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The Correction of the Frequency and Length of Running Step in Sprinters' Preparation

Alexander I. Chikurov* and Valentin I. Fedorov
Siberian Federal University
79 Svobodny, Krasnoyarsk, 660041 Russia [1]

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The purpose of the present work is to justify the use of specialized methods of exercises in sprinters' training. These exercises use asymmetric force actions in high-speed running by means of weighting down on one leg. The change of the local force actions, by adding extra weight to the lower limbs, radically alters biomechanism links in creation of forces in the body of an athlete in take-off in the cyclic exercises with maximum intensity. In this case, the capacity of non-core muscles increases within the motions which are consistent with the functioning of the main parts of the body. And the available intensity of the selected exercises generally increases as well. And that, ultimately, leads to a higher training effect.
The basic difference from the classic examples of the weights on both legs is that the use of asymmetric force action allows sportsmen to exercise with more frequent motions.
Speed regulation and "speed barrier" can be avoided by using recurrence of high-speed racing with asymmetric power in the training process impacts in the form of weights on one leg. Due to the difficult conditions, the functional ability of the athlete cannot fully adapt to this exercise. However, it leads to improvement of special strength training in natural conditions of doing a competitive exercise.
The given technique of using an asymmetric power influence in the race makes it possible to change the ratio of length and frequency of the running step by intensifying the force component in the whole structure of movements at the same speed of movement. In general, the proposed method will provide the increase in athletic performance due to the simultaneous increase of both rates in speed running, both the frequency and stride length.

Keywords: Asymmetric physical impact, *frequency and stride length, high-speed* barrier, sprint,

Introduction

The search for the new reserves to improve the training process by means of technical equipment and new technologies is a very urgent problem in the theory and methodology of sports training aimed at preparing athletes specializing in sprint (Abrosimov, 1977; Avanesov, 2007; Bugaev, 1998; Maiskiy, 2007). Topicality of the matter is due to difficulties associated with the inability to further increase sports performance, due to the known means and methods of training. (Avanesov, 1987; Alabin, 1984; Bondarchuk, 2007).

Studies of P.I. Cherkashin (1957), V.I. Oleynikov (1989) and M.A. Ilyin (2002) are aimed at finding these specific exercises,

* Corresponding author E-mail address: Chikurov71@mail.ru

which are as close as possible to competitive activity on the kinematic, dynamic and energetic performance. They believe that these exercises have the greatest coaching influence and at the same time they ensure the improvement both basic physical characteristics and techniques of athletes.

A number of recent works related to the preparation of short-distance runners focus on the development and using of methods of special preparatory exercises, which on one hand increase the efficiency of the motor capacity of athletes, and on the other hand, are the values of the kinematic and dynamic parameters comparable with the structure of competitive exercise (Raed Al Raggad 2000, Ilyin, 2002; Maiskiy, 2007; Popov, 1992; Sergeev, 1999).

Most authors in their studies find it necessary to exclude almost completely the exercise of its biomechanical characteristics not related to the solution of problems in the improvement of technical skill in pre-competitive and competitive stages (Arakelian, 1970; Vovk, 1987; Ratov, 1995).

In this context, it becomes apparent that there is nothing more specific for training of runners over short distances than the use of exercise as the primary running as quickly as possible. And the most effective is the multiple implementation of the high-speed exercise (Gagua, 2001; Pavlova, Kamardina, 2005). Namely, it concerns short distances running with a maximum speed right from the start, running as fast as possible under complicated and relaxed conditions, etc. Using light-weight method or methods of complicated training, the authors do not recommend going far from the speed and rhythm of the planned outcome (Arakelian, 1988; Kozlov, 1984; Ratov, 1982). At the same time, the expected result should be based on the actual functionality of the athlete.

One should start from the challenges facing the athlete at this stage while specifying the goal of training. Y.V. Verkhoshanskiy (1988), G.I. Popov (1992) and I.P. Ratov (1995) believe that athletes should be trained in such a way so as to gradually get those biomechanical, physiological and force rates of the performance of their motor actions, which may lead to increased athletic performance. That is, to seek the correct formulation of running at a maximum speed of movement in sprint training, using the structure of the run, i.e. the rate of the length and frequency of steps in accordance with the planned outcome (Kryazhev, 1988). Exploring the rhythmic movements of the structure-speed runner, sprinter V.V. Abrosimov (1977) recommends the use of such methods of training, in which, while repeating competitive exercises, the biomechanical characteristics of running will be formed exactly for a result that exceeds the initial level of training.

