

# Diagnostics of Functional State and Reserve Capacity of Young Athletes' Organism

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**Abstract:** The diagnosis characterizing the functional state and reserve capacity of young athletes' organism gives physical activity according to the possibility of adjusting intensity zones. Methods of functional diagnostics: polymyography, HR variability with active orthostatic test, research of physical working capacity (PWC170 test), the express -diagnostics of a functional state by Dushanin's method and the "Reaction to Moving Object" (RMO test). Research material. Complex diagnostics of young athletes' functional state and its further complex assessment by means of the received indices were carried out. The correlation and factorial analysis of the indices was carried out. Generalization and analysis of experimental research conducted with young athletes, allowed to identify the factors that determine and shape their functional training level. Results. The diagnosis and evaluation of young athletes functional training includes assessment of body systems taking into account the specifics of the sport; training loads correction plan, implementation of rehabilitation measures, individualization of training mode and correction of social conditions. Young athletes training in difficult social and environmental conditions is possible when considering the necessary components of training techniques, among which the dominant diagnosis, control and prevention save health and improve functional fitness.

## 1 RELEVANCE

The study of factors determining and forming young athletes' functional readiness at the present stage of training is the basis for the creation of diagnostic programs and evaluation criteria. The problem of diagnostics and assessment of functional state and reserve capacity of young athletes' organism is actualized.

In accordance with contemporary methodology, research and functional training diagnostics of young athletes' organism the following principles were taken into account:

system approach; complexity, taking into account functional diagnosis of the leading factors potentially determining athletes' competitive activity effectiveness;

- choose the most informative modern methods and means of diagnosis using physical loads of different intensity;
- determine the leading components of functional training.

Functional state of the organism is characterized by the combination of its physiological functions and psycho-physiological qualities, which bear the greatest burden in ensuring the professional activities (Rybina et al., 2015). In this regard, performance on the functional status cannot be established based on the study of one or several indicators and requires the integrated assessment of a number of body functions, directly or indirectly contributing to the effective implementation of training and competitive activities of young athletes.

The above was the basis to identify factors that determine and shape functional training level, conduct research on the diagnosis of the functional state and reserve capacity of young athletes' organism.

## 2 METHODS

In terms of the interdepartmental laboratory of the

Povolzhskaya State Academy of Physical Culture, Sport and Tourism (Russia), in compliance with the requirements of research young athletes specializing in running at various distances indicators of physical health were studied: organism functional state and reserve capacity; psychofunctional state; heart rate variability with active orthostatic test; functional state of the neuromuscular apparatus. Methods for assessing the functional capacity of the organism were used: Bicycle ergometry, determination of heart rate variability indicators, physical performance, aerobic performance, method of express-diagnostics of the functional state, reserve and adaptive capabilities of the organism "D&K-Test" by S. A. Dushanin, evaluation of physical working capacity PWC170 method (Dushanin et al., 1984, Solodkov et al., 2003, Rybina et al., 2015). The study of the skeletal muscle contractile relaxation characteristics, functional state of the Central nervous (CNS) and the neuromuscular system (NMS) was performed using computer polimyographic method. On the basis of the athletes polimigra quadriceps femoris recording we studied the following parameters: the speed of arbitrary tension in the muscles; the relative speed of the random voltage taking into account the body weight of athletes; maximum random relative strength; the speed of arbitrary relaxation. To assess the functional state of the CNS a number of time parameters: motor response speed of the voltage on the electromyogram; motor response speed of the voltage on the chart; motor response speed of relaxation in the diagram; the rate of development and the strength of excitatory process; rate of development and the strength of the braking process; the balance of nervous processes "inhibition-excitation"; the functional state of the Central nervous system was used.

The research was conducted with students of the Department "Theory and methodology of cyclic sports" 1-5 courses of the specialization "Theory and methodology of athletics" in Naberezhnye Chelny. The research was conducted in the period from 2010 to 2016.

### **3 RESULTS AND THEIR DISCUSSION**

Generalization and analysis of experimental research conducted with young athletes, allowed to identify the factors that determine and shape their functional training level. Among the identified factors were: the morphofunctional indicators of the body basic

physiological systems functionality, sources of muscular activity energy supply, psychological state, general and special working capacity level and correlation of these factors with the age and readiness of young athletes. Factors forming the functional preparedness of young athletes: sporting activities, combination of this activity with the school. The most important factor in determining functional readiness of young athletes are methodical bases of the educational and training process, which incorporates the terms of training sessions organization, the training regime, the volume and intensity of training loads, the conditions of classes, calendar of events, conducting training camps, providing conditions for training.

