

# RESISTANCE TRAINING EFFECTS ON FATIGUE IN RUNNERS

EFEITOS DO TREINO DE RESISTÊNCIA SOBRE A FADIGA DOS CORREDORES

EFFECTOS DEL EJERCICIO DE RESISTENCIA EN LA FATIGA DE LOS CORREDORES



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## ABSTRACT

**Introduction:** Start-up belongs to the group of fast combination exercises involving power and speed dominated by the short-term exhaustion of the whole body's power aiming at its displacement at high speed to obtain good results in competition. It is very important to master the technique correctly and to distribute the power reasonably for the acceleration of the start. **Objective:** Explore the effect of aerobic endurance training on speed strength in starts. **Methods:** Taking 16 high-level runners from a university sports team as research objects, 16 athletes were tested according to their test indicators; they were randomly assigned to the experimental group and the control group (8 people each in the experimental group and the control group). **Results:** According to the post-test results of the experiment, the athletic performance of both groups of runners after training was improved, but the improvement in the experimental group was more evident and significant ( $p < 0.05$ ). **Conclusion:** Start-up aerobic endurance training is very useful for improving endurance and speed in runners. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** Sprint Interval Training; Endurance Training; Muscle Strength; Sports.

## RESUMO

**Introdução:** O arranque pertence ao grupo de exercício de combinação rápida envolvendo potência e velocidade dominado pela exaustão a curto prazo da potência de todo o corpo objetivando seu deslocamento em alta velocidade a fim de obter bons resultados na competição. É muito importante dominar a técnica corretamente e distribuir a energia razoavelmente para a aceleração do arranque. **Objetivo:** Explorar o efeito do treinamento de resistência aeróbica sobre a força da velocidade em arranques. **Métodos:** Tomando 16 corredores de alto nível de uma equipe esportiva universitária como objetos de pesquisa, 16 atletas foram testados, de acordo com seus indicadores de teste, eles foram designados aleatoriamente ao grupo experimental e ao grupo de controle (8 pessoas no grupo experimental e 8 no grupo de controle). **Resultados:** De acordo com os resultados do pós-teste do experimento, o desempenho atlético dos dois grupos de corredores após o treinamento foi melhorado, mas a melhoria no grupo experimental foi mais evidente e significativa ( $p < 0,05$ ). **Conclusão:** O treinamento de resistência aeróbica para arranque é muito útil para a melhoria da resistência e velocidade dos atletas corredores. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Treinamento Intervalado de Arranque; Treino Aeróbico; Força Muscular; Esportes.

## RESUMEN

**Introducción:** El arranque pertenece al grupo de ejercicios combinados rápidos de potencia y velocidad dominados por el agotamiento a corto plazo de la potencia de todo el cuerpo con el objetivo de su desplazamiento en alta velocidad para obtener buenos resultados en la competición. Es muy importante dominar la técnica correctamente y distribuir la energía razonablemente para la aceleración de la salida. **Objetivo:** Explorar el efecto del entrenamiento de resistencia aeróbica sobre la fuerza de velocidad en las salidas. **Métodos:** Tomando como objeto de investigación a 16 corredores de alto nivel de un equipo deportivo universitario, se realizaron pruebas a 16 atletas que, según sus indicadores de prueba, fueron asignados aleatoriamente al grupo experimental y al grupo de control (8 personas en el grupo experimental y 8 en el grupo de control). **Resultados:** Según los resultados de la prueba posterior al experimento, el rendimiento atlético de ambos grupos de corredores después del entrenamiento mejoró, pero la mejora en el grupo experimental fue más evidente y significativa ( $p < 0,05$ ). **Conclusión:** El entrenamiento de resistencia aeróbica de arranque es muy útil para mejorar la resistencia y la velocidad de los corredores. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptorios:** Entrenamiento por Intervalos de Sprint; Entrenamiento Aeróbico; Fuerza Muscular; Deportes.



## INTRODUCTION

People's research on training is becoming more and more specialized and meticulous, and the proposal and development of special abilities are becoming more and more important in the increasingly fierce competitive sports.<sup>1,2</sup> The first term "special ability" appeared in Powell C's article "Special Ability and Special Ability of Hammer", the author wrote about the special ability training of the hammer.<sup>3</sup> After that, Mahmoud A and others also mentioned this term in their respective published articles, but they are only a superficial explanation, there is no research on its definition and its composition.<sup>4</sup> The earliest expression of the concept of "special ability" was put forward by Rezaei S in 1999: Special ability refers to the competitive ability an athlete has in a specific special field, and it is the competitive ability that must be possessed to improve the level of special training and the performance of special sports. Therefore, it is a subordinate concept of athletic ability and a part of athletic ability.<sup>5</sup>

