Proceedings of the 4th International Conference on Biological Engineering and Medical Science
DOI: 10.54254/2753-8818/72/2024.18860

Experimental study on the effect of rapid telescopic compound training on lower limb explosiveness of adolescent road cyclists

Yixuan Cao

Duke University, Fuqua School of Business, NC, US

ccaoyixuan@163.com

Abstract. To study the effect of rapid telescopic compound training on the explosive power of lower limbs of adolescent road cyclists. A total of 19 adolescent road cyclists were randomly selected and divided into two groups for 10 weeks of training intervention. The control group received traditional strength training, and the observation group received rapid telescopic compound training, and the results of standing long jump, in-situ vertical jump, vertical vertical jump, and isokinetic muscle strength test were used as observation indicators to evaluate the changes of lower limb explosive power in the two groups. The results showed that the lower limb explosiveness indexes of the athletes who received rapid telescopic compound training were better than those of the other group, indicating that the rapid telescopic composite training could have a good effect on the lower limb explosiveness of adolescent road cyclists, and could be applied to daily training.

Keywords: Teenage road cyclists, Rapid telescopic compound training, Explosive power in the lower limbs.

1. Introduction

Modern road cycling is a middle- to long-distance periodic endurance event that requires athletes to have a strong physical reserve, including good cardiorespiratory fitness, muscle strength, and endurance [1]. With the continuous development of sports competition, modern road cycling has gradually entered the cause of the public and has become a high-profile sport. In athletes, lower limb muscle strength is an important influencing factor, which can provide athletes with strong power output, enhance endurance and stability, and play a key role in the excellence of sports performance. Therefore, it is necessary to find effective lower limb training methods to improve the competitive level of road cyclists. Rapid telescopic compound training, which uses movement exercises to quickly stretch muscles and enhance explosive power through active traction of muscles to produce active and explosive contractions, is currently used in various sports and is mainly used to improve explosive power [2]. However, there are few studies on the application of rapid telescopic compound training in adolescent road cyclists, and its effect is unknown. Based on this, this study mainly selected 19 adolescent road cyclists for control experiments and analyzed their application effects, so as to provide effective suggestions and methods for the training of road cyclists.

DOI: 10.54254/2753-8818/72/2024.18860

2. Research Objects and Methods

2.1. Research Subjects

Nineteen adolescent road cyclists were included and divided into two groups for a 10-week training intervention. The control group received traditional strength training, and the observation group received rapid retraction compound training, and the specific athlete information is shown in Table 1.

Table 1. Information on young road cyclists

Constituencies	Age (years)	Height(cm)	Weight (kg)	Years of training (years)
Control group(n=9)	18.91±2.04	175.64±5.31	65.82±5.64	4.06±1.25
Observation group(n=10)	18.84±1.85	174.96±5.42	65.51±5.40	4.02±1.33

2.2. Research Methods

2.2.1. Documentary Law

By searching keywords such as "road cyclists", "lower limb strength training", "lower limb explosive power" and "rapid telescopic compound training" in Chinese and foreign databases such as CNKI, Wanfang Data, and VIP Technology, the relevant literature was searched, and the same literature was summarized after reading the relevant literature, and finally the reading literature was comprehensively analyzed.

2.2.2. Expert interview method

Before the experiment, experts and experienced coaches in related fields were interviewed to screen the test indicators for specific evaluation of lower limb explosiveness, and at the same time evaluate whether the training content meets the training requirements to ensure the smooth development of the experiment.

2.2.3. Experimental method

2.2.3.1. Experimental design

The experiment was carried out in a single-factor controlled experiment, in which the athletes were randomly grouped, and the subjects were not informed of which group they were in, nor of the purpose of the training of the experimental study, and the experimental training was carried out in the same field. On the basis of literature method and expert interviews, a 10-week training program was formulated, and the training was 3 times/week, and the content of the program was consistent except for the difference in the lower limb strength training program.

