Based on The Physiological Performance Test of Sprinters Through Indoor Treadmill

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Abstract. The situation of sprint students in Northwest China is generally low, but through long-term systematic training, sprint quality has made significant progress, especially with the use of sprint training equipment, the training effect is more remarkable. High-intensity special technical training is the main reason for the obvious decrease of Hb value of sprint students in Northwest China, aiming at evaluating the scientificity and rationality of pre-competition training load and functional state. Fifteen sprinters in Northwest China were trained to monitor biochemical indicators such as hemoglobin (Hb), creatine kinase (CK), blood urea (BU) and testosterone (T) during eight weeks of Pre-competition training. Throughout the pre-competition training period, the T value of male and female athletes decreased first and then increased steadily, which was at a higher level before the competition. 1. The major reason for the significant increase of BU value of Sprinters in Northwest China is the special quality training with large amount of exercise. 2. This experiment can improve the training level of Sprinters in Northwest China, which may be related to the fact that the subjects have not received specialized systematic training before. The experimental results show that the training effect of training instruments is the most remarkable. 3. Athletes'T value is at a higher level before the competition, reflecting a better training effect.

1. Introduction
Every technical innovation of sprint, every improvement of training equipment, or the upgrading of competition venues, can promote the improvement of sprint performance. For example, the use of the starting gear in 1936 was the first leap in sprint performance; the plastic runway first laid by 3M Company in Mexico at the 19th Olympic Games in 1968; and the continuous improvement of running shoes, all kept the world sprint record. Our country sprint mainly relies on the traditional way of special training, such as dragging and weighting, artificial kicking and pulling rubber band, fixed running, etc. It mainly relies on the coach to observe and correct the wrong movements of athletes with naked eyes. There are too many human interference factors to reflect the real situation in the
competition. There are many sprint training instruments abroad, such as dragging and pulling special deceleration parachute, elbow and knee joint fixed rubber strip manual dragging and running, ankle joint adjustable ramp board exerciser. Its prominent feature is to create the highest speed. Lanzhou Industry and Equipment Co.Ltd, Lanzhou University of technology Zhang Wanjun studied some model identification control systems [13-28] of flexible training equipment and control methods. Since the practitioner does not have forward sliding power on the ground, the front of the ground is not able to stretch the cross fork [29]. Based on the analysis of the size and direction of leg strength of sprinters during running, a professional sprint training machine is developed to enable athletes to develop the best speed strength, enable coaches to adjust the training methods more scientifically, better tap the potential of athletes, and provide scientific training equipment for improving sports performance.

By means of literature data, mathematical statistics and experimental methods, the feasibility analysis of patented products for invention authorization is carried out. The experimental results show that the hip joint trainer has a significant role.

2. Research methods

2.1. Documentation method
Taking the training of 15 sprint students in Northwest China as the research object.

2.2. Testing Indicators and Methods
Elbow venous blood was drawn fasting before morning training in the 8th, 6th, 5th, 4th, 3rd and 1st week before competition Test.

2.3. Mathematical statistics
All data were analyzed by SPSS 19.0 statistical software and Microsoft Excel 2007. The results were expressed as mean (+standard deviation). The data of different stages were tested by paired sample T test. The significant difference and very significant difference were determined as P < 0.05 and P < 0.01, respectively.

3. Structural characteristics of flexible training equipment for two legs
Since the practitioner does not have forward sliding power on the ground, the effect is not effective. Three-dimensional diagram of a flexible trainer for two legs, As is shown in Figure.1.

![Fig. 1 Structural schematic diagram of sprint training follow-up exercise device.](image-url)
In the Fig.1: 1, processor; 2, slide body; 3, support foot; 4, disc brake; 5, slide rail; 6, piston; 7, control device.

Control device of Flexible Trainer for Double Legs, As is shown in Figure.2.

![Control device of Flexible Trainer for Double Legs.](image)

In the Fig.2: 8, shell; 9, Switch button; 10, spring; 11, friction plat.

