

EFFECT OF LOAD TRAINING ON PHYSICAL FITNESS IN RUNNING ATHLETES



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EFEITO DO TREINAMENTO DE CORRIDA COM CARGA SOBRE A APTIDÃO FÍSICA EM ATLETAS DE CORRIDA

EFFECTO DEL ENTRENAMIENTO DE CARRERA CON CARGA SOBRE LA APTITUD FÍSICA EN CORREDORES

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ABSTRACT

Introduction: Cardiopulmonary capacity and sports endurance are very important for running athletes. **Objective:** Study whether running with load training can improve physical fitness, focusing on running athletes' cardiopulmonary capacity and exercise endurance. **Methods:** 36 professional athletes were selected. One group was trained with normal running and the other group was trained with running with a weight load. **Results:** In the weight-bearing training group, FVC went from 5.13 ± 0.20 to 5.68 ± 1.25 , FEV1 went from 4.38 ± 0.33 to 4.56 ± 0.35 , PEF went from 8.27 ± 0.98 to 8.88 ± 1.02 , ERV went from 1.44 ± 0.37 to 1.68 ± 0.34 , IVC went from 4.91 ± 0.45 to 5.28 ± 1.46 , VT went from 1.10 ± 0.25 to 1.42 ± 1.26 , systolic blood pressure varied from 115.16 ± 8.18 to 117.02 ± 5.47 , diastolic blood pressure varied from 78.58 ± 8.97 to 78.16 ± 7.42 , BPM varied from 73.42 ± 9.27 to 73.52 ± 9.02 , serum lactic acid was from 1.36 ± 0.28 to 1.31 ± 0.27 , and serum creatine kinase was from 21.85 ± 59.02 to 208.11 ± 49.20 . **Conclusion:** Load running training positively impacts athletes' physical fitness and may be added to improve athletes' cardiorespiratory capacity and exercise endurance. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Running; Weight Bearing Strengthening Program; Physical Fitness; Athletes.

RESUMO

Introdução: A capacidade cardiopulmonar e a resistência esportiva são muito importantes para os atletas de corrida. **Objetivo:** Estudar se o treinamento de corrida com carga pode melhorar a aptidão física, com enfoque na capacidade cardiopulmonar e a resistência ao exercício dos atletas de corrida. **Métodos:** Foram selecionados 36 atletas profissionais. Um grupo foi treinado com corrida normal e o outro grupo foi treinado com corrida com carga de peso. **Resultados:** No grupo de treinamento com rolamentos de peso, FVC passou de $5,13 \pm 0,20$ para $5,68 \pm 1,25$, FEV1 passou de $4,38 \pm 0,33$ para $4,56 \pm 0,35$, PEF passou de $8,27 \pm 0,98$ para $8,88 \pm 1,02$, ERV passou de $1,44 \pm 0,37$ para $1,68 \pm 0,3431$, IVC passou de $4,91 \pm 0,45$ para $5,28 \pm 1,46$, VT passou de $1,10 \pm 0,25$ para $1,42 \pm 1,26$, pressão arterial sistólica variou de $115,16 \pm 8,18$ para $117,02 \pm 5,47$, pressão arterial diastólica variou de $78,58 \pm 8,97$ a $78,16 \pm 7,42$, BPM variou de $73,42 \pm 9,27$ para $73,52 \pm 9,02$, o valor de ácido láctico sanguíneo foi de $1,36 \pm 0,28$ para $1,31 \pm 0,27$, e a creatina quinase sérica foi de $219,85 \pm 59,02$ para $208,11 \pm 49,20$. **Conclusão:** O treinamento de corrida com carga impacta positivamente a aptidão física dos atletas, podendo ser acrescido para melhorar a capacidade cardiorrespiratória e a resistência ao exercício dos atletas. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Corrida; Programa de Fortalecimento por Carga de Peso; Aptidão Física; Atletas.