The analysis of scientific literature on the sprinters' training indicate that the repetition of biomechanically sound sport exercises in training is used to fix the motor skill, which is manifested in the form of the basic elements of art (Abrosimov, 1977; Balsevich, 1983; Stepanov, 1977). The use of multiple training in short distance running results in the existing rhythm-speed characteristics of race, even if it occurs with increasing intensity from run to run. Stabilization of motor skill, which represents a positive development in general, carries both a negative consequence in the form of stopping the growth of athletic performance (Petrovskiy, 1978; Filin, 1964).

Due to the multiple repetitions of the same action as quickly as possible, automation of motion is created, based on the formation and consolidation of certain neural processes. This stabilizes the fast repulsive spurt, the frequency of movements of an athlete, hindering the growth rate even when the level of physical and volitional

qualities increases. During such training, however intense and varied they are, some skills and fixed individual movements of a runner are developed. There is a steady rhythm of the running step that is the constancy of the phase repulsion and flight. There are patterns of movements. The so-called high speed barrier, fastened so tightly that it is not easy, even with a significant increase in the qualitative aspects of motor capacity, for example, dynamic forces, elementary indicators of high-speed capabilities, find new movements rational relationship that would exceed, in normal conditions, the steady-state ratio of the length and frequency steps to increase the absolute speed of movement in the distance.

This problem is the most specific for the sprinters and is the result of the techniques. Excessive speed may be set forth movements, their rhythm, effort, and even some spatial characteristics (Primakov, 1981).

Out of this contradiction V.G. Popov (1992) sees the multistage constant retraining in the use of special means of preventing the consolidation of the skill.

It is believed that the variability of the system of training sprinters and the use of specific exercises will form a range of mobility motor skill, and thereby create additional reserves for the further growth of skill athletes (Vovk, 1987; Kozlov, 1984).

However, the methodological approach of using non-standard specialized exercises designed to overcome the symptoms of high-speed barrier is introduced into the practice of fragments (Oleynikov, 1989). Not taken into account in studies of the dependence of specific exercises on the qualifications of athletes, their adequacy to the functionality involved.

To avoid the appearance of stability and speed, "speed barrier", E.S. Ozolin (1986) and V.V. Pertokovskiy (1978) recommend that when performing high-speed exercise to apply the methods that facilitate or difficult ambient conditions.

The fundamental difference of reception difficulties or facilitation of the exercises is to intensify the force or velocity component in the whole structure of movements. The problem of this method lies in the stimulation of neuromuscular tensions at a new qualitative level. The system performance of speed-strength exercises in easier conditions allows athletes to create an auxiliary skill with the speed, which he plans to show in the near future competitions, feel the nuances of the new technology at high speed. Shortness of conditions does not allow the athlete throughout the entire training process is fully adapted to this exercise due to the fact that with increasing running speed increases the power factor of influence on the major muscle groups and this leads to continuous improvement of special strength training.

Changes in the moment of inertia of the foot pit in the implementation of a special racing or running exercise is an effective governing factor. Since the net effect of muscle strength is determined by the moment, great importance is the magnitude of its thrust shoulder as a peripheral mechanism of organization of movements (Kryazhev, Popov, 1988).

If you add extra weight to the limbs, the contribution of changes biomechanism primaries links in promoting the creation of forces in the athlete's body repulsion (Maiskiy, 1969; Aied Berhaim, 1997; Tiup, 1981).

Adding weights to the links, which are consistent with the movement of the operation of the main parts of the body, improves muscle power of the minority and generally increase the intensity of existing exercises selected (Levchenko, 1982; Oreschuk, 1971; Cherkashin, 1957).

In this regard, the great promise seen in the use of weights, arranged or focused on the links

athlete's body, such as how to create an artificial hyper gravity.

