

# Analysis on special speed endurance training for 400-meter running of high school male sports students

Wang Feng<sup>1,a,\*</sup>, Li Ruochen<sup>2,b</sup>

<sup>1</sup>Shaanxi University of Technology, Hanzhong, China

<sup>2</sup>Shaanxi University of Technology, Hanzhong, China

<sup>a</sup>wangfeng19801225@126.com, <sup>b</sup>1183119216@qq.com

\*Corresponding author

**Abstract:** As the longest distance event in track and field sprint, 400-meter running has a high demand on athletes' speed endurance, and good speed endurance cannot be separated from scientific and effective training. In this regard, research methods such as literature, interview, experimental analysis and mathematical statistics, combined with the knowledge of sports training science, sports anatomy and sports biochemistry, were used to sort out and analyze the characteristics and rules of speed endurance training, explore and summarize training methods, and provide references for improving the special training results of 400 meters in track and field for high school male sports students. The results show that: Through speed endurance training (special speed endurance training and general speed endurance training), the results of most test items of the experimental subjects have significantly improved, and the difference between the special speed endurance of the team members has little change, but the difference between the general speed endurance has certain changes, and the overall improvement effect is good. It suggests that scientific speed endurance training can effectively improve the level of high school male sports students for 400 meters running.

**Keywords:** 400-meter running, high school male sports students, speed endurance, training methods

## 1. Introduction

400-meter running is the longest distance in track and field sprint, and it is also recognized as a more difficult training project, which has a high requirement for the comprehensive quality of athletes. 400-meter running is a long-term, high-speed periodic exercise, during which muscles will produce lactic acid at the fastest speed and accumulate, which affects the level of athletes. However, speed endurance training can overcome the accumulation of lactic acid and improve the anti-lactic acid ability, so as to maintain high-speed running, and ultimately improve the performance level of athletes in 400-meter running. High school sports students are an important source of reserve talents for track and field events in our country, which is related to the future development of track and field events in our country. As an important 400-meter event in track and field, it is particularly important to strengthen the speed endurance training of high school sports students to improve the athletes' ability to maintain their full speed and performance level during training and competitions. Based on this, combining speed, strength, endurance and other training methods, through a variety of training methods to obtain better training results, the article takes the special speed endurance training method of high school male sports students for 400-meter running as the research object to improve the local high school male sports students 400 meters running special competitive level.

## 2. Research status

Through consulting and sorting out the literature related to the training of 400-meter athletes, it is found that the current research mainly focuses on the characteristics of 400-meter speed endurance, speed endurance training methods, energy supply characteristics and so on. In terms of speed endurance characteristics, Yang Huizhen pointed out that the speed rhythm of the first half of China's outstanding female 400-meter runners is not stable, the speed maintenance ability of the second half is poor, and the rhythm distribution of the whole process is not ideal [1]. Xu Chunxia et al. pointed out that strong speed endurance can effectively increase the oxygen deficit level and maintain a certain

acidity of muscle [2]. Zhu Yihong et al. pointed out that the rhythm change of 400-meter runners basically follows the acceleration in the first half to reach the maximum speed, while the speed in the second half drops significantly and reaches the slowest speed [3]. Gong Hui pointed out that the technical characteristics of long stride length and high stride frequency are important means to improve absolute speed [4]. HMijares pointed out that 11b fibers have motor neurons, and the stimulation conduction propagates faster and the stimulation frequency is higher, so this muscle fiber plays a decisive role in the 400-meter race [5]. In terms of speed endurance training methods, Xu Haoran et al proposed a combination of interval and repetition training methods, a combination of load change, repetition and interval training methods, and a combination of content change, repetition and interval training methods [6]. Wang Weihua pointed out that the speed endurance training mainly adopts the interval training method, and the combination of short distance and long distance running training method. Liu Mengchen et al. pointed out that the speed endurance training of 400 meters should pay attention to the technical update of training methods, the original circuit training method, interval training method and mental training method can be combined, and the problem of training load and exercise heart rate should be handled well [7]. YOzaki et al. pointed out that effective training strategies for the 400 meters race depend on the individual's stage of development, race pattern, and goal setting [8]. In terms of energy supply characteristics, Wang Yousi pointed out that the energy of 400 meters running is supplied by the three major energy supply systems of phosphogenic acid, glycolysis and aerobic metabolism at the same time, and the anaerobic energy supply is mainly used while aerobic metabolism also provides a small amount of energy. Hou Fumin pointed out that men's 400-meter race is a sprint competitive sports event with ATP-CP system as the main energy supply, and anaerobic lactic acid metabolic system as the auxiliary energy supply. Xia Yu pointed out that glycolysis is the main energy supply system for 400-meter running, but with the passing of time, if the athletes' physical oxygen content is gradually insufficient, the energy supply ability of glycolysis will decrease, and eventually lead to the decline of muscle capacity. GRKarimi studied the relationship between lactic acid rotation speed and instantaneous maximal oxygen consumption speed under the physical limit of elite 400-meter runners in Iran, and pointed out that there was no significant relationship between the two under the physical limit conditions.