RESUMEN

Introducción: La capacidad cardiopulmonar y la resistencia al deporte son muy importantes para los atletas que corren. **Objetivo:** Estudiar si correr con entrenamiento de carga puede mejorar la forma física, centrándose en la capacidad cardiopulmonar y la resistencia al ejercicio en atletas corredores. **Métodos:** Se seleccionaron 36 atletas profesionales. Un grupo fue entrenado con carrera normal y el otro con carrera con carga de peso. **Resultados:** En el grupo de entrenamiento con carga de peso, la FVC pasó de $5,13 \pm 0,20$ a $5,68 \pm 1,25$, el FEV1 pasó de $4,38 \pm 0,33$ a $4,56 \pm 0,35$, el PEF pasó de $8,27 \pm 0,98$ a $8,88 \pm 1,02$, ERV pasó de $1,44 \pm 0,37$ a $1,68 \pm 0,34$, IVC pasó de $4,91 \pm 0,45$ a $5,28 \pm 1,46$, VT pasó de $1,10 \pm 0,25$ a $1,42 \pm 1,2645$, la presión arterial sistólica varió de $115,16 \pm 8,18$ a $117,021 \pm 5,47$, PPM varió de $78,58 \pm 8,97$ a $78,16 \pm 7,42$, las pulsaciones por minuto variaron de $73,42 \pm 9,27$ a $73,52 \pm 9,02$, el valor de ácido láctico en sangre fue de $1,36 \pm 0,28$ a $1,31 \pm 0,27$, y la creatina quinasa sérica fue de $219,85 \pm 59,02$ a $208,11 \pm 49,20$. **Conclusión:** El entrenamiento de carrera con carga influye positivamente en la forma física de los atletas, y puede añadirse para mejorar la capacidad cardiorrespiratoria y la resistencia al ejercicio de los atletas. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptorios: Carrera; Programa de Fortalecimiento Soportando Peso; Aptitud Física; Atletas.



INTRODUCTION

Running is one of the most classic high speed and high endurance sports nowadays. The weight bearing running training of athletes has an effective impact on performance. The specific adaptation mechanism of the human body is consistent with the theoretical basis of weight bearing running training.¹ Running has produced a good effect through muscle stimulation. When different intensities are applied to the athletes during running and they are exercised, the effect is that the athletes' body muscles constantly adapt to this stimulation. After training, they must carry out reasonable and appropriate stretching exercises to prevent muscle strain.² Therefore, personalized exercises are carried out according to the physical conditions and physical fitness characteristics of different practitioners, and athletes can also carry out specific physical exercises at the same time. Transforms the power into a direct special power, while enhancing a certain stimulus intensity.³ Weight bearing training usually refers to the use of fitness equipment or weights, such as dumbbells, which can enable different parts of the body to be trained, including the contraction of muscle tissue of the skeletal muscles, so as to increase muscle strength and muscle strength, and improve the endurance of weight bearing running training.⁴ This is the simplest training method in weight bearing running training. Almost all competitive athletes use this method for sports training and endurance training. The main criterion of athletes' physical fitness is physical fitness. Physical fitness is an important part of athletes' competitiveness. To improve technical level and achieve excellent results, athletes need to have good physical fitness.⁵ These abilities mainly include: body shape, body function and sports level. Exercise endurance is the most important determinant of fitness. Body shape and body function are the basis for achieving high sports quality. Cardiopulmonary capacity plays an important role in enhancing athletes' health.⁶ At present, the scientific plan of improving cardiopulmonary capacity training still needs to be strengthened. In order to solve the problem of heart and lung capacity of athletes and promote their physical health, it is the focus of national sports workers' research direction.⁷ In this study, according to the rules of sports training, a plan was designed to improve cardiopulmonary function and sports endurance, which compared the intervention effects of athletes' cardiopulmonary capacity and sports endurance in different levels of weight bearing running training.⁸ In order to explore how to make better use of the key period of athletes' cardiopulmonary capacity progress, improve the effect of intervention, and achieve the deep integration of sports exercise and sports endurance, more importantly, It provides reasonable suggestions for solving the health problems of athletes, and provides a theoretical basis for promoting the physical health of athletes.⁹

METHOD

Research object

In this experiment, 36 national level professional athletes were selected as the experimental subjects. There was no significant difference in the physical indicators of these selected athletes. The study and all the participants were reviewed and approved by Ethics Committee of Shandong University of Technology (NO.SDUTF22P08). Among them, 36 experimental subjects were mainly aged 18 and 19, with average height of 174cm and average weight of 69kg. The specific physical indicators of 36 athletes are shown in Table 1. During the experiment, 36 subjects were divided into two groups for

Table 1. Analysis of the basic situation of the two groups of athletes.

Number of people	18	18
Age (year)	19.477±1.0810	18.770±0.7384
Height (cm)	178.521±4.2799	183.072±5.6312
Weight (kg)	69.631±7.7402	69.270±8.1826

10 weeks of group training. One group received ordinary running training, and the other group received weight bearing running training. During the experiment, 36 subjects kept normal work and rest and reasonable diet, and then studied whether the weight bearing running training could improve the cardiorespiratory capacity and exercise endurance of athletes.