The absence of specific experimental studies on the possible use of specialized asymmetric force effects in the cyclic maximum intensity exercise, namely sprinting, taking into account the functioning of artificial patterns of asymmetry was the premise for this study.

The technique of using an asymmetric power influence in the cyclic exercise is advised, namely running. The main idea of the hypothesis is that due to the intensification of the power component in the whole structure of movements, with the same speed of movement will change the ratio of the parameters of running technique.

The asymmetric force effect is achieved by using one leg as a complication of the cuff at the distal end of the shin, not leading to motility feet.

The essence of the action weights as follows: when the runs of neuromuscular apparatus athlete drives the links of the body, in accordance with the technical structure of this exercise. For the femoral and shin muscles is not nothing but a flexor-extensor movements of the joints. If the distal part of the leg is added the additional weight (weights), then doing the same exercise with the same technical indicators to develop the muscles should be greater efforts at reducing the rate determined by the phase relationships. Thus, demands for speed-strength muscles are increased. Adding weight to the links, the movement which has carried out with maximum capacity of the muscles, the result will lead to a reduction of the maximum intensity of the motor speed-power character.

Studies by V.V. Stepanov (1977) and I.M. Kozlova (1984), devoted to the study of mechanisms of regulation of the rate movements, have shown that activation of antagonistic muscle groups enhances the frequency of movements.

The use of asymmetric force action stimulates the performance of exercises with a greater frequency of movement than with weights on both legs.

In the case of repetitive high-speed running with weights is the development of power and speed capabilities athlete in natural conditions of competitive exercise.

I.M. Kozlov, A.V. Samsonov, V.N. Tomilov (2003) pointed to the lack of asymmetry in the performance of cyclical rhythm of work in a constant and maximum rate in their study of the relationship of tempo and rhythm of biomechanical structure of the sports movement.

The amplitudes of the effort, increasing and decreasing time of these efforts, the beginning and completion of the development effort, time of take-off and landing phases have clearly ordered sequence, and are performed with the locking and unlocking phases of leading muscles. If we expand the time complex motion into a linear sequence of simple movements, it appears that each successive simple movement has "memory" of the dynamics and the symmetry of the previous movements, and thus is dependent on him (Samsonov, 1998).

Materials and Methods

The aim of our study is to substantiate and develop scientifically the method of using special exercises with a marked cyclical asymmetry of power influence in the training process of track and field sprinters and to check its effectiveness in experimental way.

The increased number of results is expected to be due to the overcoming "a high-speed limit of motor skill" and a certain reorganization of rhythm-velocity structure of running.

The following tasks were solved:

1. Scientific analysis of methods of preparation of athletes specializing in running for short distances proposed by the predecessors.

2. The study of kinematic characteristics of running with the power impact of asymmetry (running with cuffs (250-300 g) at the distal ends of the shin), used in the training process as a special speed-force exercise and identify the relationship of these characteristics with a sports result in sprinting at 50 and 100m.

3. To work out the methodology for the application of cyclic complexes of special exercises with the possibility of asymmetric effects of power, to determine the method of application of these complexes at different stages of the annual cycle of sprinters' training.

4. To identify the effectiveness of systems designed special exercises with cyclical asymmetry of power influence, as a means of overcoming the manifestations of "speed barrier". To determine the effectiveness of the use of these exercises is to optimize the rhythm-speed performance for short-distance running.

While solving the first problem as a result of teacher observations in the training process, the characteristics of special kinematic cyclic exercises, using force action asymmetrical pattern, have been compared. The cuffs at the distal ends of the shin, which leg didn't have motor function, served as a force impact in the race. The choice of leg work was explained by V.I. Nikitin (1971) in his works, which show that the removal of the power asymmetry in cyclic sports athletes does not lead to negative changes, but rather only contributes to a more harmonious development of the muscle groups of the legs, the convergence in terms of supporting the efforts in the race, improving the structure of rhythm and movement of growth sports and technical results (Nikitin, 1971).

We carried out a preliminary stage of the experiment to determine the influence of the local weights, which is located on the distal parts of the shin on the spatiotemporal characteristics of sprint running technique. The running time of the individual phases of the step and the angles between the links in the body of an athlete in certain phases of the movement were analyzed.

