



# Development of the starting reaction of track and field sprinters using sensory-motor means

UDC 796.015.58



**O.P. Vinogradova**<sup>1</sup>

PhD, Associate Professor **L.V. Morozova**<sup>1</sup>

**T.I. Melnikova**<sup>1</sup>

<sup>1</sup>The Russian Presidential Academy of National Economy and Public Administration, North-Western Institute of Management, St. Petersburg

Corresponding author: sledi84@mail.ru

Received by the editorial office on 12.02.2024

## Abstract

**Objective of the study** was to substantiate the development of the starting reaction using sensory-motor means of special training for female sprinters.

**Methods and structure of the study.** The pedagogical experiment involved female sprinters of the I sports category, CMS (n=10) at the age of 17,5±0,5 years. Temporary indicators of the starting reaction of female sprinters competing in running at a distance of 60 m were considered. A set of special exercises was developed aimed at improving the starting reaction (RT) indicator, and corrections were made to the educational and training process at the special preparatory stage of training female athletes.

**Results and conclusions.** The starting reaction index decreased from 0,207±0,01 s to 0,164±0,01 s. Positive dynamics were achieved through targeted improvement of the neuromuscular response of female athletes. Mobilization stimuli of sensory-motor exercises ensure intensive functional changes in the neuro-functional sphere and improve the coordination structure of the starting actions of female sprinters.

**Keywords:** special training, track and field sprinters, motor reaction time, mobility of nervous processes.

**Introduction.** One of the indicators that influences the success of competitive activity of track and field sprinters is the reaction time at the start. The speed of the motor reaction to the starting signal, which generates the initial impulse of movement, largely determines the outcome of the sports fight, determining the timeliness and rationality of the sprinter's response to changes in competitive conditions. The mechanism for the development of speed-reactive qualities is based on the high mobility of the sprinter's nervous processes [1, 6].

It has been established that the physical training of female sprinters is aimed at developing complex manifestations of speed: reaction time, speed of individual movements and pace of steps [2]. Practice shows that speed qualities in a single complex coor-

dination motor action only indirectly determine the speed of an athlete [4].

The time of the starting reaction from the start signal to the moment the hands are lifted off includes latent and motor periods. The latent period is characterized by the length of time from the start signal to the onset of electrical muscle activity; the motor period is the time from the beginning of pressure on the starting blocks to the lifting of the foot from the support. The integral development of sensory and motor components of a motor reaction is a complex pedagogical task in sprinter training [3, 5].

**Objective of the study** was to development and substantiation of means for improving the sensory-motor starting reaction of track and field sprinters.



**Methods and structure of the study.** The pedagogical experiment involved female sprinters of the I sports category, CMS (n=10) aged  $17,5 \pm 0,5$  years. The training process was carried out using developed means for developing a sensory-motor response to the start signal.

At the first stage, the time indicators of the starting reaction of female sprinters competing in running at a distance of 60 m were studied. Based on the data obtained, a set of special exercises was developed aimed at improving the starting reaction (RT) of female sprinters, and corrections were made to the educational and training process for special preparatory stage of training of female athletes.

The use of means for developing a sensory-motor reaction was based on the use of the surprise factor, in which female athletes, in response to a stimulus, performed predetermined movements or motor actions that corresponded to given conditions.

The exercises used included a variety of auditory and visual stimuli that contributed to the development of reaction speed. The adjustable parameters for performing means of improving the sensory-motor starting reaction were: order, mode and number of repetitions of exercises, number of series, rest intervals.

The content of the means for developing a sensory-motor reaction to the starting signal consisted of exercises:

- performing a start from various starting positions by an audible signal in light conditions;
- exercises for reaction speed with changing the time between the preliminary and executive commands (from 1 to 6 s);
- exit from the start on a visual signal with maximum speed of response;
- performing starting actions in variable situations using additional equipment.

During the study, control and pedagogical testing was carried out to monitor physical fitness indicators: running 10, 30 and 60 m. During testing, the starting

reaction time was determined using contact sensors built into the starting blocks.

**Results of the study and discussion.** The initial time of the starting reaction with an average result in the 60 m run of  $8,01 \pm 0,17$  s varied from 0,20-0,215 ms to 0,178-0,191 ms.

After the experiment, the results of all control tests improved.