### 3. Experimental study on special speed endurance of high school male sports students running 400 meters

#### 3.1 Experimental object

This paper takes the special speed endurance training method of 400 meters running for the senior three male sports students in Hantai City as the research object, and carries out related research work on 14 senior three male special sports students for 400-meters running in Hanzhong Middle School, Nanzheng Middle School, Chenggu No. 1 Middle School and Mianxian No. 1 Middle School. The basic information of experimental subjects is shown in Table 1.

Table 1: Basic information of experimental subjects (n=14)

Research object	age	Height (cm)	Weight (kg)
object1	18	176	71
object2	17	178	70
object3	18	177	72
object4	18	179	73
object5	17	176	69
object6	17	181	79
object7	19	173	68
object8	18	179	72
object9	17	182	75
object10	18	177	68
object11	19	183	74
object12	17	178	71
object13	18	181	75
object14	19	175	72

### 3.2 Experimental design

#### 3.2.1 Experimental Procedure

14 senior three male 400-meter running special sports students were randomly selected from four high schools in Hanzhong City as experimental subjects to carry out 16 weeks of speed endurance training, including speed training, strength training, endurance training, general speed endurance training and special speed endurance training. Before and after the experiment, 14 sports students were tested for speed and endurance, and the relevant data were carefully recorded.

#### 3.2.2 Experimental scheme

The experimental training scheme is divided into three stages, and rest is arranged on Sundays. The specific training time is shown in Table 2.

Table 2: Specialised training arrangements for 400m running for senior school physical education students

phase	Time arrangement	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
First stage	6 weeks	Speed	Strength	General Speed Endurance	Speed	Endurance	Endurance	Rest
Second stage	6 weeks	General Speed Endurance, Speed	Specific speed endurance	strength	Specific speed endurance	General Speed Endurance	Specific speed endurance	Rest
Third Stage	6 weeks	General Speed Endurance	strength	Specific speed endurance	Rest	Specific speed endurance	Speed	Rest

The training includes speed endurance training (general speed endurance training and special speed endurance training), speed training, strength training and endurance training. For the general speed endurance training, the training content mainly includes: ladder running, rope ladder running jump combination training, thigh swing exercise, weight in place high lift leg, leg ten jumps; For the special speed endurance training, the training content mainly includes: repetitive running, intermittent running, variable speed running, combination running, relay running. For speed training, the training content mainly includes: repeated sprint running, running foam pad, running with weight; For strength training, the training content mainly includes: carrying barbell, sit-ups, throwing solid ball, jumping pedal; For endurance training, the training content mainly includes: 40 minutes of aerobic running and elastic ball competition. The specific methods of each type of exercise are shown in Table 3.

Table 3: Special training methods of 400 meter running for high school sports students

Training content	Training method	Training intensity	Related instructions
General speed endurance	Step running, rope ladder running and jumping combination training, thigh swing exercise, weight-bearing in situ high leg lift, double leg ten-step jump	4-6 groups, 35%-50% intensity, each group lasts for 3 minutes, with 2 minutes between groups	The training intensity is determined according to the individual specific situation
Special speed endurance	Repeated running, interval running, variable speed running, combination running, relay running	4-10 groups, 65%-85% intensity, each group lasts for 10 seconds-280 seconds, with 1-2 minutes between groups	The training intensity is determined according to the individual specific situation; All training methods include 200m, 300m, 400m, 600m and 800m
Speed	Repeated sprint running	60m×8 times, 80%-95% intensity, with 1-2 minutes between groups,	Run with small strides at a fast frequency; improve the runner's