For each athlete, according to the video recording of the running, the comparison of kinematic characteristics of the running step, several runs with a change in the weight of each individual runs (100 to 500 g, weight gain in increments of 100 g) with a standard jog without enforcement. In comparison, there was an optimal choice of (border) complication of weight, even when stored angular characteristics of the running step, but changing rhythm-racing speed parameters. When choosing a value weights, we assumed that running technique sprinters in the changed conditions should not be distorted.

It was found that when running with weights ranging from 1% to 1.5% of body weight, there is no violation of the rhythmic structures and equipment running, even though the speed is reduced by 10%, running the length of steps is reduced by 6%, the frequency of steps is reduced by 4%.

In addressing the second and third tasks were analyzed the literature to produce long-term plan of training for the period of the experiment, as well as for the construction of the scheme week cycle training sessions. Using literary sources, the special structure of the complexes of cyclic exercise with the possibility of asymmetric effects of power and defined method of application of these complexes at different stages of the annual cycle training sprinters was developed. The chosen method of training implied the use of special exercises in training twice a week during the micro cycle, training days with the predominant development of speed.

To solve the fourth problem, pedagogical experiment was conducted; there the subjects were divided into two groups and trained on a single program.

The results of theoretical studies have shown that of all the means used to overcome the barrier at the displays of high-speed sprint semi-skilled, the least studied (not seen a single mention) may be considered in the application of cyclic training micro cycle exercise with a marked asymmetric thrust force action.

In vivo studies were conducted educational training process in order to monitor the collection and compilation of material on the practical use of special speed-strength exercises in the preparation of sprinters, practicing on the stage, in-depth sports specialization.

During the observation the biomechanical parameters of running technique were recorded.

Pedagogical experiment was conducted to determine the influence of special exercises with a marked cyclical asymmetry of power quality impact on the restructuring of rhythmic structure of speed racing.

The experiment was conducted under natural conditions, the training process during the winter racing season, and it lasted for 11 micro cycle weeks from November 2008 to February 2009. The experiment coincided with the winter pre-competitive and competitive stages.

In general 20 female runners took part in this pedagogical experiment. They ran over short distances between the ages 17-21 years (all subjects were students of SFU), divided into two equivalent groups: the experimental and control group (10 athletes in the control group and 10 in the experimental one). The level of athletic skill level was 01.02 in 100m and 200m with athletics experience no more than five years.

The difference on the results of control tests at the beginning of the experiment between the results in the control and experimental groups of athletes are not statistically significant (Fig.1), therefore, it is reasonable to assume that homogeneous groups are chosen with equal training.

Check tests for the sprinters of both groups were in the form of participation in official competitions in accordance with the schedule of the Regional Athletic Federation. The measurements were made using digital video. Test results before the start of the first part of the experiment performed at the opening of the winter racing season that is November. The final test, after the experiment was planned on the main start of the season that is in February. Accuracy of measurements and calculations on the captured video is no more than 0.3% (0.02 to 7.0 for the result) of time and not more than 0.4% in the calculating the number of steps. Due to the fact that the results were compared to the competition at the same distance (50m – winter competitive season), of average running speed for distance was used in the calculation, as well as stride length and frequency of steps.

Training sessions during the experiment carried out with the athletes on one training plans. During the teaching experiment, both groups of athletes have used the methodology developed by the application of special exercises.

In the two training micro cycle used to develop speed. The first high-speed drill had a developing nature, it was repeated in two or three days of speed training, but to a lesser extent ("tonic" training), the whole micro cycle consisted of seven days, including one day of rest.

In training sessions aimed at developing the rate for the experimental group envisaged tasks, using the power of asymmetric effects of orientation (jogging speed and special cyclic-strength training with weights in the form of cuffs (250-300 g) at the distal ends of the shin of one leg). Athletes of the control group used the same special exercises, but without the use of weights.

In the remaining days of training were used for the development of other physical qualities. The effectiveness of the developed theory micro cycle was tested during the teaching experiment.

