

**SYSTEM OF ESTIMATIONS AND PROGNOSTICATIONS OF BODILY CONDITION OF SKILLED SPORTSMEN IN TRACK-AND-FIELD**

Bobrovnyk V.I.

National University of Physical Education and Sport of Ukraine

**Annotation.** The system of estimation and prognostication of bodily condition of skilled athletes is presented. The system includes the complex of pedagogical tests, evaluation tables, estimation of the functional state vegetative, nervous, cardiovascular systems, system of the external breathing. 436 sportsmen took part in research (212 women and 224 men). The analysis of electrocardiography is conducted, variability of cardiac rhythm, determination of vegetative balance, state of myocardium, violations of rhythm of heart, spirometric researches. The estimation of efficiency of activity of sportsman in extreme terms on the basis of type and properties of temperament, level of personality anxiety and estimation of psychological reliability of sportsmen is presented. The criteria of estimation of physical preparedness are certain, functional state of the basic systems of organism, influencing in a greater degree on achievement of high sporting results, psychological state of sportsmen.

**Key words:** estimation, state, preparedness, perfection, sportsman.

**Introduction.**

For the first years of independence sportsmen of national team of Ukraine on track-and-field conquered 17 medals of different dignity (4 – 7 – 6) on XXI championship of Europe (Helsinki, 27.06 - 1.07.2012). The representatives of record medals became representatives of almost all disciplines in track-and-field: race – Julia Olishevskaya, Olga Zemlyak, Natalia Pigida, Alina Logvinenko (relay 4x400 m, rank first), Maria Remen (200 m, rank first), Olesya Povkh (100 m, rank second), Kristina Stuj (200 m, rank second), Ljudmila Kovalenko (5000 m, rank second), Svetlana Shmidt (3000 m steeplechase, rank third), Olga Skripak (10000 m, rank third), Anna Mischenko (1500 m, rank third), Anna Yaroschuk (400 m the hurdles, rank third), Stanislav Melnikov (400 m the hurdles, rank third); jump – Olga Saladukha (triple jump, rank first), Sherif El-Sherif (triple jump, rank second), Elena Holosha (high jump, rank third); throwing – Vera Rebrik (javelin throwing, rank first), Natalia Semenova (discus throwing, rank third); combined events – Aleksej Kasyanov (decathlon, rank second), Ljudmila Iosipenko (heptathlon, rank second) [<http://uaf.org.ua/ua/component/content/article/40-uanews/8878---qq--.html>. [www.european-athletics.org/european-athletics-championships-2012](http://www.european-athletics.org/european-athletics-championships-2012)]. On XXX Olympic Games Ukrainian athletes conquered three medals: silver medal conquered Alexandr Pyatnitsa in javelin throwing, two bronze medals – in triple jump Olga Saladykha, in relay race 4x100 m among women (Olesya Povkh, Kristina Stuj, Maria Remen, Elizaveta Bryzgina) – four race fourth, one fifth and two second races.

Successful performance of national team on XXI Europe championship grounds to consider that the track-and-field in Ukraine got the new impulse of development, constrained as with perfection, reconstruction and building of new sport bases in such cities as, Yalta, Donetsk, Kyiv, so by the results of long-term researches, started in early 2000 with sportsmen by a reserve command of country that today made greater part of the national olympic combined team on track-and-field, taking part in XXX Olympic Games in London [1, 2, 6].

Sport result in track-and-field depends on a quality management preparation of sportsmen, plugging in itself methodically correctly the worked out training macro-, mezo-, microcycles of preparation and rational distribution of training facilities during one educational-training exercise, but also from organization and realization of the centralized educational-training sessions, system of sportsmen feed, grant of restoration services, regular events sent to the estimation of different parties of preparedness of sportsmen (operative, current, stage control). The complex scientifically-methodical providing of sportsmen of high class is the major factor of increase of efficiency of the system of preparation of national team of Ukraine on track-and-field [4, 7, 8].

Nowadays one of basic directions of scientific researches in track-and-field is perfection of estimation of physical condition, plugging the estimation of physical preparedness, functional state of the basic systems of organism, psychological preparedness of sportsmen [3, 8 – 10]. However it is not enough to limit physical condition on the modern stage of development of theory and methodology of sportsmen preparation in track-and-field for a management by the training process of high qualification sportsmen, that induces to the search of new ways of decision of problem of prognostication of performance results, racing places on basic disciplines, success of sport career of athletes. This direction actively began to develop the employees of complex-scientific group at the beginning of 2000 in the reserve combined team to the Ukraine national team on track-and-field [1]. As practice showed, it is necessary to conduct the estimation of physical condition of athletes, that must plug in pedagogical testing (complex of exercises composed before, approved, informative, infallible, through that it is possible to define not only the level of development of different motive qualities and capabilities, but also predisposition of sportsman to certain specialization), monitoring of the functional state of cardiovascular and vegetative nervous systems of organism (electrocardiogram, different approaches to the analysis of variability of cardiac rhythm: mathematical, spectral, structural-linguistic and other) and psychological state [2]. During researches in less degree it was notices to possibility of prognostication development of physical qualities, sport result, duration and success of performance during all sport career of athlete to 30 - 40 years

old. The necessity of development of the system of high-efficiency prognostication of success of performance for responsible competitions and duration of stay in optimal sport form does not cause a doubt and is a pressing question in preparation of high class sportsmen. Developed system of estimation and prognostication of physical condition, successful performance on competitions will allow to perfect the system of selection of sportsmen in the national track-and-field teams of country for participating in the competitions of different level.