In the study, Zarei M et al.'s article in sports scientific research wrote about the performance of sprinters' competitive level, which is mainly reflected in some important indicators of body shape (such as height, weight, etc.), the level of basic physical fitness, as well as the development level of special ability and sports coordination ability suitable for the physiological characteristics of sprinting.<sup>6</sup> Therefore, Campbell E H believes that special ability and special physical fitness are a species, and special ability is a subordinate concept of competitive ability, special physical fitness is the subordinate concept of special ability, the special physical fitness of sprinters refers to the physical fitness that is closely related to sprinting and has an important impact on their performance, including special strength, special speed, special sensitivity and other indicators.<sup>7</sup>

## Experimental subjects and methods

### Mathematical Statistics

In the form of testing the skills of the selected athletes, the changes in each group of athletes before and after the experimental study were compared, with the assistance of SPSS statistical software, the statistics and integration of data information are realized, the author plans to use the SPSS25.0 (cracked version) software package to implement the above work items. The information obtained in the test study was integrated into an Excel table, and the statistical differences in the relevant data of the athletes in the experimental group and the control group were analyzed by univariate analysis, *t* refers to the *T* test, which is mainly used for normally distributed data with small sample size ( $n < 30$ ) and unknown population standard deviation. The smaller the *P* value, the more significant the result.  $P < 0.05$  means the data difference is meaningful;  $P < 0.01$  means the data difference is very significant.<sup>8</sup>

### Logic Analysis

Based on the comparative experimental study of core strength training and traditional strength training in sprinters, using the method of logical analysis, this paper analyzes the correlation between core strength training and the competitive level of sprinters from the three dimensions of special physical fitness, technical movements and special sports performance, and on the basis of logical analysis, a comprehensive discussion and analysis of the quantitative results of the paper are carried out, and relevant suggestions and opinions are put forward for the solution of the problem.<sup>9</sup>

## Experimental method

The subjects of the experiment were 16 high-level sprinters from a sports college team. First, a total of 20 active sprinters from a sports college team were selected for the primary selection. The primary indicators include the 100-meter, 300-meter run, and 50-meter step and jump test. Ask professional coaches to test the samples, and refer

to the results of daily training and large-scale competitions, among them, 16 athletes with the closest level and physique were selected for the test, and randomly assigned to the experimental group and the control group according to their test indicators (8 people in each of the experimental group and the control group), this maximizes the exclusion of sample differences.

## Experimental results

The sample selection is representative to a certain extent, through the study of this sample, it can effectively reflect the reality of the core strength training of sprinters, in this way, scientific conclusions can be drawn, and effective suggestions with universality are put forward.<sup>10</sup> The basic information of athletes is shown in Table 1.

It can be seen from Table 2 that, after statistical analysis of the data of each item, it is concluded that the mean values of 60 meters, 300 meters, 500 meters, standing long jump and 50 meters step jump in the experimental group are 6.8, 36.55, 68.24, 2.71, 18.44, respectively, the mean values of 60m, 300m, 500m, standing long jump, and 50m step jump in the control group were 6.99, 36.67, 68.12, 2.66, and 18.41, respectively, in the experimental group and the control group, on various special physical fitness test indicators before the experiment, there was no significant difference ( $P > 0.05$ ). Can be explained, the differences in the specific indicators of athletes before training are relatively balanced, indicating that this grouping is reasonable, the physical state of the two groups of athletes before the experiment is at the same level, so it can ensure that the specific test data and results are comparable, and follow-up research work can be carried out.<sup>11</sup>

After 20 weeks of training, the two groups of athletes tested the athletes' performance of 60 meters, 300 meters, 500 meters, standing long jump, and 50 meters step jump under similar conditions as previously tested. The results are shown in Table 3:

**Table 1.** Basic information of athletes.

| serial number | gender | Athlete class       | Main training project | training years |
|---------------|--------|---------------------|-----------------------|----------------|
| 1             | Man    | first class athlete | 100 metres            | 7              |
| 2             | Man    | first class athlete | 100 metres            | 7              |
| 3             | Man    | first class athlete | 100 metres            | 6              |
| 4             | Man    | first class athlete | 100 metres            | 5.5            |
| 5             | Man    | secondary athlete   | 400 metres            | 5.5            |
| 6             | Man    | first class athlete | 400 metres            | 6              |
| 7             | Man    | first class athlete | 200 metres            | 6              |
| 8             | Man    | secondary athlete   | 200 metres            | 5              |
| 9             | Man    | secondary athlete   | 200 metres            | 6              |
| 10            | Man    | secondary athlete   | 200 metres            | 7              |
| 11            | Man    | secondary athlete   | 400 metres            | 6              |
| 12            | Man    | secondary athlete   | 400 metres            | 5.5            |
| 13            | Man    | secondary athlete   | 100 metres            | 6              |
| 14            | Man    | secondary athlete   | 400 metres            | 6              |
| 15            | Man    | secondary athlete   | 200 metres            | 5              |
| 16            | Man    | first class athlete | 100 metres            | 7              |