Table 1: Changes in the experiment in the women's 50m

№	rates	The mean values (x ± m)		Significance of differences within the group
		before the experiment	after the experiment	
The experimental group				
	Step length, m	1,72±0,01	1,75±0,02	P< 0,05
	The frequency step 1/s	4,01±0,04	4,05±0,05	P> 0,05
	Time for 50m	7,27±0,07	7,08±0,06	P< 0,01
Control group				
	Step length, m	1,74±0,01	1,76±0,01	P< 0,05
	The frequency step1/s	3,89±0,04	3,92±0,03	P> 0,05
	Time for 50m	7,39±0,06	7,31±0,05	P< 0,05
Indicators of reliability of differences between groups.				
	Step length, m	P> 0,1	P> 0,05	
	The frequency step1/s	P< 0,05	P< 0,05	
	Time for 50m	P> 0,1	P< 0,05	

Results and discussion

According to the difference in the final testing and monitoring the competition, almost all the sportswomen have improved results in the women's 50 meters, both in experimental and control groups. Therefore, we can consider the chosen method of maximum speed to be effective and increasing results to be fully reliable.

The average rate of performance for running at 50 m from the participants in the experimental group has improved by 1.9 sec. (P <0.01).

In the control group, the average running time is 50 m at 0.08. (P <0.05).

Participants in the experimental group in terms of change were as follows: the average length of a step in the women's 50m has increased by 0.03 m (P <0.05) and the maximum step rate has increased by 0.04 (P> 0.05).

In the control group changes of parameters characterizing the running speed, were as follows: the average length of a step in the women's 50m has increased by 0.02 m (P <0.05) and a maximum frequency of lower limb movements has increased by 0.03 (P <0.05) .

The reliability of the data was determined with t-criterion of the Student's test. The level of significance P <0.05. was taken as the basis.

Conclusions

The analysis of individual data showed that in some cases, the increase of athletic performance was against the background of a significant reduction of more distinctive rates. Thus, the analysis of the data indicates that the method of using the power of asymmetric effects of orientation (jogging speed and special cyclic-strength exercises with weights in the form of cuffs (250-300 g) at the distal ends of the shin of one leg) in the training of short-distance runners, provides a performance increase running speed, mainly due to increase in the length of the running step, and to a lesser degree of frequency steps.

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Коррекция длины и частоты бегового шага при подготовке легкоатлетов-спринтеров

А.И. Чикуров, В.И. Федоров
Сибирский федеральнй университет
Россия 660041, Красноярск, пр. Свободный, 79

Цель представленной работы состоит в обосновании методов применения специализированных упражнений при подготовке спринтеров. Эти упражнения представляют собой использование в скоростном беге асимметричных силовых воздействий в виде отягощения на одной ноге. В циклических упражнениях максимальной интенсивности изменение локальных силовых воздействий путем прибавления дополнительной массы к нижним конечностям кардинальным образом меняет биомеханизм маховых звеньев в создании сил, продвигающих тело спортсмена при отталкивании. При этом, в движениях, которые согласуются с функционированием основных частей тела, повышается мощность работы неосновных мышц и в целом увеличивается имеющаяся интенсивность выбранного упражнения. А это, в конечном итоге, приведет к более высокому тренировочному эффекту.

Принципиальное отличие от классических примеров применения отягощений на обеих ногах состоит в том, что использование асимметричного силового воздействия позволяет выполнить упражнения с большей частотой движений.

Используя в тренировочном процессе многократные повторения скоростного бега с асимметричным силовым воздействием в виде отягощения на одной ноге, можно избежать стабилизации скорости и возникновения "скоростного барьера". За счет затруднения условий функциональные способности спортсмена не могут полностью адаптироваться к этому упражнению. Однако при этом происходит улучшение специальной силовой подготовки в естественных условиях выполнения соревновательного упражнения.

Предлагаемая методика использования асимметричного силового воздействия в беге, позволяет путем интенсификации силового компонента в целостной структуре движений при одной и той же скорости передвижения изменить соотношение длины и частоты бегового шага. В целом, предложенная методика позволит обеспечить прирост спортивной результативности за счет одновременного повышения обоих показателей скорости бега, как частоты, так и длины шага.

Ключевые слова: асимметричное физическое воздействие, частота и длина шага, скоростной барьер, спринт.