The article was done according to SRW of National University of Physical Education and Sport of Ukraine.

#### **Aim, tasks, materials and methods.**

*Aim of research* – perfection of the system of evaluation and prognostication of skilled athlete physical state on the basis of development of estimation criteria of physical preparedness, functional state of cardiovascular system and psychical reliability of competition activity of sportsmen.

*Methods and organization of research.* Analysis of scientifically-methodical literature and generalization of sport advanced experience; analysis of competitions protocols; anthropometry, dynamometry; pedagogical testing; psychological testing; spirometry; electrocardiogram; methods of mathematical analysis of variability of cardiac rhythm with the use of diagnostic automated complex "Cardio+", methods of statistical treatment of results. The program "ORACLE" allows to carry out the multilateral analysis of electrocardiogram, deeply estimate the parameters of variability of heart rhythm, diagnose violation of heart rhythm, operatively to define the level of the functional state.

Technology of realization of estimation of physical condition level consisted in pedagogical testing of sportsmen, interpretation of the obtained data of testing - determination of physical preparedness level, and also estimations of the functional state of sportsmen organism on the basis of drawing on the diagnostic automated complex "Cardio+", of estimation of the psychological state of sportsmen.

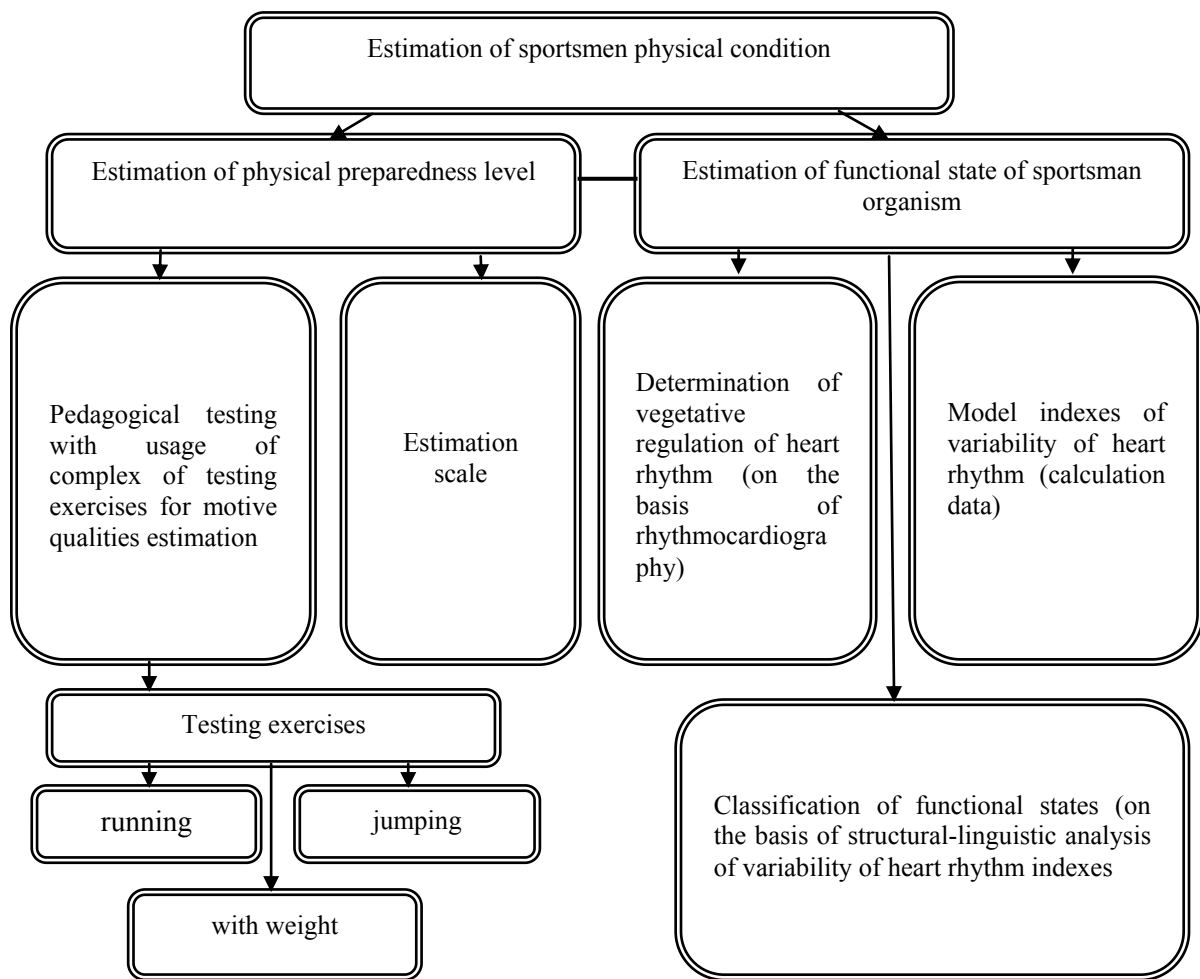
Researches passed in three stages. On the first stage (September 2004 – February 2005) was conducted a theoretical analysis and generalization of the special scientifically-methodical home and foreign literature on issue of estimation of physical condition of sportsmen of different specialization [6].