**Table 2.** Comparative analysis of the specific physical fitness test indicators between the experimental group and the control group before the athlete experiment.

| index              | test group |       | control group |       | T      | P     |
|--------------------|------------|-------|---------------|-------|--------|-------|
|                    | X          | S     | X             | S     |        |       |
| 60 metres          | 6.8        | 0.104 | 6.99          | 0.071 | -1.128 | 0.278 |
| 300 metres         | 36.55      | 0.139 | 36.67         | 0.276 | 0.263  | 0.797 |
| 500 metres         | 68.24      | 0.451 | 68.12         | 0.389 | 0.119  | 0.907 |
| Standing long jump | 2.71       | 0.104 | 2.66          | 0.104 | 0.966  | 0.350 |
| 50m step jump      | 18.44      | 0.535 | 18.41         | 0.535 | 0.000  | 1.000 |

Note: X is the mean, S is the standard deviation; The same below.

**Table 3.** Comparative analysis of the specific physical fitness test indicators between the experimental group and the control group after the athlete experiment.

| index              | test group |       | control group |       | T      | P     |
|--------------------|------------|-------|---------------|-------|--------|-------|
|                    | X          | S     | X             | S     |        |       |
| 60 metres          | 5.01       | 3.102 | 6.71          | 0.083 | -1.629 | 0.126 |
| 300 metres         | 35.32      | 0.266 | 35.44         | 0.334 | -4.061 | 0.001 |
| 500 metres         | 58.61      | 0.716 | 66.21         | 0.601 | -0.922 | 0.372 |
| Standing long jump | 2.88       | 0.076 | 2.84          | 0.074 | 4.333  | 0.001 |
| 50m step jump      | 15.65      | 0.707 | 17.18         | 0.518 | -5.245 | 0.002 |

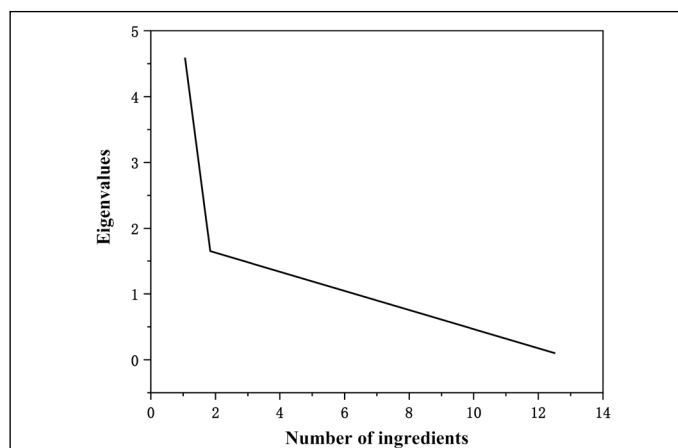
Note: X is the mean, S is the standard deviation; The same below.

As can be seen from Table 3, after 20 weeks of training, the mean values of 60m, 300m, 500m, standing long jump and 50m step jump in the experimental group were 5.01, 35.32, 58.61, 2.88, 15.65, respectively, the mean values of 60 meters, 300 meters, 500 meters, standing long jump, and 50 meters step jump in the control group were 6.71, 35.44, 66.21, 2.84, and 17.18. The improvement of the control group was greater than that of the experimental group, especially in the 300m, standing long jump and 50m step jump indicators, the performance is more prominent, the improvement in the test indicators of speed endurance and speed strength was more obvious, because the experimental group strengthened the exercise of the deep small muscle group, the stability of the trunk is effectively maintained, so that the center of gravity of the human body is located between the upper and lower limbs, and the rapid transmission of power is realized. From this, the gravel chart for the screening of physical fitness indicators of 100-meter sprinters was obtained. As shown in Figure 1.

There is no need for a code of ethics for this type of study.

### Ethical Compliance

Research experiments conducted in this article with animals or humans were approved by the Ethical Committee and responsible authorities of Hebei Professional College of Political Science and Law and Hebei Vocational College of Rail Transportation following all guidelines, regulations, legal, and ethical standards as required for humans or animals.



**Figure 1.** Gravel chart for the screening of physical fitness index components of 100-meter sprinters.

### CONCLUSION

According to the post-test results of the experiment, the sports performance of the two groups of sprinters in the 100-meter, 200-meter and 400-meter races after training has improved, however, the improvement in the experimental group was more obvious and more significant. Emphasizing the coordination and cooperation of multi-joint muscle groups, the nervous system's ability to dominate the muscles, the integrity of the kinematic chain is emphasized, and the power transmission efficiency is high, it can ensure the stability of the athlete's body during fast running, enhance the neuromuscular system's ability to control muscles, and recruit more motor units to participate in the work with high precision. Moreover, due to some means of core strength training to promote the increase of thigh muscle strength, the ability of athletes to actively lift their legs has been improved, conducive to the improvement of technical movements.

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

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