		the time is controlled within 8 seconds	running speed
	Run on foam mats	100m×6-8 times, with 1-2 minutes between groups, running at full speed	20 small foam mats are placed on the 100m track, with a distance of 60-200 cm, and the runner passes through the foam mats at the fastest speed to improve stride and stride frequency
	Weight-bearing running	80m×6 times, 80%-85% intensity, with 2-3 minutes between groups	The runner's waist is tied with an elastic band, and the elastic band pulls the kettle, with 10-20 kg of weight; improve the runner's leg swing speed
Strength	Carry barbell	Squat: 8-12 times × 5 groups, barbell 40-65 kg; Half squat: 8-12 times × 5 groups, barbell 40-75 kg; Jumping exchange jump: 8-12 times × 5 groups, barbell 35-65 kg; Fast bench press: 20 times * 4 sets, 35-65 kg barbell. The above movements are 2-3 minutes apart between each set.	Enhance the muscle strength and explosiveness of the limbs of the practitioners
	Sit-ups to throw the ball	20 times * 6 sets, 2-3 minutes apart between sets.	Enhance the core strength of the waist of the practitioners
	Jumping jacks	4 times * 6 sets, 2-3 minutes apart between sets.	Jump on 4 different height stools continuously. Enhance the muscle strength and explosiveness of the lower limbs of the practitioners
Endurance	30 minutes of aerobic running	Heart rate 150-165 beats/min, speed 20-25 km/h, continuous running for 25-30 minutes.	Improve the aerobic endurance level of the practitioners
	Elasticity ball competition	The time is controlled at 25-35 minutes, without intervals.	The practitioners are divided into two groups, separated by a fence. The practitioners use their hands or any part of the body to hit the elastic ball into the opponent's field. Improve the aerobic endurance of the practitioners and increase the fun of training.

The design of the experimental training program combines the physical fitness and training goals of male sports students in high school, and specifically designs various forms of training methods for speed, strength and endurance based on improving the energy supply levels of the three major energy supply systems of phosphoric acid, glycolysis and aerobic metabolism, especially the first two anaerobic metabolic systems. Meanwhile, speed endurance training is divided into general speed endurance and special speed endurance. And a variety of different training methods are designed to ensure that the entire training program can fully exercise the speed endurance level of athletes, such as different barbell exercise method enhances the muscle strength and explosive power of different parts of the practitioner. At the same time, other related qualities of the body are also considered, such as improving the physical coordination ability through jumping training, and improving the reaction ability of the rope ladder running and jumping combination training. In addition, by introducing the game into the training method, the boredom of long-term high-load training is alleviated, and the fun of training is increased. For example, when carrying out endurance training, the elastic ball game training method is used. The whole experimental training scheme conforms to the general principle of sports training, which is conducive to improving the speed endurance level of high school sports students who are specialized in 400-meter running in track and field, and lays a solid foundation for the realization of training goals

### 3.2.3 Experiment time

The experimental program will be implemented from September 4 to December 24, 2023, and the

test site will be the school playground of Hanzhong Middle School.

### 3.2.4 Test contents and methods

The test content includes: special speed endurance test (200 meters, 300 meters, 400 meters, 600 meters) and general speed endurance test (weight-bearing jump rope, thigh folding swing, weight-bearing high leg lift, variable distance return run, 10-step jump).

The test methods are as follows: The special speed endurance test requires the students to complete the sprint of different lengths respectively, and the completion time is measured; For the general speed endurance test, the weight-bearing jump rope required students to measure the number of jumps completed within 60 seconds while each foot was tied to a 1.5 kg sandbag. The folded thigh swing required the student to achieve a minimum knee Angle and measured the number of completed movements. The students were asked to carry 30 kg barbell on their shoulders within 30 seconds to measure the number of high leg lifts completed. The variable distance run requires students to complete a set of 50-100-150-200 meters and measure the number of seconds completed. Level 10 jump requires students to start from standing on their feet in place, complete the level 10 long jump in the form of stride jump, and measure the distance between the nearest point of landing on one foot and the starting point of jumping in level 10. All subjects were tested before the training and again after the training.

### 3.3 Analysis of experimental results

#### 3.3.1 Comparative analysis of speed endurance before and after experimental training

##### 3.3.1.1 Comparative analysis of special speed endurance test

For the special speed endurance test, the test methods of 200 meters, 300 meters, 400 meters and 600 meters were used to measure the results of 14 senior three male sports students before and after the special experimental training of 400 meters. The measurement results are shown in Table 4.