On the second stage (from March 2005 to September 2011) is conducted methodology of estimation of runners' physical condition on short and middle distances, worked out methodology of estimation of physical preparedness of the athletes specialized in running on short, middle and long distances, in long jumps, high jump, with a pole and triple jump, javelin-throwings, disk, hammer, shotput, combined events and heel-and-toe walk, and also introduction and approbation of these methodologies in the system of sportsmen preparation of national and reserve teams of Ukraine. The estimation of sportsmen physical condition was conducted during educational-training sessions in Yalta and Evpatoria in spring-summer and fall-winter setup times of circannual cycle on the stages of preparation to the higher achievements, maximal realization of individual possibilities. In testing took part 436 sportsmen (212 women and 224 men of sport qualification of Candidate in Master of Sports, Master of Sports).

On the third stage (October 2011 – March 2012) is conducted perfection of methodology of physical condition estimation, development of algorithm of realization of estimation of the functional and psychological state of skilled athletes and approbation of it in the system of preparation of sportsmen reserve and national teams of Ukraine.

#### **Results.**

In the process of done work was worked out methodology of athletes' physical condition estimation specialized in running on short and middle distances, of sport qualification from II rating to Master of Sports. Methodology was developed taking into account leading requirements – sport qualification, specialization of sportsmen, stage of preparation, where they are, availability and informing of the offered components of methodology of estimation. In methodology was used test exercises assisting all-round estimation of physical preparedness level of sportsmen taking into account specialization, pedagogical testing was also used in a complex with the accessible methods of estimation of sportsmen functional state of organism (portable apparatus through that it maybe to inspect plenty of sportsmen in the field terms). Methodology of physical condition estimation of the sportsmen of different qualification, specialized in running on short and middle distances, plugs in complex of pedagogical tests, evaluation tables, model indexes of variability of heart rhythm, determination of type of the vegetative adjusting of cardiac rhythm and classification of the functional states of the sportsmen of different qualification, specialized in running on short and middle distances (fig .1).



*Fig. 1. An outline of methodology of physical condition estimation of skilled athletes – members of reserve national team of Ukraine on track-and-field, applied during 2007 – 2011 during an inspection [6].*

Offer methodology is single for runners on short and middle distances of sport qualification from II digit to Master of Sports, however test exercises, the estimation criteria of both physical preparedness and functional state differ. Evaluation tables settled accounts taking into account a sport digit. Mathematical analysis of variability of cardiac rhythm, on the basis the determined type of the vegetative adjusting of cardiac rhythm, conducted in a state of rest, to the forthcoming loading, after the day of rest. Classification of the functional states was conducted to loading, in a state of rest and after the standard test loading. The model indexes of variability of cardiac rhythm settled accounts taking into account sport specialization and qualification of runners (in a state of rest, after loading).

Methodology of estimation of physical preparedness of different qualification athletes that well went approbation and introduction in the system of preparation of skilled athletes was also worked out (fig. 2).

