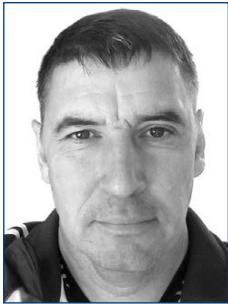




# Optimization of speed qualities in sprinters in the sensitive period of 14-17 years

UDC 796.422.12

PhD, Associate Professor **D.V. Sorokin**<sup>1</sup><sup>1</sup>Russian State Agrarian University – Moscow Timiryazev Agricultural Academy, Moscow

Corresponding author: sorokin\_denis\_08@list.ru

Received by the editorial office on 12.06.2025

## Abstract

**Objective of the study** is to substantiate a training methodology that takes into account age-related characteristics for maximum potential of athletes.

**Methods and structure of the study.** The methodology includes an analysis of modern approaches, such as the development of explosive strength (squats, lunges), improvement of running technique (correction of posture, step rhythm) and reaction training (variable starting signals). Physiological aspects are considered, including hormonal changes (testosterone in boys, estrogen in girls), development of the nervous system and genetic predisposition to fast muscle fibers, as well as psychological factors – motivation and stress resistance.

**Results and conclusions.** The analysis showed that the sensitive period opens up wide opportunities for the development of speed qualities due to the high adaptability of the neuromuscular system. A combination of strength exercises, technical work and starting training significantly improves the indicators. It is necessary to balance loads and recovery, individualize programs and integrate psychological preparation for stress management.

The implementation of adapted plans should be combined with alternating phases and monitoring of the physical condition. Thus, an integrated approach that combines physical development, technical improvement and psychological support is essential for the successful preparation of sprinters and can be used in youth sports to optimize training and minimize the risk of overload.

**Keywords:** speed, sprinters, sensitive period, speed training, running technique, age-related characteristics, revealing the potential of athletes.

**Introduction.** In modern sports, the age of 14-17 years is a critical period for the preparation of young athletes, characterized by significant physiological and psychological changes. This sensitive period provides unique opportunities for the development of physical qualities, especially speed of movement, which is critical for sprinters [6].

The relevance of the study lies in the high ability of the body to adapt and master complex motor skills during this age period. Developing training methods taking into account the age characteristics of athletes allows us to maximize their potential. Errors in the training process can have long-term negative consequences for athletic development [8].

**Objective of the study** is to substantiate the training methods for developing speed in sprinters aged 14-17 years, taking into account their age characteristics.

**Methods and structure of the study.** The study is based on a theoretical analysis of scientific and methodological literature in four types of training methods: traditional strength (TTG), functional coordination (FTG), combined (CTG) and aerobic endurance ( $VO_{2max}$ ), age physiology and sports psychology [1], and also includes an experimental study that provides for pedagogical observation of the training process, testing of athletes' physical qualities, analysis of running technique and monitoring of functional state. Theoretical methods include analysis of scientific literature, generalization of best practices and modeling of the training process. Empirical methods cover pedagogical testing, chronometry, video analysis of running technique and methods of mathematical statistics [2].

The organization of the training process is based on several key areas. Particular attention is paid to the



development of explosive strength through the performance of squats, lunges and deadlifts. An important component is the improvement of running technique, including work on posture and step rhythm. Training of starting reactions and development of coordination abilities are also an integral part of the program. Periodization of loads provides for alternation of intensive training with recovery periods, gradual increase of load taking into account individual characteristics of athletes [4].

The control and assessment system includes several components. The physical condition of athletes is assessed through testing of speed qualities, assessment of strength indicators, monitoring of flexibility and coordination. Technical improvement is monitored through video analysis of running technique, correction of motor actions and assessment of the effectiveness of exercise performance. Psychological preparation is monitored through assessment of the level of motivation, stress resistance and emotional stability [5].

The study is conducted in three stages. During the preparatory stage, subjects are selected, initial testing is conducted, and training programs are developed. The experimental sample included adolescents aged 14 to 17 years, divided into four groups (12 people in each): TTG, FTG, CTG, and a control group (CG) that did not undergo special training. The duration of the experimental cycle was 8 weeks. The main stage is characterized by the implementation of the experimental methodology, regular monitoring of the results, and adjustments to the training process. The final stage includes final testing, analysis of the data obtained, and the formulation of conclusions and recommendations [7].

The criteria for evaluating the effectiveness cover several areas. Physical indicators are assessed by the reaction time to the starting signal, speed over short distances, and explosive strength indicators. Technical parameters are analyzed through the quality of the starting movement, the stability of the running technique, and the efficiency of the arms and legs. Psychological characteristics are assessed by the level of motivation, ability to concentrate, and emotional stability [3]. The developed research methodology allows for a comprehensive study of the process of speed development in young sprinters, taking into account their age characteristics and individual characteristics, which ensures reliable results and the possibility of their practical application in the training process.