The starting reaction rate decreased from  $0,207 \pm 0,01$  s to  $0,164 \pm 0,01$  s, which is 20,8% and is in the zone of optimal values for athletes of this qualification. The positive dynamics of the starting reaction indicators was achieved through the targeted improvement of the neuromuscular reaction. Despite the improvement in the starting reaction of female athletes, the differences before and after the experiment were not statistically significant ( $p > 0,05$ ).

After the experiment, the 10 m running time decreased by 9,9%, which indicates an improvement in the integral manifestation of strength, speed and reactive abilities of track and field athletes. Results in the 30m race improved by 4,7%; in the 60 m run – by 4,3%. The results of control tests before and after the experiment are statistically significant at  $p < 0,05$ , which indicates the effectiveness of using means to improve the sensory-motor starting reaction of female sprinters.

The feasibility of introducing into the process means of improving the sensory-motor starting reaction, helping to reduce the response time to an audio signal, is justified by analyzing the results of the study. The mechanism of action of means of developing a sensory-motor reaction, based on the use of the surprise factor, in which female athletes, in response to a stimulus, perform predetermined movements or motor actions that correspond to given conditions, has shown its effectiveness. Variation of the conditions for performing starting movements is a powerful irritant of the central nervous system, promoting the mobilization of sensory-motor components of the starting response, which leads to improvement of the time

*Dynamics of physical fitness indicators of track and field athletes,  $\bar{X} \pm m$*

| Indicator   | Results          |                  | t    | p        |
|-------------|------------------|------------------|------|----------|
|             | Before           | After            |      |          |
| 10m run, s  | $1,82 \pm 0,06$  | $1,64 \pm 0,09$  | 9    | $< 0,05$ |
| 30 m run, s | $4,65 \pm 0,04$  | $4,43 \pm 0,05$  | 10,6 | $< 0,05$ |
| 60 m run, s | $8,01 \pm 0,08$  | $7,66 \pm 0,08$  | 7,4  | $< 0,05$ |
| RT, s       | $0,207 \pm 0,01$ | $0,164 \pm 0,01$ | 0,43 | $> 0,05$ |



indicators of the start of female sprinters and an improvement in sports results.

**Conclusions.** The results of the conducted criterion study experimentally prove the effectiveness of means of developing a sensory-motor reaction in controlling adaptation mechanisms to the need for an instant response to the start signal when performing sprint exercises. Mobilization stimuli of sensory-motor exercises, maximally oriented towards minimizing the start time, ensure intensive functional changes in the neuro-functional sphere and improve the coordination structure of the starting actions of track and field sprinters.

#### References

1. Bakaev V.V., Ponimasov O.E., Vasilyeva E.A. Operatsionnyye efekty pliometricheskoy trenirovki v razvitiy vzryvnoy sily sportsmenov gornogo bega. *Teoriya i praktika fizicheskoy kultury*. 2024. No. 3. pp. 6-8.
2. Bakaev V.V., Ponimasov O.E., Vasilyeva E.A., Punich S.V. Parametry trenirovochnykh nagruzok v gornom bege kak factor upravleniya trenirovnochnym protsessom. *Teoriya i praktika fizicheskoy kultury*. 2024. No. 2. pp. 9-11.
3. Vinogradova O.P., Morozova L.V., Melnikova T.I., Ponimasov O.E. Korrektsiya polozheniya tulovishcha legkoatletok-sprinterov na osnove izmeneniya posturalnogo balansa. *Teoriya i praktika fizicheskoy kultury*. 2024. No. 1. pp. 31-33.
4. Katenkov A.N., Anisimova E.A., Novikova E.M. Obosnovaniye usloviyi faktorov, opredelya yushchikhskorost bega na korotkiye distantsii. *Teoriya i praktika fizicheskoy kultury*. 2020. No. 2. pp. 83-85.
5. Kolesnikov N.V. Ponimasov O.E., Fursov V.V., Strega S.I. Faktornaya struktura predsorevnovatelnoy podgotovki skorokhodov v vysokoy kvalifikatsii. *Teoriya i praktika fizicheskoy kultury*. 2023. No. 7. pp. 90-92.
6. Sergeev O.V. Osobennosti startovoy reaktsii sprinterov. *Teoriya i praktika fizicheskoy kultury*. 2014. No. 9. 30 p.