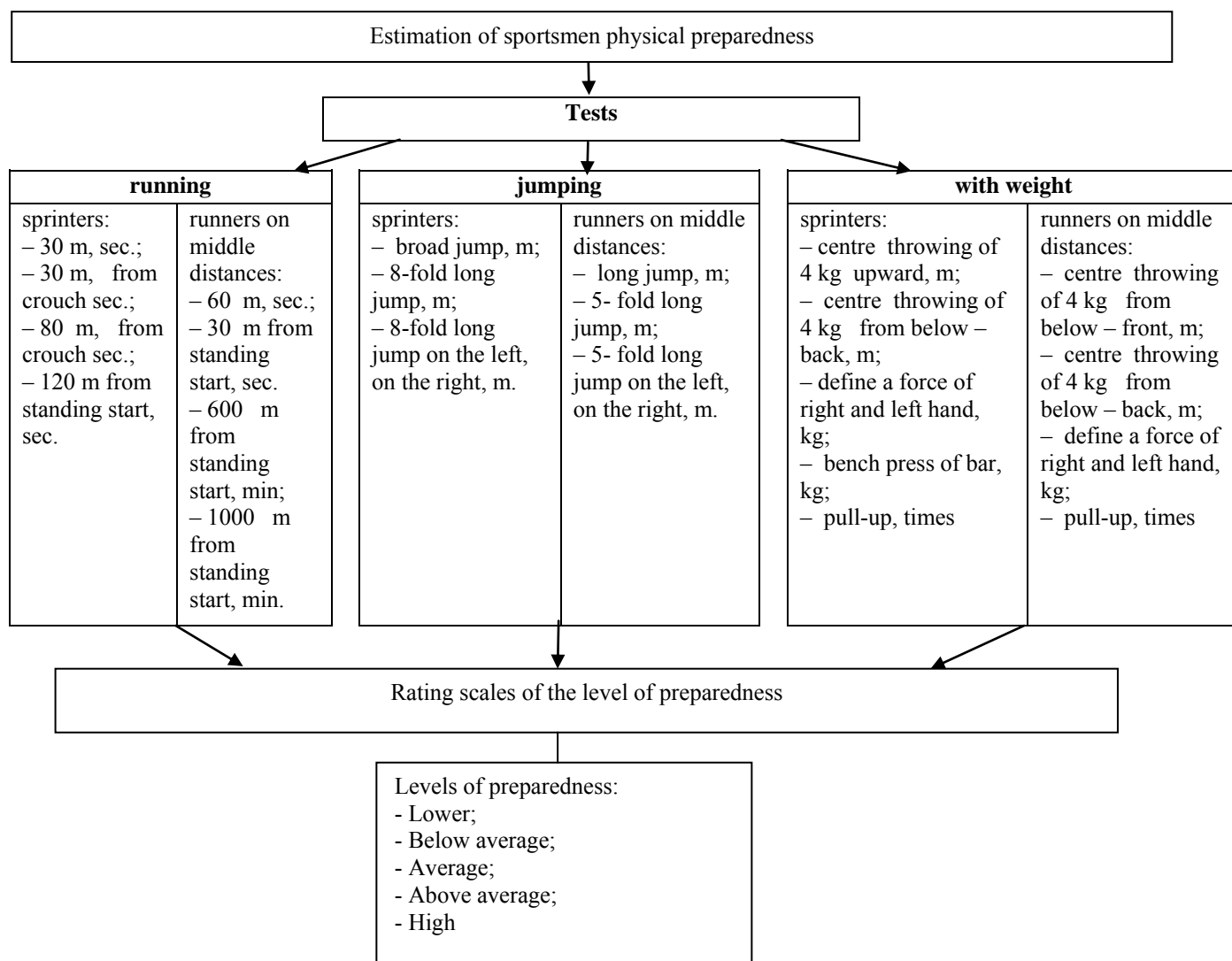


Fig. 2. The scheme of assessment methodologies of physical preparedness of qualified athletes (on example of runners over short and medium distances)

The proposed method of evaluation of physical preparedness of athletes introduced into the system of preparedness of athletes of reserve Ukrainian team in athletics was used for years 2007 - 2011. The developed method of evaluation of physical preparedness allows on the basic stages of preparation to identify a reserve of athletes who can achieve high results and then keep it at a later stage, to determine the athlete's predisposition to a particular discipline of athletics, carry out the selection of athletes to the national team. Efficiency of the method was confirmed by the results of athletes' performance in international competitions of different levels - I Junior Olympic games, match plays, World Championships, European Championships among juniors, young men, youth [1, 2, 6].

Despite successful testing and confirmation of the effectiveness of the developed system of assessing the physical condition of athletes of different qualification in modern conditions of athletes' preparedness require finding ways to improve the system, which include in its fundamental structure methods that allow to obtain reliable information about functional status of the leading systems of the body athletes (autonomic nervous system, cardiovascular system, respiratory system). The need to diagnose the psychological state is also clear, in that earlier do not pay enough attention. It is known that training and competitive activities of athletes accompanied by great mental strain. The effectiveness of the athlete activity in stressful situations depends on the type of temperament, personal anxiety and mental safety of athletes. It is also time to review and correct methodology for assessing physical preparedness, enabling tests to assess coordination abilities, expanding criteria for evaluating preparedness of athletes (Fig. 3).

