# Studies on the accuracy of sense of speed in sprint

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**Abstract:** With the ever-developing track and field athletics, athletes have significantly improved their performance. Based on the data analysis of the previous sprinters' performances, it can be seen that athletes' accurate understanding of the sense of speed during high speed running in sprint can effectively help the athletes to adjust their sprint skills and the coordination of muscle group, thus enhancing their competitive ability and giving full play to all strength. This paper will discuss how to improve the accuracy of the sprinter's sense of speed through basic training, and technical analysis of several sprinters' competition data for a direct understanding of the decisive role of the accuracy of the sense of speed in the whole sprint competition.

## 1. Introduction

Sprint is a small part of athletics mainly including 50-meter dash, 100-meter dash, 200-meter dash, 4 x 100 meter dash. There are two modes, individual race and relay race, in which the winner of the competition is determined by recording the time taken by the competitors to run the specified distance at the highest speed. Due to the particularity of sprinting, athletes must complete the competition by running at the speed of body extreme. Each athlete will approximately estimate their own running speed in the competition to allocate physical strength and control the running rhythm, thus guaranteeing full play of their dashing strength and avoiding accidents. Based on the accurate sense of their own sprint speed in daily training, athletes can continuously strengthen their control of the sense of speed, grasp the sense of movement and the sprint skills to be performed at this speed, the breathing rhythm to be adjusted, the coordination of muscle group, and changes in psychological quality for comprehensive combination so that athletes can play normally in the game and obtain a good competition result with a good psychological state, sufficient energy and correct control of speed in the whole competition.

## 2. Specific measures to improve the accuracy of sense of speed in sprint

### 2.1 Formulate appropriate load training schemes

The first step is to test the sprinter's physical condition, set the number of times of athlete's high knee lift in one minute, the time the time that athlete can run at the maximum speed and the instantaneous value of the highest speed. It is feasible to add certain training skills into the subsequent training of preloading force and the explosive force so as to improve sprinter's basic capacities. The leg muscle circumference of sprinter will affect competition to a certain extent. After weight-bearing training, the circumference of the muscle group can be effectively increased, thus helping athletes to improve core explosive power and the reaction mechanism at the time of starting. At the same time, muscle fibers in response to changes in preload resistance will cause the local volume of muscle fibers to expand, which is generally known as building muscles. The continuous growth of muscle fibers can promote the increase of muscle cross-section and muscle circumference. The complementary increase of muscle fiber, muscle cross-section, and muscle circumference will be beneficial for sprinters to enhance their core explosive power and endurance.

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### 2.2 Training methods of running at maximum speed in sprint

The particularity of the time and speed of sprint requires athletes to conduct continuous short-term exercise at the maximum speed, which is a challenge to athlete's physiological limits. In daily training at the maximum speed, we need to formulate training schemes of reasonable maximum speed combined with athletes' physiological properties.

It can be seen from Table 1 that sprinters receive short-time training at the maximum speed under the circumstance of sprint training in the anaerobic respiratory physiological metabolism for 30-60 meters, which can continuously improve athletes' maximum speed. Keeping the speed can help them to obtain a specific sense of speed during running.

Table 1 Sprinter's training level

| Classification | Metabolic function | Scheme | Main functions | Time plan |
|---|---|---|---|---|
| 1 | Aerobic exercise | Fast running | Intensify core strength | Once a week |
| 2 | Aerobic plus anaerobic exercise | 500m | Adjust body | Daily training |
| 3 | Anaerobic exercise | 250m | Increase running frequency | Daily training |
| 4 | Anaerobic exercise | Fast starting | Improve reacting ability | Interval training |

After sprint training for a while, athletes were asked to relax muscle groups. After the relaxation, the athlete's endurance, explosive power and maximum speed have changed, as shown in Table 2

Table 2 Changes in athletes' athletic ability after relaxing and resting

| Time range | Muscle ability |
|---|---|
| 1 | Ability declines |
| 2 | Endurance declines |
| 3 | Remain unchanged |
| 4 | Improve significantly |

There exist different relationship changes for different sprint items and corresponding rest time. The physical energy consumption in 100-meters sprint and relay race is different. The specific experimental data is shown in Table 3:

