

ROCK-CLIMBING EXERCISE IN THE PHYSICAL TRAINING OF ATHLETES



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EXERCÍCIO DE ESCALADA EM ROCHAS NO TREINAMENTO FÍSICO DOS ATLETAS

EL EJERCICIO DE ESCALADA EN ROCAS EN LA FORMACIÓN FÍSICA DE LOS DEPORTISTAS

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ABSTRACT

Introduction: With the promotion of rock climbing in the Tokyo Olympic Games in 2020 and the China National Games in 2017, the sport has been spread to the general public, and the country has paid more attention to its development. **Objective:** Study the effects of rock-climbing exercise on athletes' performance in physical training. **Methods:** A comparative study was conducted on the physical training of rock climbers through literary consultation, experience, and mathematical statistics aiming to explore the impact of the sport on physical training in rock climbers. Fifteen professional rock-climbing team athletes participated in this research. **Results:** A significant difference was found in strength quality between the experimental group and the control group ($p < 0.05$), there were very significant differences in the fixed bar, push-ups, and 1min abdominal exercises ($p < 0.01$) after the experiment, there were significant differences in speed, agility, and endurance between the experimental group and the control group ($p < 0.05$), with emphasis on motor coordination and speed quality ($p < 0.01$). **Conclusion:** Integrating physical training with rock climbing training has a remarkable effect on improving athletes' physical performance. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Training, Exercise; Physical Conditioning, Human; Athletes.

RESUMO

Introdução: Com a promoção da escalada em rocha nos Jogos Olímpicos de Tóquio em 2020 e nos Jogos Nacionais da China em 2017, o esporte foi difundido pelo público em geral e o país tem dado mais atenção ao seu desenvolvimento. **Objetivo:** Estudar os efeitos do exercício de escalada em rocha sobre o desempenho do treinamento físico nos atletas. **Métodos:** Foi realizado um estudo comparativo sobre o treinamento físico de escaladores em rocha através de consulta literária, experiência e estatísticas matemáticas visando explorar o impacto do esporte no treinamento físico em escaladores. Participaram dessa pesquisa 15 atletas profissionais da equipe de escalada em rocha. **Resultados:** Foi encontrada uma diferença significativa na qualidade da força entre o grupo experimental e o grupo controle ($p < 0,05$), houve diferenças muito significativas nos exercícios de barra fixa, flexões e abdominais de 1min ($p < 0,01$), após o experimento, houve diferenças significativas na velocidade, agilidade e resistência entre o grupo experimental e o grupo controle ($p < 0,05$), com destaque entre a coordenação motora e a qualidade da velocidade ($p < 0,01$). **Conclusão:** A integração do treinamento físico com o treinamento de escalada em rocha tem um efeito notável sobre a melhoria do desempenho físico dos atletas. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Treinamento Físico; Condicionamento Físico Humano; Atletas.

RESUMEN

Introducción: Con la promoción de la escalada en roca en los Juegos Olímpicos de Tokio en 2020 y los Juegos Nacionales de China en 2017, este deporte se ha extendido al público en general y el país ha prestado más atención a su desarrollo. **Objetivo:** Estudiar los efectos del ejercicio de escalada en roca sobre el rendimiento del entrenamiento físico en atletas. **Métodos:** Se realizó un estudio comparativo sobre la preparación física de los escaladores mediante la consulta literaria, la experiencia y la estadística matemática con el objetivo de explorar el impacto del deporte en la preparación física de los escaladores. Quince atletas profesionales de equipos de escalada en roca participaron en esta investigación. **Resultados:** Se encontró una diferencia significativa en la calidad de la fuerza entre el grupo experimental y el grupo de control ($p < 0,05$), hubo diferencias muy significativas en los ejercicios de barra fija, flexiones y abdominales de 1min ($p < 0,01$), después del experimento, hubo diferencias significativas en la velocidad, agilidad y resistencia entre el grupo experimental y el grupo de control ($p < 0,05$), con énfasis en la coordinación motora y la calidad de la velocidad ($p < 0,01$). **Conclusión:** La integración del entrenamiento físico con el de escalada en roca tiene un efecto notable en la mejora del rendimiento físico de los deportistas. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptorios: Entrenamiento Físico; Acondicionamiento Físico Humano; Atletas.