Treadmill training venue for sprint training, As is shown in Figure.3.

![Treadmill training venue for sprint training.](image)

4. Process of sprint training equipment training
Strength is the basis of sport and the key for sprinters to master skills and improve speed. All kinds of training methods and means must be conducive to the transfer, exertion and utilization of strength quality to sprint. In the aspect of strength training, we usually adopt the method of increasing the
weight, running training with sandbags on the leg, or muscle training with elastic bands on the leg injuries and at rest. These two training methods can train the leg muscle strength, but in the case of weight bearing, the load is mostly downward, and the effect of the muscle group cannot be the best. There are some shortcomings in the power exerted in straight running and the training in static state cannot be well combined with running state. Negative force is the resistance that hinders the rapid progress of athletes, and they get strength training in each running process.

When the invention is in use, two segments of slideways suitable for length should be installed on both sides of the runway. The two slideways are parallel to each other and to the plane of the runway, so as to ensure that the friction force acts in the direction of resistance to the greatest extent. In this example, two disc brakes are installed at the front end of two legs at the bottom of the taxiing body to control the operation of the taxiing body. If they are installed at the back side, a certain connection strength between them is required. Therefore, in this example, the disc brakes are installed at the front end of the taxiing body corresponding to the height of the slide rail 1, and the friction force can be produced by the contact of two planes. Because of sliding friction, the wear of contact surface is relatively large. Two-disc brakes are set to reduce the working load of one-disc brake and prolong its service life. At the same time, the force of sliding body can be balanced. The shape of slideway or friction disc can also be changed to increase the friction contact area and enhance stability, such as making the friction disc into an arc which coincides with the outer surface of slideway. The resistance can be tested to meet the requirements for athletes to train.

5. Results and analysis
In our lab, analysis of experimental data before and after experiment in different groups. Our lab, As is shown in Fig.4.

![Fig. 4 Our lab.](image)

5.1. Pre-competition Training Program
Special quality training stage is 8-6 weeks before the competition, special technical training stage is 5-3 weeks, pre-competition training stage is 2-1 weeks.

5.2. Test items
Hemoglobin was determined by methemoglobin cyanide. The test instrument was EPPENDORF6124 semi-automatic biochemical analyzer. The test reagent was Tianjin Gaoke Wenqi's solution.
Serum creatine kinase was determined by EPPENDORF6124 semi-automatic biochemical analyzer. The test reagent was the CK kit of Zhongsheng Beizhong Biotechnology Co., Ltd. and the N-acetylcysteine method was used.

Serum creatine kinase was determined by EPPENDORF6124 semi-automatic biochemical analyzer. The test reagent was the CK kit of Zhongsheng Beizhong Biotechnology Co., Ltd. and the N-acetylcysteine method was used.

Serum testosterone was determined by radioimmunoassay. The semi-automatic biochemical analyzer EPPENDORF 6124 was used to test the serum testosterone kit SEROZYME, i.e. anti-testosterone reagent, testosterone derivatives, standard solution, cleaning solution, matrix solution, termination solution, etc.

All data were analyzed by SPSS 19.0 statistical software and Microsoft Excel 2007. The results were expressed as mean (+standard deviation). The data of different stages were tested by paired sample T test. The significant difference and very significant difference were determined as $P < 0.05$ and $P < 0.01$, respectively.

5.3. Hb change
As shown is Fig.5, students' Hb values are in normal range during pre-competition training. Fourth and third weeks for male students compared with the baseline value in the 8th week, the Hb value decreased significantly ($P < 0.05$), and the lowest value in the 4th week. The Hb value of female students in the third week was significantly lower than that in the eighth week ($P < 0.05$).

Changes of Hb in Sprint of Northwest Students during Pre-competition Training, As is shown in Fig.5.