Table 4: Comparison of special speed endurance before and after experimental training (unit: seconds)

Test items	testing time	Student1	Student2	Student3	Student4	Student5	Student6	Student7	Student8
200metres	pre-training	23.79	23.23	23.72	24.24	24.69	24.91	24.18	23.35
	after training	23.53	22.78	23.24	23.89	24.15	24.33	23.57	22.87
	difference	0.26	0.45	0.48	0.35	0.54	0.58	0.61	0.48
300metres	Pre-training	35.28	34.29	35.67	35.62	36.09	35.83	35.02	34.97
	after training	34.66	33.71	35.01	35.02	35.50	35.18	34.53	34.70
	difference	0.62	0.58	0.66	0.6	0.59	0.65	0.49	0.27
400metres the first half (of a journey)	Pre-training	24.94	24.19	24.82	24.22	24.89	25.35	25.17	24.66
	after training	24.63	23.91	24.55	23.80	24.57	25.01	24.69	24.48
	difference	0.31	0.28	0.27	0.42	0.32	0.34	0.48	0.18
400metres latter half (of a trip)	Pre-training	26.58	26.11	26.69	26.87	25.89	27.32	26.61	26.44
	after training	26.19	25.88	26.27	26.53	25.54	26.79	26.36	26.19
	difference	0.39	0.23	0.42	0.34	0.35	0.53	0.25	0.25
400metres	Pre-training	51.49	50.21	51.37	50.89	50.91	52.65	51.59	50.99
	after training	50.86	49.79	50.83	50.42	50.15	51.89	51.17	50.52
	difference	0.63	0.42	0.54	0.47	0.76	0.76	0.42	0.47
600metres	Pre-training	86.42	84.95	85.68	87.26	87.73	88.28	86.86	85.94
	after training	85.23	83.92	83.67	86.18	86.59	86.47	85.16	84.90
	difference	1.19	1.03	2.01	1.08	1.14	1.81	1.7	1.04

Table 4: Comparison of specialised speed endurance before and after experimental training (in seconds) (continued)

Test items	testing time	Student9	Student10	Student11	Student12	Student13	Student14	average value	variance	p
200metres	Pre-training	24.11	23.27	23.59	24.36	23.90	23.54	23.92	0.25	0.032
	after training	23.67	22.83	23.12	24.07	23.69	22.82	23.47	0.26	
	difference	0.44	0.44	0.47	0.29	0.21	0.72	0.45	0.02	
300metres	Pre-training	34.87	34.24	34.39	35.27	34.96	35.04	35.11	0.30	0.019
	after training	34.56	33.65	33.97	34.85	34.41	34.50	34.59	0.26	
	difference	0.31	0.59	0.42	0.42	0.55	0.54	0.52	0.01	
400metres the first half (of a journey)	Pre-training	24.92	23.94	24.77	23.99	25.09	24.53	24.68	0.18	0.089
	after training	24.69	23.74	24.58	23.71	24.75	24.32	24.39	0.17	
	difference	0.23	0.2	0.19	0.28	0.34	0.21	0.29	0.01	
400metres latter half (of a trip)	Pre-training	26.52	25.99	26.58	26.76	26.49	26.46	26.52	0.12	0.027
	after training	26.07	25.73	26.30	26.55	26.37	26.21	26.21	0.10	
	difference	0.45	0.26	0.28	0.21	0.12	0.25	0.31	0.01	
400metres	Pre-training	51.41	49.98	51.37	50.69	51.48	50.92	51.14	0.39	0.047
	after training	50.93	49.78	50.79	50.41	51.15	50.56	50.66	0.29	
	difference	0.48	0.2	0.58	0.28	0.33	0.36	0.48	0.03	
600metres	Pre-training	86.39	84.98	85.67	87.36	86.83	85.82	86.44	0.93	0.001
	after training	85.19	83.87	83.54	86.18	85.13	84.72	85.05	1.00	
	difference	1.2	1.11	2.13	1.18	1.7	1.1	1.39	0.14	