INTRODUCTION

As rock climbing enters the 2020 Tokyo Olympics, entering the National Games in 2017, rock climbing has gradually entered the public's field of vision, and the country has paid more and more attention to the development of rock climbing, in terms of competitive rock climbing, a bold attempt has also been made to select cross-border and cross-item materials.¹ The popularity of rock climbing in extreme sports is not as good as other Olympic sports in China, As a result, the training system of Chinese competitive rock climbing is far less mature than that of European and American athletes, and the level of competition is far from that of European, American, Japanese and Korean athletes.²

Broadly defined as: The three aspects of form, function and quality; Narrowly defined as: The physical quality of the athlete.³ Yee K E scholars pointed out that the definition of special physical fitness for speed climbing refers to the ability of the body to continue to move in the speed climbing exercise, which is formed by the athletes through congenital inheritance and acquired training, refers to the athlete's special training and competition load, the most effective ability to mobilize various organ systems of the organism to complete special training and competition.⁴ Koumaditis K shows that rock climbing has high requirements on the physical fitness of participants, and is an aerobic exercise that has a certain effect on the quality development of all parts of the body.⁵ Park GH refers to rock climbing as a sport that combines strength, flexibility, flexibility, balance and self-confidence.⁶ Aseev SV also mentioned that rock climbing is mainly done by the body's lower limbs doing push-ups, upper limbs doing pull-ups, and the trunk doing abdominal retraction, hip flexion and other movements in coordination.⁷

By reviewing relevant materials and field visits, it is found that physical fitness training is not given enough attention in rock climbing training, in the existing rock climbing physical training, there is still a deviation in the understanding of physical training, therefore, it is very necessary to properly integrate physical training in rock climbing training, and it is hoped that the gap between the competition level of European, American, Japanese and Korean players can be shortened from the aspect of improving rock climbing physical training, it provides a certain reference for the physical training methods and means of rock climbing in the future.

METHOD

Research object

This study takes 15 athletes in the rock climbing team as the research object, including 4 girls and 11 boys. One athlete ranked tenth in 2020, and five athletes entered the 2021 China Rock Climbing League Finals.

Research methods

(1) Documentation Law

Through CNKI, the literature and materials related to rock climbing, physical training, and rock climbing sports quality were consulted and collected.

(2) Experimental method

Taking the members of the rock climbing team as the experimental objects, the experimental plan of incorporating track and field physical training into the rock climbing training was designed and implemented, and the experimental data were obtained through the experimental results of the experimental group and the control group after the experiment.

(3) Mathematical statistics

The author uses Excel 2016 and SPSS16.0 to statistically process the data of each indicator obtained by the test, and uses the Shapiro-Wilk (W test) to test the data, and it is concluded that the distribution of each

data indicator is a normal distribution,⁸ bivariate was used to analyze the correlation between each basic physical fitness index and the special index of rock climbing after the experiment.⁹

Experimental testing methods and methods

Athletes are tested for basic rock climbing physical fitness and specific rock climbing skills before and after they are integrated into track and field physical training. Determine weighted pull-ups and half-squats as test indicators of maximum strength; Weight-bearing suspension is used as the test index of strength endurance; 20s pull-up and three-level frog leap are used as the test index of explosive force; 1 min sit-ups are used as test indicators of trunk strength; Cross forks, sitting body forward flexion, and dorsal hooks of both hands are used as test indicators of general flexibility; The meter running is used as the test index of agile coordination quality; The 60m run is used as the test index of action speed; The 3000m run is used as the test index of general endurance; Difficulty climbing, speed climbing, and rock climbing are the test indicators for the special ability of rock climbing.¹⁰

ETHICAL COMPLIANCE

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

RESULTS

After 12 weeks of experimental training, independent sample T-test analysis was performed on the data obtained by the experimental group and the control group on the basic physical fitness index and special skill index of rock climbing after the experiment, the test results are shown in Table 1, Table 2, and Table 3.

As can be seen from the column of significance level in Table 1, after the experiment, there was a significant difference in the strength quality between the experimental group and the control group, among which the weight-bearing pull-up, 20s pull-up, flexion suspension and 1 min sit-ups were all significantly different, the half squat calf raise was significantly different. From the column of mean in Table 1, it can be concluded that the mean of each strength quality of the experimental group is better than that of the control group after the experiment. Rock climbing special skills and physical training also have a certain degree of improvement in strength quality, but in a short period of time, it is not as good as track and field physical training methods for improving strength quality.