2.2.3.2. Training program

The control group received traditional strength training, mainly including lunge squat, weight-bearing calf raising, weight-bearing step jump, squat barbell, barbell weight-bearing half-squat jump, weight-bearing straight-leg deadlift, and maximum load leg lifting exercises, with 12 pieces in each group, three groups each time, and 2min rest between action groups.

The observation group received rapid telescopic compound training: two-foot hurdle jumping, frog jumping, continuous vertical jump on the spot, lunge step-by-step jump on the spot, continuous single-legged left and right lateral jumps, front-back, left-right jumps, kneeling jumps and double-leg box jumps, 10 in each group, three groups each time, and a 2min break between action groups.

2.3. Test indicators and evaluation criteria

Standing long jump: Before the test mat jumper, the team members swing their arms back and forth at the beginning of the test, and when they are ready to jump, they will quickly swing their hands, bend their knees, land on the ground with their front feet, and quickly raise their hands forward and upward, while pushing the ground hard with the forefeet, the center of gravity will be shifted forward and upward,

DOI: 10.54254/2753-8818/72/2024.18860

and the rear drive will be C-shaped, the landing leg will be stretched forward, and the heel will be cushioned. The results of the 2nd test will be the best.

Jump in situ to touch the height: feet and shoulders are the same width, arms are opened and naturally raised, with the upper limbs fully rhythmically swinging, and then burst into jumping, observing the highest point of the finger touch ruler in the hand. The results of the 2nd test will be the best.

Vertical jump: Stand on the Smart Jump Mat with your hands on your hips, squat down and quickly jump vertically, with your feet not bending your knees when jumping upwards, and landing on the jump mat as much as possible without bending your knees when falling. The results of the 2nd test will be the best.

Isokinetic muscle strength test results. Before starting the test, 10min warm-up exercise was performed, and then the peak knee joint torque of 60°/s slow speed and 180°/s fast knee joint was tested 3 times, and the maximum value was taken.

2.4. Mathematical Statistics

Excel and Spss24.00 software were used for statistical analysis, quantitative variables were described by mean and standard deviation, and independent samples t-test was used for comparison between groups, and P<0.05 was statistically significant.

3. Results and Analysis

3.1. Comparison of test results between the two groups before and after the experiment

Table 1 showed that there were no significant differences between the two groups in the standing long jump, in-situ vertical jump, and vertical vertical jump before the experiment (P>0.05). After 10 weeks of training, the test results of the two groups were improved, and the difference was statistically significant (P<0.05). However, the standing long jump, in-situ vertical jump, and vertical vertical jump in the observation group were higher than those in the control group (P<0.05).

Table 1. Comparison of test results between the two groups before and after the experiment($\overline{x} \pm s$)

Constitu-encies	Number of examples	Standing Long Jump (cm)		Vertical jump on the spot (cm)		Vertical Jump (cm)	
		Before the experi-ment	After the experi-ment	Before the experi-ment	After the experi-ment	Before the experi-ment	After the experi-ment
Control group	9	234.63 ±5.89	240.14 ±3.58*	293.08 ± 4.23	301.08 ± 5.37*	54.27 ± 3.31	56.06 ±1.13*
Observation group	10	235.41 ±5.09	246.31 ±5.02*	293.04 ± 5.55	305.61 ± 4.33*	54.39 ±2.94	58.02 ±1.51*
t-value		1.256	3.851	0.829	6.057	1.662	6.538
P-value		0.437	0.001	0.154	0.008	0.319	0.002

Note: * indicates P<0.05 before and after the experiment.

3.2. Isokinetic muscle strength test results of the two groups before and after the experiment

Table 2 showed that there was no significant difference in the group peak moments of extensor and flexor muscles at 60°/s and 180°/s between the two groups before the experiment (P>0.05), indicating that the knee muscle strength of the two groups was at the same level before the start of the experiment. After the experiment, the group peak moments of extensor and flexor muscles of the two groups increased to varying degrees at 60°/s and 180°/s, and the observation group was higher than that of the control group (P<0.05).