Table 3 the effect of different training and relaxation times

| Item | Muscle changes corresponding to different items | Corresponding effect |
|---|---|---|
| 1 | Continuously decline | Speed remains unchanged |
| 2 | Endurance declines | Running speed is improved |
| 3 | Slow progress | The overall speed reduces |
| 4 | No change | No effect |

### 2.3 The correlation between stride frequency and step length in sprint

Athlete's stride frequency and step length are important factors affecting the athletes' performance in sprint. The whole competition is a running process combined with four stages, that is, starting, accelerative running, midway running and sprinting. In the whole process, athlete's stride frequency and step length are in a process of acceleration and growth.

The training method to improve the pace mainly include reducing the time of body staying in the air, more contact between the foot and the ground, that is, speedup of the step change efficiency. In the process of extending the step length, athlete's step length during running can be improved by increasing the swing frequency of the hip joint, intensifying the strength of back-kick muscles and improving sprinting skills.

### 2.4 Specific training schemes for sprinters' core strength

The core strength in sprinting is crucially important. How to improve athletes' core strength has become a new problem for coaches. Next, we will conduct a systematic evaluation and training for

athletes’ core strengths.

Experimental subject: 12 track and field athletes.

Experimental scheme: Three-week training and data test record of 12 athletes’ core strength was conducted. The training results were evaluated for 30 minutes each time after the end of the training. Two athletes composed a group to record the test data of each other and then provided feedback to the teacher.

Experimental implementation: The core strength training was divided into four stages. At each training stag, the athletes were required to complete according to the prescribed standards. The specific training techniques are shown in Table 4:

Table 4 Core strength training plan

| Different stages | Corresponding method |
|---|---|
| 1 | Side plank |
| 2 | Sit-up |
| 3 | Push-up |
| 4 | Weight-bearing squat |

Test records: athletes are asked to use two ways of running, 50-meters accelerative running and the 100-meters count run. In addition to the time of weight-bearing squat and the loading mass, the test data of all athletes are recorded.

Data analysis: In conclusion, after core strength training after a period of time, athletes’ sprinting ability has been greatly improved. Basic barbell jerk, weight-bearing squat and jump in place have substantially intensified sprinters’ core strength.

### 2.5 Application of intelligent close-fitting chip in sprint

With the continuous development of information technology, intelligent chips have been widely applied in track and field sprint. By installing the intelligent chip on the bottom of the athlete's sneakers, we can collect athletes’ data in each competition from the chip, and conduct statistics of the stride frequency, step length, step number, the time from acceleration to the maximum speed, and the time used in transitional period, the time used for final dashing. Then, we can formulate more efficient and scientific training schemes for athletes, and continuously improve the athlete's sprint comprehensive ability by strengthening the athlete's specialty and perfecting the technical weaknesses. Through data analysis, athletes can also directly realize their own strengths and weaknesses, give full play to their all power with accurate control over the sense of speed, and set high requirements for themselves.

### 2.6 Intensive training for sprinters' psychological quality

Sprinters’ psychological quality is also a key issue in competition. Unreasonable dredging of sprinters’ psychological pressure will affect the competition performance. It is not serious if some experienced sprinters are nervous. But some newcomers in each competition generally have outstanding ability to enter the finals. But psychological pressure causes their bad performance. Therefore, before the start of the competition, it is necessary for new sprinters to consult senior sprinters with rich practical experience. By imparting of experience, new athletes cannot only gain new understanding of sprinting skills, but also learn a lot of methods to relieve tension before actual competition. With a good psychological state, sprinters can ensure the accurate control of their sense of speed in the competition, and avoid any technical errors and speed abnormality.

## 3. Technical analysis of athlete’s competition records

### 3.1 Analysis of Su Bingtian’s techniques in the hundred-meter dash

Su Bingtian’s 10-second breakthroughs in 100 meters sprint in 2015 has led China's atheletics industry to a new development direction. With similar height of Bolt, Su Bingtian does not have a step length as long as Bolt's. But his higher stride frequency has won some advantages for himself.