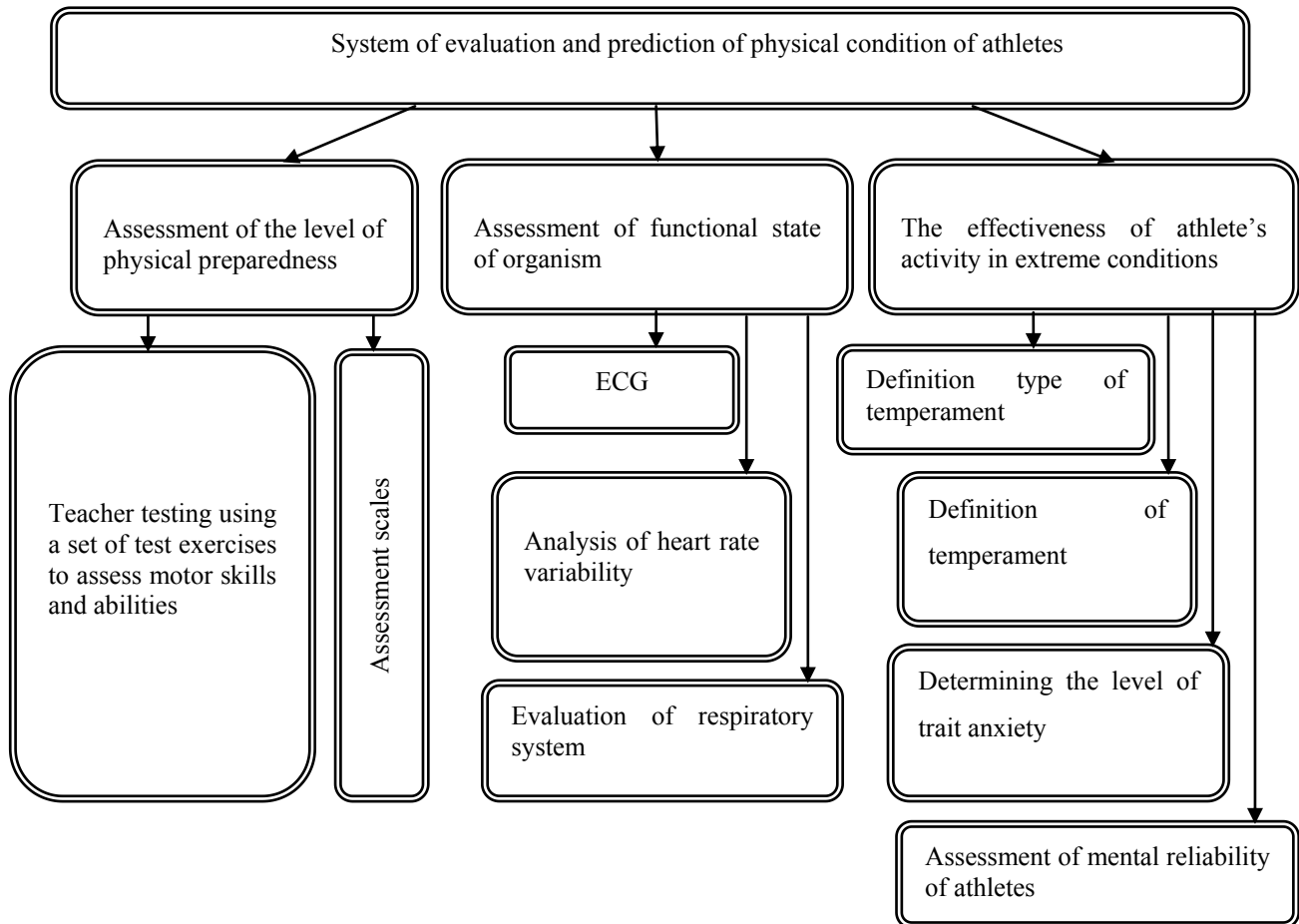


Fig.3. The scheme of assessment and prediction system of physical condition of qualified athletes - members of the reserve team of Ukraine on athletics applied from October 2011

Shown in Fig. 3 evaluation and prediction system of physical condition has a number of advantages over the system previously developed and presented in Figure 1, - more broader present component "Evaluation of the functional state of the body", and also included a completely new feature - "The effectiveness of the athlete's activity in extreme conditions" .

The first component in the evaluation and prediction system of the physical condition of qualified athletes at the stages of specialized basic training and training to the highest achievements – “Evaluation of physical preparedness”, including test exercises: running, jumping, lifting weights, on coordination, and evaluation criteria in the form of evaluation scales and the degree of expression of physical preparedness from the maximum percentage (Fig. 4).

The application of developed methods of assessing physical condition of qualified athletes allows comprehensively evaluate the athlete - to determine the level of expression and development of high-speed, speed-strength, power, coordination abilities, special endurance, intermuscular and intramuscular coordination with accessible, informative tests, and carpal dynamometry (the reliability of each exercise proved mathematically). A number of used in the method exercises is equal to 19, regardless of specialization and skill athletes. In addition to assessing the level of development of physical abilities can predispose an athlete to determine the specialization of athletics, to predict successful performance in the upcoming competitions, identify leaders, and on this basis to equip the team to participate in high-level competitions.

The second component in the evaluation and prediction system of the physical condition of qualified athletes is “Evaluation of the functional state of the body” including the assessment of the cardiovascular system, the autonomic nervous system and the respiratory system through the use of automated diagnostic complex "Cardio +" (Fig. 5).