As can be seen from the table, the test scores of all 14 students have improved in different amplitude after training. Among them, in the 200-meter race test, the average score after training was shortened by 0.45 seconds, and the variance was increased by 0.02, with significant difference before and after training ( $p < 0.05$ ). In the test of 300 meters, the average score after training was shortened by 0.52 seconds, the variance increased by 0.01, and the score before and after training was significantly different ( $p < 0.05$ ). In the first half of 400 meters, the average score after training was shortened by 0.29 seconds, the variance increased by 0.01, and there was no significant difference before and after training ( $p > 0.05$ ). In the latter half of 400 meters, the average score after training shortened by 0.31 seconds, the variance increased by 0.01, and there was a significant difference before and after training ( $p < 0.05$ ). In the 400-meter race, the average score after training shortened by 0.48 seconds, the variance increased by 0.03, and there was a significant difference before and after training ( $p < 0.05$ ). In the 600 meter race, the average time after training was shortened by 1.39 seconds, and the variance was increased by 0.14, with significant difference between the scores before and after training ( $p < 0.05$ ). It can be seen that through the special speed endurance training, except for the first half of 400 meters, the test subjects have significantly improved the performance of each test item, and the difference between the team members is not large, and the overall improvement effect is good, indicating that the special speed endurance experimental training program can effectively improve the special speed endurance of senior three sports students in men's 400 meters running.

3.3.1.2 Comparative analysis of general speed endurance test

Table 5: Comparison of general speed endurance before and after experimental training (in seconds)

Test items	testing time	Student1	Student2	Student3	Student4	Student5	Student6	Student7	Student8
Weights Jump rope (pcs)	Pre-training	172	172	173	168	169	166	172	174
	after training	184	189	185	182	187	172	179	183
	difference	-12	-17	-12	-14	-18	-6	-7	-9
Thigh Fold Swing (pcs)	Pre-training	34	36	37	32	34	35	34	37
	after training	38	41	40	37	36	37	38	41
	difference	-4	-5	-3	-5	-2	-2	-4	-4
Weighted in-place leg raises (pcs)	Pre-training	53	56	52	54	52	53	54	55
	after training	67	66	64	62	63	64	61	68
	difference	-14	-10	-12	-8	-11	-11	-7	-13
Variable Distance Folding run (seconds)	Pre-training	49.29	48.28	49.15	49.74	49.91	49.98	49.73	48.65
	after training	49.11	48.14	49.10	49.59	49.72	49.83	49.56	48.44
	difference	0.18	0.14	0.05	0.15	0.19	0.15	0.17	0.21
Ten jumps (metres)	Pre-training	22.11	22.78	21.85	21.39	21.18	20.67	21.69	22.48
	after training	23.99	24.15	22.97	23.18	22.79	21.94	22.90	24.12
	difference	-1.88	-1.37	-1.12	-1.79	-1.61	-1.27	-1.21	-1.64

Table 5: Comparison of general speed endurance (in seconds) before and after experimental training (continued)

Test items	testing time	Student9	Student 10	Student 11	Student 12	Student 13	Student 14	average value	variance	p
Weights Jump rope (pcs)	Pre-training	169	175	172	164	166	157	169.21	21.45	0.00
	after training	181	188	183	178	185	167	181.64	34.52	
	difference	-12	-13	-11	-14	-19	-10	-12.43	13.67	
Thigh Fold Swing (pcs)	Pre-training	33	36	35	32	33	31	34.21	3.31	0.00
	after training	36	39	38	35	37	33	37.57	4.67	
	difference	-3	-3	-3	-3	-4	-2	-3.36	0.94	
Weighted in-place leg raises (pcs)	Pre-training	54	54	55	53	54	52	53.64	1.37	0.00
	after training	62	67	60	61	60	59	63.14	7.98	
	difference	-8	-13	-5	-8	-6	-7	-9.50	7.68	
Variable Distance Folding run (seconds)	Pre-training	49.26	48.31	49.18	49.79	49.88	49.98	49.37	0.33	0.48
	after training	49.11	48.16	49.05	49.54	49.70	49.81	49.20	0.32	
	difference	0.15	0.15	0.13	0.25	0.18	0.17	0.16	0.00	
Ten jumps (metres)	Pre-training	22.13	22.84	21.93	21.37	21.22	20.89	21.75	0.42	0.00
	after training	23.96	24.17	22.99	23.28	22.85	22.36	23.26	0.47	
	difference	-1.83	-1.33	-1.06	-1.91	-1.63	-1.47	-1.51	0.08	

For the test of general speed endurance, the test methods of weight-bearing jump rope, thigh folding swing, weight-bearing high leg lift in place, variable distance running back and forth, and 10-step jumping were adopted to measure the performance of 14 senior three male sports students before and after the special experimental training of 400-meter running, and the measurement results are shown in Table 5.