Factor analysis helped to identify the main signs of improvement in the functional training of young athletes: improving general and special physical performance, functional status and reserve capacity of the organism increase, improving the efficiency of functional systems, improving regulatory mechanisms, maintaining emotional state, revealing individual typological features of muscle activity energy supply.

The methodology structure and content of the programme the diagnosis and evaluation of young athletes' functional training includes assessment of body systems taking into account the specifics of the sport; assessment of functional, adaptive and reserve capabilities of individual systems and body functions at rest and after exercise; training loads correction plan, implementation of rehabilitation measures, individualization of training mode and correction of social conditions. Young athletes' general health methodology testing with the use of ergometric tools allows to evaluate the functional and reserve possibilities of an organism.

Our results are consistently interpreted and put in the data bank functional training of young athletes. The obtained results allow to develop practical recommendations for decision-making on correction of young athletes' training program.

Evaluation of young athletes' functional training takes place on the basis of the obtained results.

Mathematical analysis of heart rate variability in the prone position and in the active autoprobe showed that students-athletes have the tendency to slow heart rate, high voltage functional state of the heart observed in the period of main competitions, the voltage of regulatory mechanisms is observed in young athletes specializing in sprint distances. Analysis of the vegetative ensure the workability of young athletes revealed a predominance of sympathetic regulation after competitive load.

The indicators characterizing the contractile capabilities of the muscle and the activity of inhibitory processes during the experiment undergo considerable changes. The relative speed of arbitrary tension allows to match the indices of athletes specializing in various running distances. In our example, an increase of this index in athletes specializing in running on average distances. It is known that the speed of muscles relaxation is directly dependent on the functional state of the higher regulatory systems, is the most important system-forming factor of coordination and, accordingly, technical skill, which also makes a significant contribution to the level of special physical working capacity of athletes. Therefore, we obtained data sufficient to characterize the state of the young athletes neuromuscular system. According to many scientists speed of different muscle groups arbitrary relaxation less dependent on their structure, but is determined, mainly, by the braking systems functional activity. The better brake control and the sooner "veternarians" all motor neurons that send motor impulses to the muscle twitch, the quicker the flow of these pulses and the higher is muscle relaxation speed (Nazarenko et al., 2016; Chernova et al., 2017).

Indicators of functional state and reserve capacity of the organism were assessed twice – before and after the pedagogical experiment.

The growth indicators of anaerobic metabolic capacity, describing better ability to perform the amount of exercise in the third and fifth zones of intensity, the athletes made -10,26%. An indicator of aerobic metabolic capacity, as a measure of the ability to perform physical activities in the first, second and partially in third zones of intensity, young athletes increased by 13.44%. Overall metabolic capacity serves as an indicator characterizing the body level of health increased by 12.53%. The power of phosphocreatine source of power supply determines the lactate component of the body speed capabilities and the power of sportsmen muscular activity power supply phosphocreatine source. Young athletes' phosphocreatine source of power supply has changed by 19.47%. The power of glycolytic source of energy supply is on an improving trend: increase for the period of the experiment is 25.23%. The power of aerobic source of muscle activity energy supply as a qualitative indicator of the athletes' load became 10.96%. The efficiency of muscle activity energy supply aerobic source for the period of the experiment changed by 5.55%. Heart rate (criterion of aerobic source use efficiency) increased by 4.16%.

Young athletes training taking into account the advantages and disadvantages of muscular activity supply system has a positive effect on performance and functional reserve capacity of the organism. The range of individual changes in the parameters characterizing the functional state and reserve capacity of young athletes' organism helps to control the variables of training loads aimed at developing physical qualities and functionality.

## 4 CONCLUSION

Thus, the diagnosis characterizing the functional state and reserve capacity of young athletes' organism, gives physical activity according to the possibility of adjusting intensity zones.

Training of young athletes in difficult social and environmental conditions is only possible when considering the necessary components of training techniques, among which the dominant diagnosis, control and prevention save health and improve functional fitness. The factors that determine functional training level should be considered in all stages of sports training as the cornerstone of young athletes' professional skills formation.

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