Method of evaluation the functional state of qualified athletes using the computer program "Multimode Cardio1" (manager, developer and co-workers - PhD I.A. Tchaikovsky, PhD in physical education and sports, professor V.I. Bobrovnik, PhD in physical education and sport, associate professor E.V. Krivoruchenko) first developed for athletes taking into account sports specialization and integrated into the software of the complex functional diagnosis "Cardio +" in the form of the "ORACLE". The technique involves an integrated assessment of autonomic regulation on the basis of heart rate variability, state of the myocardium based on full analysis of amplitude and time parameters of the electrocardiogram analysis of cardiac rhythm disorders. The "ORACLE" includes a comprehensive assessment of

the cardiovascular and autonomic nervous systems (criteria of evaluation are designed to sports specialization and qualification of athletes).

The third component in the evaluation and prediction system of physical condition of qualified athletes is “The effectiveness of the athlete in extreme conditions”, which includes psychological testing (Fig. 6).

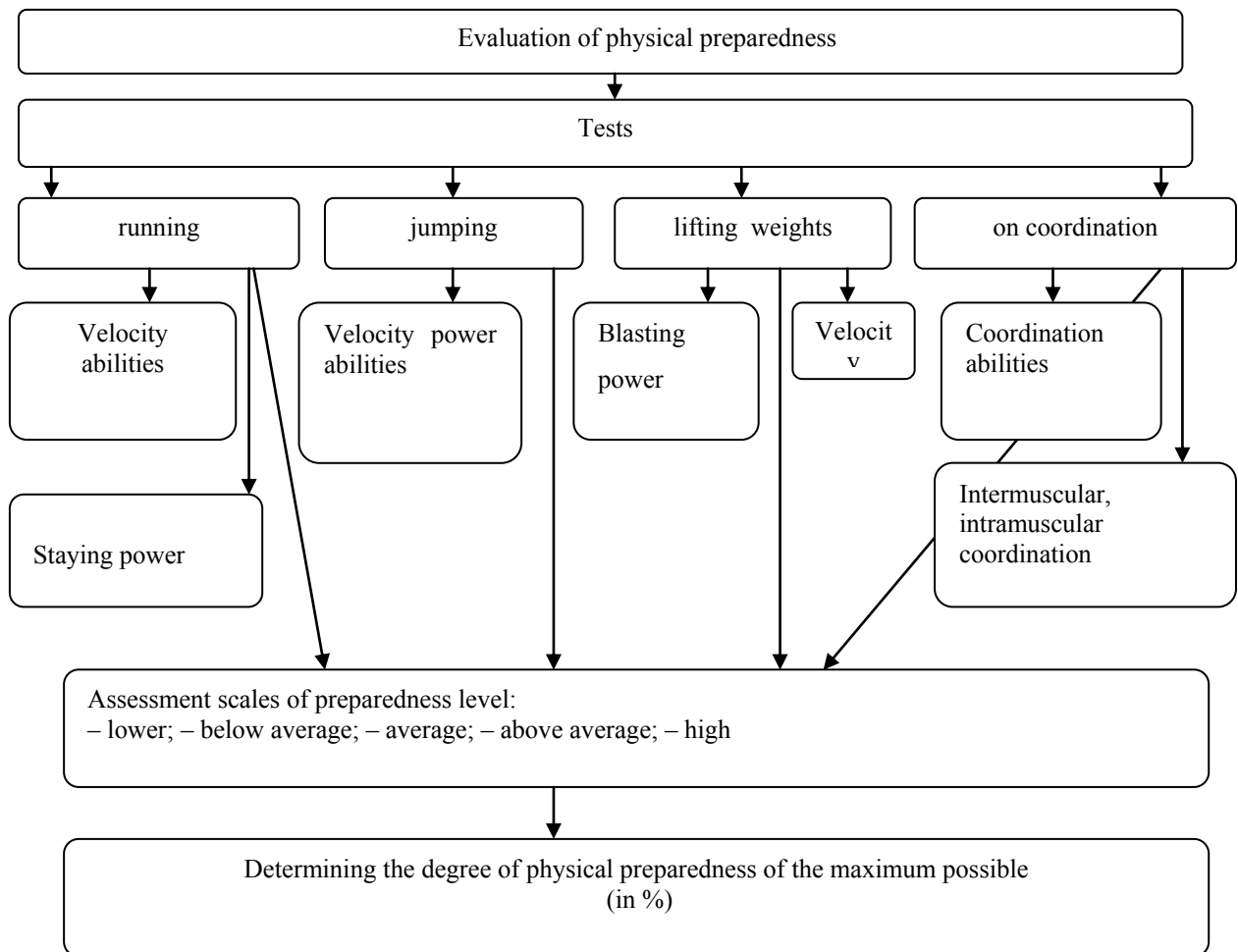


Fig. 4. The scheme of the evaluation system of physical preparedness of qualified athletes - members of the reserve team of Ukraine on athletics applied from October 2011