As can be seen from the table, the scores of all test items of all 14 students have improved to

varying degrees after training. Among them, in the weight-bearing jump rope test, the average score after training increased by 12.43, the variance increased by 13.67, and there was a significant difference between the scores before and after training ( $p < 0.05$ ). In the thigh folding and swinging test, the average score after training increased by 3.36 points, the variance increased by 0.94, and the score before and after training had a significant difference ( $p < 0.05$ ). In the test of weight bearing in place high leg lift, the average score after training increased by 9.50, the variance increased by 7.68, and the scores before and after training had a significant difference ( $p < 0.05$ ). In the variable distance return race, the average score after training was shortened by 0.16 seconds, the variance remained unchanged, and there was no significant difference between the scores before and after training ( $p > 0.05$ ), indicating that the experimental training content had little effect on improving the agility of athletes. In the 10th grade jump event, the average score after training increased by 1.51 meters, the variance increased by 0.08, and there was a significant difference between the scores before and after training ( $p < 0.05$ ). It can be seen that through general speed endurance training, in addition to the variable distance return run, the results of each test item of the test subjects have been significantly improved, and the gap between the team members has increased, and the overall improvement effect is good. On the whole, the general speed endurance training program in the experiment can effectively improve the general speed endurance of senior three sports students specialized in men's 400 meters running.

#### 4. Summary

The experimental training program is designed in combination with physical fitness, training objectives and 400-meter running energy supply rules for senior three male sports students. The training content includes general speed endurance, special speed endurance, speed, strength and endurance training, and fully considers the pertinence, comprehensiveness, diversity and playfulness of the training content. The experimental results show that through speed endurance training (special speed endurance training and general speed endurance training), the test subjects have significantly improved the performance of most of the test items, and the difference between the special speed endurance of the team members has little change, but the difference between the general speed endurance has a certain change, and the overall improvement effect is good. It shows that the speed endurance experimental training scheme can effectively improve the speed endurance level of the high school sports students specialized in men's 400 meters running.

#### 5. Discussion

In the organization of the speed endurance training of men's 400-meter running special high school sports students, we should pay attention to the pertinence, diversity and games of training methods, and at the same time, we should coordinate the balanced development between speed endurance and speed, strength and endurance training, in addition, we should pay attention to the comprehensive training of physical fitness, psychology and technical tactics of good athletes. At the same time, it is necessary to make full use of the relevant policies of the national and local governments, pay close attention to the construction of the coaching team, effectively use school resources to provide better training conditions and training environment for athletes, and speed up the construction of China's men's 400-meter running special high school sports students training evaluation and diagnosis system to provide reference and guidance for better 400-meter running training.

#### References

- [1] Dai Ming-hui, XIAO Wen-Ge, Long Bin. Study on the relationship between division distance and speed distribution of elite Men 400-meter runners [J]. *Journal of Wuhan University of Physical Education*, 2019, 53(7):5.
- [2] Gu Jing. Analysis on the rhythm and Energy Supply characteristics of 400m sprint in men [J]. *Quick Reading Magazine*, 2016.
- [3] Yang Huizhen. Analysis on speed characteristics of Chinese excellent female 400-meter runner Yang Huizhen [D]. Beijing: Beijing Sport University, Liaoning Sports Science and Technology, 2019.
- [4] Xu Chunxia, Shi Lei, Shi Shengying. A study on the regulation of the competitive ability of the 400-meter training members of the National Women's Track and Field Team for the Postponed preparation of the Tokyo Olympic Games [C]. 12th National Sports Science Congress, 2022, 03.
- [5] Zhu Yihong, Su Yiping. Analysis of Endurance characteristics and Training methods of 400m



*Running women [J]. Sports Training Science, 2019, 21(11):53-55.*

[6] Gong Hui. *Study on the full speed and Training Program of Wu Yuang, an excellent Chinese male 400-meter runner [D]. Nanchang: Jiangxi Science and Technology Normal University, 2021.*

[7] Xu Haoran, Yin Feifei, LI Fuyou. *Special characteristics of 400-meter running in track and field and the combination training method of developing speed and endurance [J]. Sports Vision, 2022, (11): 113-115.*

[8] Wang Weihua. *Features and Training Points of 400m running events [J]. Sports Vision, 2020, (11): 65-66.*