ten weeks, the experimental group's performance on 30 meters was significantly improved (P<0.05). There was a statistical increase in acceleration in the 50m start (P<0.01). There was no significant difference between the experimental and control groups in the 30-meter starting speed (P>0.05). The experimental group significantly improved the 50m performance (P<0.05). Conclusion: Sprint interval training is effective in increasing the speed of athletes. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Athletes; Track and Field; Sprint Interval Training.

RESUMO

Introdução: O arranque é um evento de atletismo que combina força e velocidade. Tem um caráter cíclico. Cada grupo muscular envolvido no arranque completa centenas de contrações. A força máxima e a contração mais rápida do músculo são as melhores combinações. Este é o poder explosivo dos corredores. Objetivo: Analisa os efeitos do treinamento intervalado de arranque sobre a velocidade dos atletas corredores. Métodos: Numa amostragem aleatória, foram selecionados 30 atletas universitários para a investigação. Esses corredores foram divididos em grupos experimental e controle. O grupo experimental adotou o método de treinamento físico intervalado de arranque com a tração de pneus. O grupo de controle não se envolveu no exercício físico. A carga de treinamento de velocidade do atleta foi gradualmente aumentada durante o período experimental, com duração de 10 semanas. Os competidores realizaram testes de curta distância após o treinamento físico. Resultados: Após dez semanas, o desempenho do grupo experimental em 30 metros foi significativamente melhorado (P<0,05). Houve aumento estatístico na aceleração dos 50m de início (P<0,01). Não houve diferença significativa entre os grupos experimental e controle na velocidade de partida de 30 metros (P>0,05). O grupo experimental melhorou significativamente o desempenho dos 50 metros (P<0,05). Conclusão: O treinamento intervalado de arranque é efetivo em aumentar a velocidade dos atletas. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Atletas; Atletismo; Treinamento Intervalado de Arranque.*

RESUMEN

Introducción: El arranque es una parte atlética que combina fuerza y velocidad. Tiene un carácter cíclico. Cada grupo muscular implicado en el arranque completa cientos de contracciones. La fuerza máxima y la contracción muscular más rápida son las mejores combinaciones. Esta es la fuerza explosiva de los corredores. Objetivo: Analizar los efectos del entrenamiento por intervalos de sprint en la velocidad de los atletas que corren. Métodos: En un muestreo aleatorio, se seleccionaron 30 atletas universitarios para la investigación. Estos corredores se dividieron en grupos experimentales y de control. El grupo experimental adoptó el método de entrenamiento por intervalos de arranque con tirón de neumáticos. El grupo de control no realizó el ejercicio físico. La carga de entrenamiento de velocidad del atleta se incrementó gradualmente durante el periodo experimental, que duró 10 semanas. Los competidores realizaron pruebas de corta distancia después del entrenamiento físico. Resultados: Después de diez semanas, el rendimiento del grupo experimental en 30 metros mejoró significativamente (P<0,05). Hubo un aumento estadístico de la aceleración en la salida de 50 metros (P<0,01). No hubo diferencias significativas entre los grupos experimental y de control en la velocidad de salida de 30 metros (P>0,05). El grupo experimental mejoró significativamente el rendimiento en los 50 metros (P<0,05). Conclusión: El entrenamiento por intervalos de sprint es eficaz para aumentar la velocidad de los atletas. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Atletas; Atletismo; Entrenamiento por Intervalos de Sprint.*

DOI: http://dx.doi.org/10.1590/1517-8692202329012022_0588 Article received on 30/10/2022 accepted on 11/11/2022

INTRODUCTION

Sprinting in track and field is a competitive game. The physical fitness of the athlete is the most critical. The ability to be fast in sprints has a lot to do with physical fitness. The performance of the sprint depends on the athlete's reaction speed, acceleration, and duration of maximum speed. The three elements can be reasonably blended in different sprint events. During the 400-meter run, the athlete can gradually accelerate according to the physical condition and maintain the fastest speed in the competition.[1] The printing process can be divided into start-up acceleration, half-run, and sprint. Your performance at each stage of a competitive event will affect the event's outcome. Every link in the sprint program can play a huge role. Starting acceleration is when an athlete gradually improves from a stationary state. Athletes must have strong reflexes and explosiveness to obtain better results in the acceleration stage. If the athlete gains the lead in the starting stage, then in the half--course and sprint competitions, better conditions will be created to play their level better. This paper mainly discusses the effect of tire traction running training on the acceleration performance of sprint start. This article analyzes the specific effects of athletes implementing physical training in the acceleration phase. The results of this study provide a reference for athletes with poor acceleration ability to formulate more reasonable training plans.