The efficiency of competitive activity of athlete depends on the type of temperament, level of personal anxiety and mental reliability of athlete. Temperament is the biological basis of personality, and based on the properties of the nervous system - the power of excitation and inhibition, and mobility of nervous processes, balance the nervous system [5]. However, it is not enough data about temperament to predict the success of competitive activity, you need more information about the structure of temperament. Used in the evaluation and prediction system of the physical condition of qualified athletes survey “Study of the psychological structure of temperament” by B.N. Smirnov reveals a number of polar properties of temperament: extraversion – introversion, emotional irritability – emotional balance, the rate of reactions (fast - slow), activity (high - low). In order to study the mental reliability of athletes used the method developed by V.E. Milman, to characterize the level of competitive emotional stability, competitive motivation, stability, noise immunity and self-regulation.

The current direction of scientific research in the development of the evaluation system of physical condition of qualified athletes is relevant and promising, that is confirmed by the use of long-term results of the study to predict the performances of athletes of reserve Ukrainian team in athletics at major forums of a year and achieve high results.

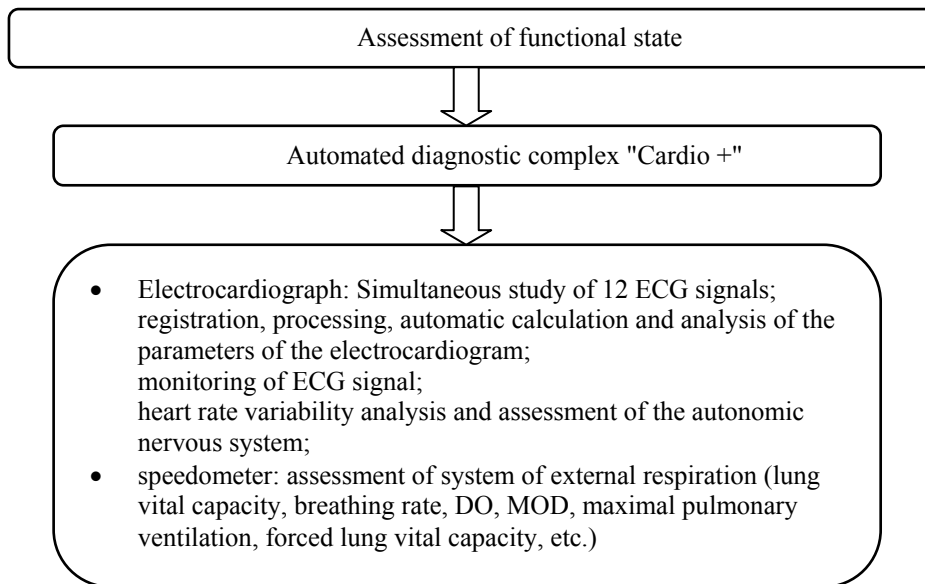


Fig. 5. Methods of assessing the functional state of qualified athletes - members of the reserve team of Ukraine on athletics applied from March 2011

