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DYNAMICS OF THE FORMATION OF PHYSICAL FITNESS AND FUNCTIONAL STATE OF SHORT-DISTANCE RUNNERS DURING THE ANNUAL TRAINING CYCLE

Mulladjanov Umid Ahmedovich
Associate Professor of the Department of Physical Education
Termez State Pedagogical Institute

Abstract. In the context of increasing competition in world athletics, improving the training system of short-distance runners is becoming increasingly relevant. Sprint performance largely depends on the level of physical fitness and functional state formed during the annual training cycle. This study aimed to identify the dynamics of physical development and functional indicators of short-distance runners at the initial stage of annual preparation. The study involved 24 male sprinters. The findings justify a differentiated approach to training load planning.

Keywords: short-distance running, annual training cycle, physical fitness, functional state, sprinters, respiratory system, sports training.

Introduction. The intensification of competition in world athletics and the steady growth of sports results demonstrated at competitions of various levels objectively require further improvement of athlete training systems. The preparation of highly qualified short-distance runners represents a complex long-term pedagogical process based on stage-by-stage planning of training activities and rational management of training loads [3, 5, 6].

Within the athlete training system, key importance is attached to the structure of training stages and periods, the methodology of organizing training sessions, the ratio of general and special physical preparation, the characteristics of technical and tactical training, the cyclic nature of the training process (micro-, meso-, and macrocycles), training load volume and intensity, as well as competitive activity and the maintenance of sports form [1, 2, 4]. These components largely determine the effectiveness of long-term preparation and the successful selection of promising athletes.

An analysis of international and domestic experience indicates that in leading countries worldwide, scientific research is focused on optimizing the planning of sprinters' training processes, rational distribution of training loads, and improving athletes' functional, psychological, technical, tactical, and integrated preparedness [7, 9, 11]. At the same time, a review of scientific and methodological literature reveals unresolved issues related to planning the annual training cycle of student-athletes, selecting appropriate training means and methods, balancing loads of different orientations, regulating exercise intensity, determining the number of repetitions, and optimizing rest intervals [8, 10, 12].

Step frequency plays a particularly important role in achieving high sports performance in short-distance running. Under competitive conditions, where athletes differ in anthropometric and morphofunctional characteristics, a high level of step frequency development often becomes the decisive factor for success. At the same time, sprint performance is determined not only by step length but also by the level of physical development and the degree of functional state formation of the athlete [13, 14, 15].

In this context, the study of the dynamics of physical fitness and functional state formation in short-distance runners during the annual training cycle represents a relevant scientific and practical research problem.

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Methods. The purpose of the study was to determine the dynamics of physical development and functional indicators of short-distance runners during the annual training cycle.

The objectives of the study were:

to analyze scientific and methodological literature addressing the dynamics of physical development and functional state of sprinters;

to assess indicators of physical development and functional state of short-distance runners using specialized tests.

The pedagogical experiment involved 24 athletes specializing in short-distance running, including 12 men and 12 women. Physical development and functional state were evaluated using a set of 11 tests incorporating anthropometric measurements, cardiovascular and respiratory system indicators, and functional tests.

Results. The results of the initial testing showed that the mean body height of male athletes was 181.6±3.75 cm, while in female athletes it was 160.6±2.64 cm. The average body mass of men was 82.5±1.78 kg, whereas women demonstrated a mean body mass of 50.0±2.35 kg. The body mass index (BMI) amounted to 25.0±0.69 kg/m² in men and 19.0±0.53 kg/m² in women.

Chest circumference indicators in men were 90.5±2.35 cm at rest, 94.8±2.72 cm during inhalation, and 86.8±2.14 cm during exhalation. In female athletes, the corresponding values were 83.0±1.78 cm at rest and 88.0±1.78 cm during inhalation.

Resting heart rate in men averaged 65.4 beats per minute, while in women it reached 67.0±2.54 beats per minute. Maximal oxygen consumption in men was 51.5±1.08 ml/min, whereas in women it amounted to 47.0±1.17 ml/min.

Functional test results indicated that, according to the Genchi test, men were able to hold their breath for an average of 32.5±1.78 s, while women achieved 26.0±0.90 s. In the Stange test, male athletes demonstrated a result of 52.5±1.78 s, whereas women reached 44.0±1.16 s. Vital lung capacity in men was 4148.3±95.33 ml, compared to 3909±71.41 ml in women.

Indicator	**Control Group (Mean ± SD)**	**Experimental Group (Mean ± SD)**
Height (cm)	181.5 ± 3.75	181.5 ± 3.75
Body Mass (kg)	82.5 ± 1.78	83.9 ± 1.83
BMI	25.03 ± 0.69	25.05 ± 0.71
Vital Capacity (ml)	4148 ± 95.33	4241 ± 104.26
Genchi Test (s)	32.5 ± 1.78	34.7 ± 1.48
Stange Test (s)	52.5 ± 1.78	55.7 ± 1.60

Discussion. The comparative analysis of physical development and functional state indicators in short-distance runners revealed no statistically significant differences between the experimental and control groups across most of the assessed parameters. These findings indicate a comparable baseline level of physical and functional preparedness among the examined athletes, confirming the methodological validity of group allocation and ensuring the reliability of subsequent comparative analyses.

At the same time, the obtained results emphasize the necessity for further optimization of the annual training cycle with consideration of individual morphofunctional characteristics of sprinters. Although the general indicators were similar between groups, a tendency toward higher values of respiratory system functional parameters was observed in the experimental

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group. This tendency suggests that individualized modulation of training load volume and intensity, particularly during preparatory phases, may positively influence functional adaptation mechanisms.

The dynamics of functional indicators such as breath-holding capacity and vital lung capacity highlight the importance of integrating targeted respiratory and speed–strength exercises into the training process. Given that sprint performance is determined not only by biomechanical factors, including step length and frequency, but also by the efficiency of cardiovascular and respiratory systems, optimizing these components may contribute to enhanced competitive performance.

Furthermore, the absence of pronounced intergroup differences underscores the importance of longitudinal monitoring within the annual training cycle. Continuous assessment of physical development and functional state allows coaches to timely adjust training stimuli, prevent overtraining, and ensure stable maintenance of sport form. Therefore, a differentiated and individualized approach to training load planning appears to be a key factor in improving the effectiveness of long-term preparation of short-distance runners.

Conclusion. The pedagogical experiment conducted to determine the level of physical development and functional preparedness of student-athletes specializing in short-distance running allowed the following conclusions to be drawn:

1. The analysis of scientific and methodological literature revealed that, despite the relevance of the problem, insufficient attention has been paid by national researchers to the study of physical development and functional state of short-distance runners. This gap was clearly identified during the pedagogical experiment.

2. In the process of selecting athletes for short-distance running events, priority consideration of physical development indicators and subsequent targeted orientation toward this sport significantly increases the potential for training highly qualified athletes.

3. The results demonstrated that the functional preparedness of student sprinters is not sufficiently developed to ensure high competitive performance. Therefore, it is advisable to incorporate training means and methods aimed at improving functional preparedness into the training process. Moreover, functional preparedness is closely interconnected with all components of athletic training and plays a decisive role in achieving stable sports performance.

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