DOI: 10.54254/2753-8818/72/2024.18860

Table 2. Comparison of isokinetic muscle strength test results between the two groups before and after the experiment($\overline{x} \pm s$)

Constituencies		60°/s		180°/s	
		Before the experiment	After the experiment	Before the experiment	After the experiment
Control group	extensor	344.51±34.26	395.16±48.76*	310.76±41.28*	345.63±52.37*
	flexor	193.54±21.02	210.33±25.32*	153.45±15.75*	160.15±19.08*
Observation group	extensor	345.48±30.89	420.21±50.01*	311.82±40.57*	365.86±50.42*
	flexor	192.86±20.94	221.71±26.64*	152.47±16.83*	173.76±20.03*
t-value		0.841	6.215	1.024	6.552
P-value		0.087	0.002	0.247	0.003

Note: * indicates P<0.05 before and after the experiment.

4. Analyze and discuss

With the continuous development of modern science and technology, training methods and means to improve sports performance are also increasing. Rapid telescopic compound training is a basic training, which is an effective means of improving athletes' physical qualities such as strength, explosiveness, speed, agility, and coordination. As a training method to efficiently improve athletes' performance, rapid telescopic compound training has been widely used in various sports. Wei Wei et al.'s research has shown that rapid telescopic compound training can be applied to youth football players, and compared with conventional agility training, it can effectively and sensitively improve the quality and have a positive training effect [3]. And the strong lower body strength of road cyclists can provide them with good forward momentum, generating huge explosive power and long-lasting endurance.

Lower limb explosive power refers to the ability of the neuromuscular system to control the corresponding muscles to exert strength quickly, and the magnitude of the ability to produce is determined by the contraction characteristics of muscle fibers and the number of motor units activated at the same time during work, which is conducive to improving the overall speed level of road cyclists [4]. Standing long jump, in-situ vertical jump, and vertical vertical jump are simple and effective actions to test the explosive force of the lower limbs, which can reflect the ability of the extensor muscles of the lower limbs to quickly change from eccentric contraction to centripetal contraction. In this study, after 10 weeks of training, the results of standing long jump, in-situ vertical jump, and vertical vertical jump in the observation group were higher than those in the control group (P<0.05), indicating that rapid telescopic compound training can effectively improve the lower limb explosiveness of road cyclists, which is consistent with the results of Guo Le's research [5]. The results of this study showed that the group peak moments of extensor and flexor muscles at 60°/s and 180°/s were higher than those in the control group (P<0.05), suggesting that compared with traditional strength training, rapid telescopic compound training had a better effect on improving the lower limb explosive power of road cyclists. The main focus is that rapid stretching compound training affects the elastic potential energy and the intensity of nerve adjustment through the length of muscle elongation and the speed of elongation, and improves the quality of muscle contraction. At the same time, the rapid telescopic compound training also enhances the coordination between nerves and muscles, allowing road cyclists to distribute muscle strength more precisely during the race.

In summary, rapid telescopic compound training can effectively improve the lower limb explosiveness of young road cyclists, which can be applied to practical training.

References

[1] Zhang Guizhong, Zhang Hongshuai. Research on the grey association between college students' road cycling performance and physical function[J].Journal of Jilin University of Physical Education, 2019, 35(05):61-64+86.

DOI: 10.54254/2753-8818/72/2024.18860

[2] [Ren Junbo. Research on the effect of rapid telescopic compound training on the speed and agility of basketball players[J].Sports Science and Technology Literature Bulletin, 2023, 31(09):84-85+90.

[3] Wei Wei, Wei Shiwan. Effect of rapid telescopic compound training on the agility of 11~12-year-old youth football players[J].Contemporary Sports Science and Technology, 2023, 13(28):39-42.

[4] Guo Le. Effect of rapid telescopic compound training on lower limb explosiveness of adolescent road cyclists[J].Fujian Sports Science and Technology, 2024, 43(04):75-79.