From Table 2, it can be concluded that, after the experiment, there was a very significant difference in the flexibility between the experimental group and the control group in the performance of cross fork and sitting body forward flexion, but there was no significant difference in the dorsal hook of both hands.

Observing Table 3, it can be concluded that there are significant differences in the speed, sensitivity and endurance between the experimental group and the control group after the experiment, among them, there is a very significant difference in agility coordination and speed quality, while endurance quality is significantly different. This shows that the weekly speed quality training in the track and field physical training greatly improves the speed quality, the coordination training methods and methods of the experimental group and the improvement of trunk strength greatly improve the sensitivity and coordination quality, the effect is very obvious, and the training methods of aerobic endurance such as 2000m running and 3000m cross-country running can greatly improve the quality of aerobic endurance.

As can be seen from Table 4, the mean of the experimental group and the control group after the experiment, the increase in the speed of the control

Table 1. Independent sample T-test of the strength and quality test indicators of the experimental group and the control group after the experiment.

Index	Group	Mean	Standard deviation	T value	P corresponding probability
Weighted Pull Ups	test group	49.58	3.68	3.37	0.007**
	control group	40.08	5.83		
20s pull-ups	test group	30.17	2.48	12.14	0.000**
	control group	16.00	1.41		
Flex arm hang	test group	51.83	2.52	7.07	0.000**
	control group	31.50	6.57		
Three-level leapfrog	test group	9.99	0.58	6.09	0.000**
	control group	8.44	0.23		
Half Squat Calf Raise	test group	134.17	0.80	2.96	0.014*
	control group	126.00	0.82		
1min sit-ups	test group	83.17	3.19	9.62	0.000**
	control group	53	6.99		

Note: **** means $p < 0.01$, there is a very significant difference, ** means $p < 0.05$, there is a significant difference, the same below.

Table 2. The independent sample T test of the flexibility quality test indexes of the experimental group and the control group after the experiment.

Index	Group	Mean	Standard deviation	T value	P corresponding probability
Cross fork	test group	8.28	2.70	6.10	0.000**
	control group	24.70	6.02		
Sitting forward bend	test group	28.85	2.80	6.18	0.000**
	control group	13.88	4.31		
Back hook	test group	6.67	3.23	0.42	0.68
	control group	7.50	3.62		

Table 3. Independent sample t-test of the speed, sensitivity and endurance quality test indicators of the experimental group and the control group after the experiment.

Index	Group	Mean	Standard deviation	T value	P corresponding probability
Rice run	test group	8.28	2.70	6.91	0.000**
	control group	14.13	2.08		
60m run	test group	7.03	0.16	5.01	0.001**
	control group	7.56	0.21		
3000m run	test group	11.25	0.81	2.51	0.031*
	control group	12.43	0.82		

Table 4. Independent sample T-test of the test indexes of rock climbing special skills in the experimental group and the control group after the experiment.

Index	Group	Mean	Standard deviation	T value	P corresponding probability
Difficulty climbing	test group	30.83	3.60	3.99	0.003**
	control group	23.33	2.88		
Rock climbing	test group	63.86	22.75	2.71	0.022*
	control group	36.50	9.57		
Speed climb	test group	10.58	1.19	6.40	0.000**
	control group	16.81	2.06		

group is far less than that of the experimental group; It can be seen from the mean values after the difficulty climbing and rock climbing experiments that, the difficulty and rock climbing performance of the experimental group were greatly improved after the experiment; Although the control group also had a certain improvement, the magnitude of the improvement was far less than that of the experimental group. This shows that the integration of track and field physical training into rock climbing training has a very obvious effect on the improvement of rock climbing special skills.

DISCUSSION

Strength training is the focus of physical fitness training in rock climbing, excellent core strength allows athletes to maintain consistent power output, body stability and explosive speed during vertical and horizontal movement. However, the indicators are not perfect, for example, the deep and long jump should be changed to the deep and high jump, the flexibility indicator should be a hip flexion and a leg lift, the indicator should be more

specific and more accurate and effective. In addition, the coordination index is not involved, and the future training and testing are the focus.

CONCLUSION

Incorporating physical training into rock climbing training can make up for the lack of trunk strength and lower limb strength, speed, sensitivity and coordination, flexibility, and endurance quality training

in rock climbing physical training, in this way, the physical fitness of rock climbers can be developed in an all-round and balanced manner, and sports injuries caused by unbalanced physical fitness development can be reduced, extending the sports life can better serve the special training and competition of rock climbing.

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