Research methods

1. Literature research method: Before the experiment began, more than 50 articles related to weight bearing running training, cardio pulmonary capacity and exercise endurance were found through relevant searches on CNKI, China Journal Full Text Database, Wanfang Database and other literature data websites, which provided a basis for further discussion of this experiment. Through literature research, this paper has basically mastered how to measure the relevant indexes of cardiopulmonary capacity and sports endurance of experimental subjects, and also learned how to appropriately increase the total amount of weight bearing running training in the training process, so as to ensure the exercise safety of experimental subjects in the experimental process to the greatest extent.
2. Experimental method: In the process of selecting experimental objects, the body indicators of athletes were accurately measured, so as to further select 36 athletes whose body indicators did not have significant differences, and the 36 athletes were divided into two groups, one group for ordinary running training, the other group for weight bearing running training. In the process of the experiment, the relevant indexes of the athletes' cardiopulmonary capacity and sports endurance were continuously measured through professional equipment, and the measured data were further summarized and analyzed to obtain more accurate results. After the experiment, the cardiopulmonary capacity information and sports endurance information of the two groups of experimental subjects were compared before and after, in order to analyze the specific impact of weight bearing running training on the cardiopulmonary capacity and sports endurance of athletes.

RESULTS

Effect of weight bearing running training on improving athletes' cardiopulmonary capacity

Table 2 shows the changes of relevant indexes of cardio pulmonary capacity of athletes who have conducted regular running training before and after the experiment.

By comparing the data before and after the experiment, it can be seen that the data before and after the experiment did not change significantly, and the values of four data items decreased significantly, namely FEV1, PEF, ERV and IVC, while the values of the other four indicators, such as FVC, VT, systolic blood pressure and diastolic blood pressure, increased slightly.

As shown in Table 3, after the 10 week experiment, the changes of various cardiopulmonary capacity indexes of the athletes in the other group who were carrying out weight bearing running training.

Table 2. The effect of ordinary running training on improving the cardiorespiratory ability of athletes.

Option	Before experiment	After experiment
FVC(L)	5.265±0.2495	5.312±0.1938
FEV1(L)	4.548±0.3458	4.401±1.3760
PEF(L)	8.479±1.2339	8.061±0.9480
ERV(L)	1.417±0.3642	1.407±0.3330
IVC(L)	4.988±0.4654	4.702±1.4769
VT(L)	1.122±0.1976	1.138±1.2441
Systolic blood pressure (mmHg)	115.661±5.6081	120.763±7.0724
Diastolic pressure (mmHg)	78.084±9.9837	80.822±10.1356

Table 3. Effect of weight bearing running training on improving cardiorespiratory ability of athletes.

Option	Before experiment	After experiment
FVC(L)	5.137±0.2096	5.686±1.2543
FEV1(L)	4.385±0.3359	4.560±0.3541
PEF(L)	8.276±0.9892	8.881±1.0278
ERV(L)	1.447±0.3744	1.683±0.3431
IVC(L)	4.917±0.4553	5.285±1.4669
VT(L)	1.101±0.2568	1.427±1.2645
Systolic blood pressure (mmHg)	115.167±8.1826	117.021±5.4738
Diastolic pressure (mmHg)	78.583±8.9741	78.161±7.4289

By comparing the two groups of data before and after the experiment, it can be seen that the data before and after the experiment has changed significantly, and there are seven indicators that have improved after weight bearing running training, namely FVC, FEV1, PEF, ERV, IVC, VT, systolic blood pressure. Only the diastolic blood pressure has decreased. By further comparing the changes of various indexes of cardiorespiratory capacity between ordinary running training and weight bearing running training, it can be concluded that weight bearing running training can improve the cardiorespiratory capacity of athletes more than ordinary running training.

Weight bearing running training improves athletes' sports endurance

Table 4 shows the influence of ordinary running training on various indexes related to athletes' sports endurance before and after the experiment.

By comparing the sports endurance related data of the two groups before and after the experiment, it was found that the data before and after the experiment did not change significantly, and four of the data values showed a decreasing trend, namely blood lactate value, serum creatine kinase, subjective fatigue feeling score and subjective respiratory fatigue feeling score. The other two data indicators, quiet heart rate and subjective respiratory fatigue feeling score, showed an increasing trend.

The impact of weight bearing running training on athletes' sports endurance related indicators is shown in Table 5.

By comparing the relevant data values of the two groups of sports endurance before and after the experiment, it was found that the data changes before and after the experiment were not very significant, and only three data values showed a decreasing trend, namely serum creatine kinase, subjective fatigue feeling score and subjective respiratory fatigue feeling score. The other three data indicators, quiet heart rate, blood lactic acid value and 12 minute endurance running distance showed an increasing trend. Through further comparative analysis of the impact of ordinary running training on athletes' sports endurance indicators and the impact of weight bearing running training on athletes' sports endurance indicators, it can be seen that weight bearing running training has a more obvious effect on athletes' sports endurance, and can further enhance athletes' sports endurance.