METHOD

General approach

This study selected 30 outstanding boys from sports colleges as the research object. In this paper, 30 subjects were divided into an experimental group and a control group, with 15 people in each group. (Table 1) In this paper, the sports training method of automobile tire traction is used to train the athletes' physical fitness. The trainees in the experimental group used tires with a diameter of 10 kg and a diameter of 1.2 meters during the speed training.[2] Athletes tie car tires around their waists to perform a 30-meter and 50-meter acceleration run. When running, athletes have to overcome the resistance of the tires to complete speed training to increase the difficulty of training.

Table 1. Athlete Profile.

Group	Test group	Control group
n	15	15
Age	19.12±2.11	19.25±3.25
Height/cm	172.44±3.49	171.35±4.02
Weight/kg	62.55±2.65	63.47±2.22
30m/s	4.88±0.32	4.78±0.41
50m/s	6.82±0.59	6.91±0.63

Test scheme

The trial lasted ten weeks. Except for speed training, other athletes follow a unified training program.[3] The purpose is to ensure that the experimental and control groups' training results are consistent in all aspects. The experimental group was based on the speed of 30 meters and 50 meters, while the control group was accelerated by 30 meters and 50 meters, respectively, without the load. This paper compares the acceleration ability of athletes before and after the experiment.

Simulation of the short-distance Achilles tendon

On this basis, this paper uses the motion state of the Malpighi ball in the static state to calculate the motion parameters of the human body to construct the biomechanical model of the lower limbs.[4] The model contains the geometric parameters of the bones and muscles of all lower limbs and is compared with the physical parameters of the experimental subjects according to a certain proportion. The model consists of the torso, pelvis, tibia, femur, fibula, foot, and other scales. In this process, each body link is regarded as a rigid body, connected by a kinematic chain. This paper adopts linear acceleration, angular velocity, and angular acceleration based on known subjects' height, weight, chain length, and inertia parameters to solve the link system.

$$F_{total} = F_1 + F_2 + F_{weight} = ma \quad (1)$$

$$F_{total} = T_1 + T_2 + F_1 \times d + F_2 \times L \quad (2)$$

a is the acceleration of gravity. F_1 and T_1 are the pressure and torque of the distal joint. F_2 and T_2 refer to the joint forces and moments on the proximal joint. L is the moment arm from F_2 to the center of gravity. d is the moment arm from F_1 to the center of gravity. F_{weight} is gravity. Equation 3 shows that the total external force of a system is equal to the rate of change of the system's momentum. The rate of change of linear and angular velocities can be derived from the motion analysis results.[5] The force value of each muscle as an extension of the inverse kinematics is calculated from the joint torque data. This results from a nonlinear optimization equation done under specific equations and physical constraints.

$$\min \sum_{i=1}^{n} \alpha^2 \quad (3)$$

α is the amount of muscle activity of the exercise. This value calculates the sum of the squares of all muscle activity within the number box. n is the number of all data points. The optimal controller is a nonlinear optimization algorithm of generalized intensive control.[6] In this paper, information such as the active amount of the tendon and the width of the tendon are input into the mechanical model to obtain the strength of the tendon.

ETHICAL COMPLIANCE

Research experiments conducted in this article with animals or humans were approved by the Ethical Committee and responsible authorities of Changzhou Vocational Institute of Mechatronic Technology, following all guidelines, regulations, legal, and ethical standards as required for humans or animals.

RESULTS

The role of improving the speed of movement

After ten weeks of regular speed training, the control group's 30-meter performance increased from 4.356 seconds to 4.329 seconds.[7] The score increased by 0.27 seconds. The magnitude of increase was not significant (P>0.05). The 50-meter sprint improved from 6.129 seconds to 6.057 seconds. The score improved by 0.072 seconds. The increase was not significant (P>0.05). Eight weeks of regular speed training had some, but no significant, effect on developing speed ability. (Table 2)

Table 2. Average scores of the control group before and after the experiment.

Experiment time	30m	60m
Time required before experiment/s	4.356	6.129
Time required after the experiment/s	4.329	6.057
Decrease time/s	0.027	0.072
P	>0.05	>0.05

The 30-meter start time of the test group increased from 4.329 seconds to 4.221 seconds. The improvement range was 0.108 seconds, and the difference was significant (P<0.05). The 50-meter start acceleration increased from 6.102 seconds to 5.895 seconds.[8] The improvement is 0.207 seconds. The 50-meter start acceleration was significantly improved (P<0.01). Athletes use tire resistance training to improve their students' acceleration. Especially during relatively long runs above 50 meters. (Table 3)

Table 3. The learning effect of the experimental group before and after the experiment.