**Results and conclusions.** The conducted studies allowed us to identify key features of speed development in sprinters aged 14-17 years. Analysis of the dynamics of indicators during an eight-week training cycle allowed us to evaluate the effectiveness of functional, strength and combined programs presented in the table below [9].

*Main results of the analysis of training results*

| Group | $\Delta$ Time<br>30 m (%) | $\Delta$ Explosive<br>power (%) | $\Delta$ Coordi-<br>nation (%) | $\Delta$ VO <sub>2max</sub><br>(%) |
|-------|---------------------------|---------------------------------|--------------------------------|------------------------------------|
| CTG   | -4.71                     | +8.93                           | +4.10                          | +4.32                              |
| FTG   | -0.92                     | +1.10                           | +4.40                          | +1.85                              |
| TTG   | -2.18                     | +1.43                           | +1.02                          | +0.74                              |
| CG    | -0.15                     | +0.11                           | -0.04                          | +0.10                              |

Physiological aspects have shown that this period is characterized by increased excitability of the nervous system and significant hormonal changes: testosterone levels increase in young men, and estrogen levels in young women. These factors directly affect the development of speed qualities.

The introduction of a comprehensive training method has demonstrated high efficiency, the average time to run a 30-meter distance from a low start has decreased by 4.71%. The combination of strength exercises with stretching and flexibility has significantly improved explosive strength, this indicator has increased by 8.93%. Start reaction training using variable signals has significantly reduced the reaction time to the start signal.

Working on running technique through correcting posture and step rhythm has minimized energy loss. The use of video analysis to correct technical errors has shown high efficiency.

Research has confirmed the important role of psychological factors: motivation and stress resistance significantly influenced the results. Alternating intensive training with recovery periods ensured optimal adaptation of the nervous system and muscles. Taking into account genetic predisposition when developing programs allowed us to achieve better results in athletes with a high percentage of fast muscle fibers.

**Conclusions.** Based on the obtained research results, practical recommendations were formulated for the implementation of adapted training plans taking into account the age characteristics of athletes, periodization of loads and recovery, regular monitoring of physical condition, the use of video analysis of



running technique and the integration of psychological training.

The study confirmed that an integrated approach to developing speed in young sprinters, taking into account physiological, technical and psychological aspects, is the most effective. The sensitive period of 14-17 years provides unique opportunities for forming the basis of physical fitness, including the development of strength, coordination and reactions.

## References

1. Verkhoshansky Yu.V. Osnovy specialnoy fizicheskoy podgotovki sportsmenov. M.: Sovetskiy sport, 2021. 320 p.
2. Volkov V.M. Fizicheskaya podgotovka sportsmena: osnovy teorii i metodiki. M.: Sovetskiy sport, 2012. 216 p.
3. Kots Y.M. Sportivnaya fiziologiya: uchebnik dlya institutov fiz. kultury. Edited by Y.M. Kots. M.: Fizkultura i sport, 1986.
4. Platonov V.N. Sistema podgotovki sportsmenov v olimpiyskom sporte. Obshhaya teoriya i ee prakticheskie prilozheniya. M.: Sovetskiy sport, 2015. 820 p.
5. Seluyanov V.N. Podgotovka beguna na srednie distancii. Moscow: Olympia Press, 2001. 144 p.
6. Solodkov A.S., Sologub E.B. Fiziologiya cheloveka. Obshhaya. Sportivnaya. Vozrastnaya. (Textbook. 2nd ed., revised and enlarged). M.: Olimpiya Press. 2005. 528 p.
7. Upravlenie vosstanovitelnyimi processami pri sportivnoy deyatel'nosti. Editorial Board: Prof. V.M. Volkov (Chief Editor) et al.; Kom. po fiz. kul'ture i sportu pri Sovete Ministrov RSFSR. Smol. gos. in-t fizkultury. Smolensk: 1975. 192 p.
8. Khalansky Yu.N., Sitkevich G.N., Prokopov O.V. Legkaya atletika i metodika prepodavaniya: kurs lekciy. Vitebsk: VGU imeni P.M. Masherova, 2020. 235 p.
9. Liu X., Shao Y., Saha S., Zhao Z., Karmakar D. Maksimizatsiya sprinterskoy podgotovki u podrostkov: sravnitel'nyy analiz funktsional'nogo, tradicionnogo i kombinirovannogo podhodov. *Frontiers in Public Health*. 2025. Vol. 13. Art. 1596381. DOI: 10.3389/fpubh.2025.1596381. (in English).