![Fig. 5 Changes of Hb in Sprint of Northwest Students during Pre-competition Training.](image)

5.4. CK Change
Changes of CK in Sprint of Northwest Students during Pre-competition Training, As is shown in Fig.6.
Fig. 6 Changes of CK in Sprint of Northwest Students during Pre-competition Training.

Fig. 6. Compared with the baseline values of the 8th week, the CK activity of male students increased significantly in the 6th and 5th week (P < 0.01), and significantly in the 4th, 3rd and 1st week (P < 0.05). Compared with the baseline values of the eighth week, CK activity in the sixth, fifth, fourth and third week of female students increased significantly (P < 0.05).

5.5. T Change
As shown in Fig. 7, during pre-competition training, the T level of athletes is within the normal range. Changes of T in Sprint of Northwest Woman Students during Pre-competition Training, As is shown in Fig. 7.

Fig. 7 Changes of T in Sprint of Northwest Woman Students during Pre-competition Training.
Changes of T in Sprint of NorthwestMan Students during Pre-competition Training, As is shown in Fig.8.

![Graph showing changes of T](image)

**Fig. 8** Changes of T in Sprint of NorthwestMan Students during Pre-competition Training.

The test value of T for male students is relatively stable, and there is no significant difference between the test value in the next few weeks and the baseline value in the eighth week, among which the value in the fifth week is the lowest. Compared with the eighth week, the T value of female students in the fifth week decreased significantly (P < 0.05).

As can be seen from Fig.7-8, from the analysis of the T value change of Woman students in the whole training stage, Woman students are not adapted to the training plan of coaches and need to be adjusted.

6. Reasons for Change of Load and Function Monitoring Indicators

6.1. Analysis of Hb Change

Hb can better reflect the training load and the degree of fatigue recovery, and it is an important indicator of athletes' physical function monitoring [6]. The normal range of Hb was 12-16 g/dl for males and 11-15 g/dl for females. The intensity of exercise is an important factor affecting the concentration of Hb in athletes. In the main stage of special quality training from the 8th to the 6th week, the Hb values of both male and female students decreased first and then increased, but there was no significant change.

6.2. CK Change Analysis

CK activity is a sensitive biochemical index for evaluating body function, enduring stimulation of muscles, understanding micro-injury of skeletal muscles and their adaptive recovery [8-9]. The results showed that CK activity changed greatly after training in high impact sports events [10]. Gender and body shape were also important factors affecting CK activity [11-12]. From the 8th week to the 6th week, it can be seen that the change trend of CK of male and female students is basically the same, showing an upward trend.

6.3. T-change analysis

T level is often used as an index to understand the anabolic state of athletes, to judge the fatigue degree and competitive state of athletes. Long-term and heavy-load exercise will cause the decline of T.
Research shows that the better the athlete's competitive state, the higher the basic value of T. Therefore, the level of T before competition is very important for athletes to achieve good results in the competition. The T value of male and female students in pre-competition training decreased first and then increased.

7. Summary
(1) The situation of sprint students in Northwest China is generally low, but through long-term systematic training, sprint quality has made significant progress, especially by using sprint training equipment, the training effect is more remarkable. High intensity special technical training is the main reason for the obvious decrease of Hb value of sprint students in Northwest China.
(2) Specific quality training, especially strength training, can easily lead to a significant increase in CK activity of Sprinters in Northwest China.
(3) The special quality training with large amount of exercise is the main reason for the obvious increase of BU value of sprint students in Northwest China. This experiment can improve the training level of Sprinters in Northwest China, which may be related to the fact that the subjects have not received specialized systematic training before, so that 32 weeks of stretching exercises have a more profound stimulation on beginners. The experimental results show that the training effect of training equipment is the most remarkable.
(4) From the analysis of the BU value change of Woman students in the whole training stage, Woman students are not adapted to the training plan of coaches and need to be adjusted.
(5) Athletes T value is at a higher level before the competition, reflecting a better training effect.

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