We can extend the step length by shortening the time and contact area of single-step landing. According to data analysis indexes, Su Bingtian's single-step buffer landing area is 0.35 meters, while Bolt's single-step landing area is 0.42 meters, which obviously show the difference between Bolt and Su Bingtian in stride frequency. To improve Su Bingtian's stride frequency, it is feasible to strengthen Su Bingtian's back-kick force, single stride swinging frequency, and increase the amplitude of swinging forward. It still requires core basic strength training to increase the back-kick strength, improve muscle training to ensure enough back-kick strength in actual competition, and increase step length to shorten the time consumed by the competition. It requires step-by-step actual daily training to increase the distance of single-step swinging and the force of swinging forward. As temporary skills cannot help to solve urgent problems, we need to do solid foundation work.

### 3.2 Analysis of Bolt's techniques in the hundred-meter dash

Bolt as an excellent and sTable sprinter not only owns outstanding physical fitness but also applies competition skills adeptly. Bolt's mid-range maximum speed stabilization time is very long, which means he can run stably for a long time at the highest speed, thus opening the distance with other athletes in the middle. Bolt's step length is also a huge advantage. Technical statistics show that Bolt's single-step touchdown distance is 0.42 meters, a little larger than Chinese and foreign excellent sprinters, which means his personal step length is a little bit larger than other athletes.

Bolt's single-step back-kick distance also maintains world's leading status. Chinese sprinter Su Bingtian's single-step back-kick distance is 0.02 meters shorter than Bolt's, indicating that Bolt's stride is very large very sTable

### 3.3 Analysis of Zhang Peimeng's techniques in the hundred-meter dash

Zhang Peimeng has certain gap between the stride frequency and the step length in 100-meters sprint. According to the technical statistics of Incheon Asian Games, Su Bingtian's 100-meter step length was 1.192 meters, and Zhang Peimeng's 100-meter step length was 1.156 meters. , and Bolt's step length was 1.245 meters. For step frequency consumed in 100 meters sprint, Su Bingtian's step frequency was 4.526 steps/S, Zhang Peimeng's step frequency was 4.576 steps/S, and Bolt's step frequency was 4.278 steps/S. In terms of stride frequency, Bolt's step frequency was not as fast as Zhang Peimeng and Su Bingtian, but he has larger step length than both. Therefore, the step length is a technical problem limiting Chinese sprinters' ability to make breakthroughs at this stage.

### 3.4 Technical differences and similarities of above three athletes

Table 5 Athletes' competition data statistics

| Athlete | Height | Stride frequency | Step length | Average stride frequency | Average step length | Total step number |
|---|---|---|---|---|---|---|
| Bolt | 1.96m | High | 1.244m | 4.278 step/second | 2.44m | 40.96 steps |
| Su Bingtian | 1.72m | Medium | 1.191m | 4.826 step/second | 2.05m | 48.74 steps |
| Zhang Peimeng | 1.86m | Low | 1.157m | 4.576 step/second | 2.15m | 46.58 steps |

The correlation and data of height, total step number, average step length, and average stride frequency of above three athletes are shown in Table 5. It can be seen that the technical weaknesses of China's sprinting athletes and international elite athletes, and it is necessary to adopt specialized personal management training model to solve the special problem in future training, strive to improve China's sprinting athletes' key techniques.

### 3.5 Development direction of the accuracy of sense of speed in future sprint

In future sprint training, it is necessary to carry out quantitative training according to some training schemes so as to enhance the training effect, improve the dull and repetitive training, and stimulate athletes' strong desire for the medals and longingness for victory. By establishing a simple and fast programmed training system for athletes, and perfectly integrating all training aspects, the effect of each training has been improved. In terms of the overall effect, sprinters' athletic ability has been

significantly improved. In future training and psychological counseling for competition, it is feasible to combine training and rest, ask experienced senior athletes to comfort new athletes to quickly improve new athletes' competitive ability.

## 4. Summary

To sum up, we have learned that differences between China's sprinting techniques and some sprint skills in foreign advanced countries will influence athlete's control over the accuracy of the sense of speed. To solve the practical problem, we have proposed improvement solutions combined with actual conditions, and implemented the effective measures in actual training. By doing so, Chinese sprinters' core competence will be greatly enhanced, and in the future, they can make unremitting endeavor for winning big prizes in China's athletics circles.

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