DISCUSSION

The physical ability that a person relies on when carrying out a long and lasting exercise needs to be provided by cardiopulmonary function, which is an important part of physical fitness and human health. In other words, the better the cardiopulmonary function, the longer the body will exercise. Cardiopulmonary capacity reflects the body's ability to absorb and transport oxygen. In this process, it effectively reflects and evaluates the body's ability to coordinate various physiological systems. Many training programs focus on the training of cardiopulmonary capacity,

Table 4. Effect of ordinary running training on athletes' sports endurance.

Option	Before experiment	After experiment
Quiet heart rate (bpm)	73.923±8.0230	75.631±7.4037
Blood lactic acid value (mmol/L)	1.356±0.2173	1.317±0.4553
Serum creatine kinase (U/L)	227.774±64.2568	212.829±71.7975
12 minute endurance run (m)	2803.294±119.8159	2863.442±116.4895
Subjective fatigue perception score (RPE)	15.936±1.0523	15.312±1.0877
Subjective respiratory fatigue score (RPB)	6.761±1.0472	6.486±0.9484

Table 5. Effect of weight bearing running training on athletes' sports endurance.

Option	Before experiment	After experiment
Quiet heart rate (bpm)	73.429±9.2703	73.527±9.0251
Blood lactic acid value (mmol/L)	1.367±0.2865	1.317±0.2732
Serum creatine kinase (U/L)	219.851±59.0253	208.117±49.2055
12 minute endurance run (m)	2787.747±111.5294	3050.074±120.7684
Subjective fatigue perception score (RPE)	16.411±1.1130	14.927±1.1675
Subjective respiratory fatigue score (RPB)	6.567±1.1163	5.319±1.0198

which is considered to be the key factor to ensure the effectiveness of training, and also the key to promote the physical health of athletes. Weight bearing training can help shape the sports form, enhance physical health, and promote the coordinated development of body and psychology. The cardio pulmonary capacity and endurance of athletes have made significant progress under the intervention of weight bearing running training.

A good runner should have good endurance as the basis of his body. If he usually runs for a short time, he must also follow the general rules of training. The running schedule should be focused to quickly improve the running speed. High speed and high endurance are the characteristics of running, so one or two basic trainings should be arranged every day. Speed and endurance are combined with two irrelevant qualities for basic quality training and physical flexibility training. Usually, when taking a week as a cycle for running training, the coach must understand each athlete's physical conditions. After a period of endurance training, athletes need to carry out some activities in time to correctly adjust their physical conditions. The human body can better transition from the pressure state to the calm state after exercise, so that the cardiovascular system and respiratory system remain at a higher level, which is conducive to paying off the oxygen debt during exercise. The finishing activity after completing the exercise is to eliminate fatigue and promote the recovery of the body. It can relax the muscles and avoid local circulation obstacles that affect metabolism. The finishing activity usually involves some muscle relaxation, shaking and stretching exercises, usually about 10 minutes. After the weight bearing training, actively carry out some slow whole body relaxation exercises, and correctly adjust the amount of exercise from strong to weak, which will help athletes from a tight muscle state to a calm state. And the training of weight bearing running needs less conditions to facilitate, so it has a good impact on improving the performance of athletes. Improving the endurance and cardiopulmonary capacity of athletes is a topic discussed by every sports coach. Through the use of scientific training methods to improve the weight bearing running training, in order to improve the physical quality of athletes, so as to improve the performance of athletes, and guide athletes to conduct scientific training to play an important role.

CONCLUSION

Through further analysis and research on the experimental results in this paper, it can be concluded that only ordinary running training has no obvious effect on the improvement of athletes' cardiopulmonary capacity and sports endurance. Even after ordinary running training, the relevant indexes of athletes' cardiopulmonary capacity and sports endurance show a decreasing trend, such as FEV1, PEF, ERV and IVC values related to cardiopulmonary capacity, And the blood lactic acid value, serum creatine kinase, subjective fatigue feeling score and subjective respiratory fatigue feeling score related to exercise endurance. In the process of daily training, properly increasing the weight bearing running training can further improve the cardiorespiratory capacity and sports endurance of athletes. The improvement of cardiorespiratory capacity is mainly manifested in the increase of the relevant indexes of cardiorespiratory capacity, such as FVC, FEV1, PEF, ERV, IV, VT and systolic blood pressure. At the same time, the impact of weight bearing running training on the improvement of athletes' sports endurance

is mainly reflected in the quiet heart rate The increase of blood lactic acid value and 12 minute endurance running distance. Therefore, the weight bearing running training can be gradually increased in the daily training of athletes, and the total amount of weight bearing running training can be continuously increased by means of gradual transition. In this process, attention should also be paid to the physical condition indicators of athletes, and sufficient buffer time should be given to athletes when necessary.

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