Experiment time	30m	50m
Time required before experiment/s	4.329	6.102
Time required after the experiment/s	4.221	5.895
Decrease time/s	0.108	0.207
P	<0.05	<0.01

The results showed no significant difference between the experimental and the control groups in the improvement of the 30-meter starting speed (P>0.05). The difference in 50-meter sprint speed is divided into 0.135 seconds. The experimental group was significantly improved than the control group (P<0.05). Athletes' use of physical tire training has a significant effect on improving the speed ability of sprinters.[9] In particular, the performance of the 50-meter distance is particularly significant. (Table 4)

Table 4. The scores of each professional skill in the experimental group and the control group before and after the experiment.

Experiment time	30m	50m
Time required before experiment/s	0.108	0.207
Time required after the experiment/s	0.027	0.072
Decrease time/s	0.081	0.135
P	<0.05	<0.05

The effect of tire resistance training on the extraordinary performance of athletes

The effect of tire resistance training on improving rear pedal strength

In the short sprint, the athlete is relatively slow in the acceleration phase after the start. To quickly increase the movement speed to the maximum, the athlete must use the power of the active back kick to push the body's center of gravity forward to obtain more incredible speed. In the short sprint, the rear kick technique is an essential factor in improving the acceleration ability of the short take-off. The wheels will always create a rearward obstruction in the practice of running with wheel traction resistance.[10] This increases the running obstacle for the runners. This exercise is beneficial to the player's rapid back-kick strength in the initial stage. This brings more kinetic energy to the contestants in the acceleration phase and thus makes the contestants' sports performance more prominent.

Tire resistance training contributes to the development of cadence and stride length

Both the experimental and control groups improved the average number of steps in a 50-meter run after receiving tire traction resistance training. The improvement in both groups was not significant. (Table 5) An increase in the number of 50-meter runs indicates an improvement in the athlete's stride length. Because of the short distance of 50 meters, relatively few steps are required.[11] There is no significant difference because the step length that increases the power of the back kick is challenging to show. Within 20 seconds, the high leg-raising running of the experimental group increased by an average of 2.50 times, and the difference was statistically significant (P<0.05). The average score in the control group improved but not significantly. The experimental group's performance was significantly improved compared to the control group. It can be seen that both traction running and regular speed training can promote the development of an athlete's cadence. The training effect of tire traction running is more significant.

Table 5. Comparison of stride length and cadence variation.

Project		Complete 50-meter steps	20 seconds of high leg raise/time
Test group	Before experiment	22.842	58.617
	After the experiment	22.167	60.867
	promote	0.675	2.25
Control group	Before experiment	23.292	58.95
	After the experiment	22.842	59.625
	promote	0.45	0.675
Between-group comparison	Compared	>0.05	<0.05

DISCUSSION

Some scholars believe that building muscle strength makes sprinters faster. However, the existing research data shows that athletes' sports performance has not been significantly improved when their strength, speed, explosive power, and other aspects have been improved. This is a process of development rather than sheer strength. Speed quality has clear regulations regarding training methods, training methods, training content, and training intensity. In the physical training of sprint trainers, the assistance and practice of increasing the speed can improve the athletes' back-push strength and stride frequency so that the athletes' take-off acceleration ability can be better developed. Athletes cannot perform wheel traction resistance running exercises independently but should be combined with other speed and technical training. Athletes combine it with the technical characteristics of sprinting in their training for tire traction resistance running. We need to pay attention to the various physical development of athletes and make appropriate adjustments according to their situation and training level.

CONCLUSION

There was no significant difference in 30-meter start achievement between the experimental and control groups during ten weeks of tire resistance running practice. The 50-meter start performance was significantly improved. Tire drag resistance running training has a significant effect on improving the acceleration ability of athletes. The wheel-driven resistance running can make the player's backpedaling force develop. It can significantly promote the improvement of stride length and stride frequency. In this way, the acceleration ability of the players is further improved, and it is beneficial to improve the exceptional performance. Athletes should pay attention to proper resistance during traction training to prevent excessive resistance from affecting the development of stride frequency. In addition, the athlete should practice with the correct stride length. Athletes should not deliberately slow down their stride to increase their cadence, affecting running technique and rhythm.

The author declares no potential conflict of interest related to this article.

AUTHORS' CONTRIBUTIONS: The author made significant contributions to this manuscript. Xinghua Wang: writing; data analysis; article review and intellectual concept of the article.

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