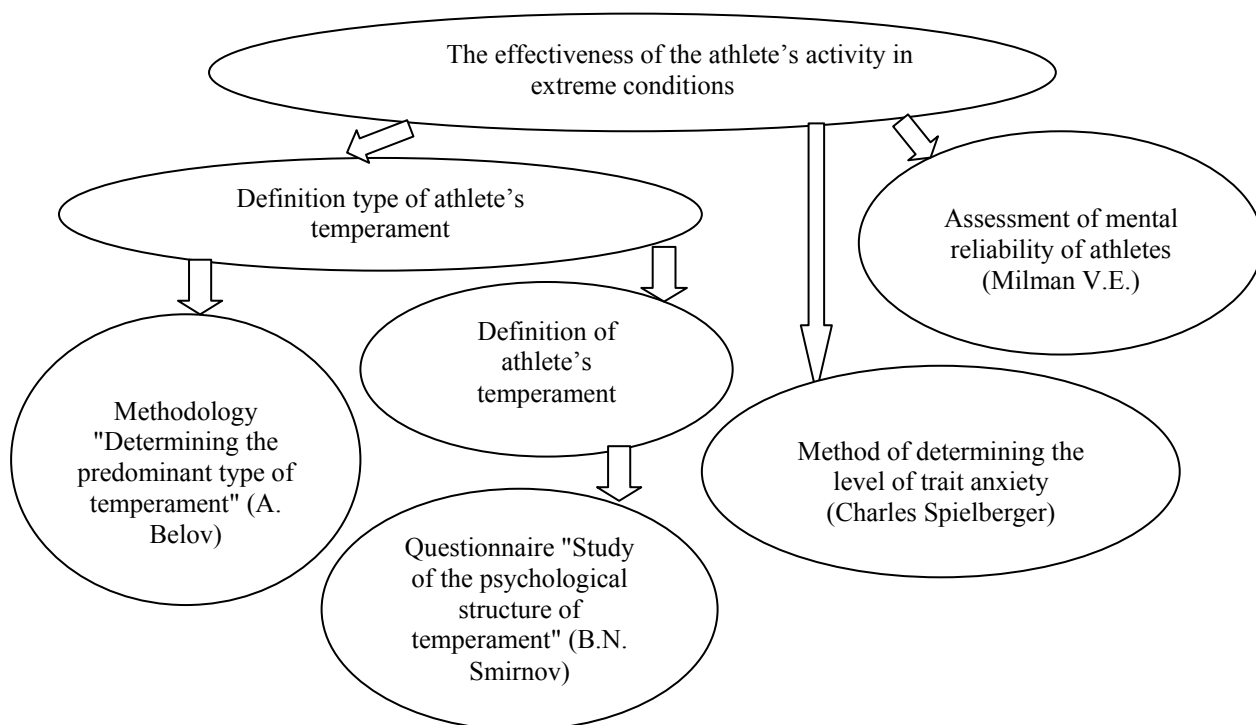


Fig. 6. Scheme for evaluating the effectiveness of the athlete in extreme conditions

### Conclusion.

1. The main directions of development of research activity in the assessment and prediction of the physical condition of athletes qualified for specialized stages of basic training, preparation for records, the maximum realization of individual opportunities.

2. Developed groups of educational tests and criteria of assessment of physical ability development used for evaluation of physical preparedness, and to determine the athlete's predisposition to specialize in athletics.

3. Developed and tested in training process of qualified athletes method of functional diagnostics of major body systems that impact more on achieving high results. For a more accurate prediction of competitive activity of qualified athletes developed a method of psychological assessment. Developed a system for assessing and predicting the physical condition of qualified athletes, which includes a set of pedagogical tests, scorecards, assessment of the functional state of the autonomic nervous system, cardiovascular system, respiratory system by analyzing the ECG, heart rate variability, the definition of autonomic balance, state of the myocardium, cardiac arrhythmias, spirometric

studies, and also evaluation of effectiveness of the athlete's activity in extreme conditions by determining the type and properties of temperament, level of personal anxiety and psychological evaluation of reliability of athletes.

*Prospects for future research* are to determine the level of physical preparedness and functional status of qualified athletes by implementing evaluation systems and predict the physical condition of athletes in the training process.

#### References:

- 1 Bobrovnyk V., Krivoruchenko O. *Teoriia i metodika fizichnogo vikhovannia i sportu* [Theory and methods of physical education and sport], 2010, vol.3, pp. 12–17.
- 2 Bobrovnyk V.I., Krivoruchenko E.V. *Nauka v olimpijskom sporte* [Science in Olympic Sport], 2010, vol. 1-2, pp. 47 – 55.
- 3 Grechishkina S.S., Petrova T.G., Namitokova A.A. *Vestnik TGPU* [Announcer TSPU], 2011, vol.5(107), pp. 49 – 54.
- 4 Driukov V.O. *Aktual'ni problemi fizichnoyi kul'turi i sportu* [Issues of the day of physical culture and sport], 2007, vol.12, pp. 33 – 46.
- 5 Il'in E.P. *Psikhologiiia individual'nykh razlichij* [Psychology of individual distinctions], Sankt Petersburg, Peter, 2004, 701 p.
- 6 Krivoruchenko O.V. *Pedagogika, psihologia ta mediko-biologicni problemi fizichnogo vikhovanna i sportu* [Pedagogics, psychology, medical-biological problems of physical training and sports], 2012, vol.5, pp. 83 – 85.
- 7 Platonov V.N. *Nauka v olimpijskom sporte* [Science in Olympic Sport], 2009, vol.1, pp. 198 – 218.
- 8 Platonov V.N. *Sistema podgotovki sportsmenov v olimpijskom sporte* [The system of preparation of sportsmen in Olympic sport], Kiev, Olympic Literature, 2004, 808 p.
- 9 Borresen J. Autonomic control of heart rate during and after exercise: measurements and implications for monitoring training status. *Sports medicine*. 2008, vol.38, pp. 633 – 646.
- 10 Ostojic S.M., Stojanovic M.D., Calleja-Gonzalez J. Ultra Short-Term Heart Rate Recovery after Maximal Exercise: Relations to Aerobic Power in Sportsmen. *Chinese Journal of Physiology*, 2011, vol.54(2), pp. 105 – 110.

---

#### Information about the author:

**Bobrovnyk V.I.:** bobrovnyk@ukr.net; National University of Physical Education and Sport of Ukraine; Fizkultury str. 1, Kiev, 03680, Ukraine.

---

**Cite this article as:** Bobrovnyk V.I. System of estimations and prognostications of bodily condition of skilled sportsmen in track-and-field. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2013, vol.1, pp. 12-19. doi:10.6084/m9.figshare.106930

The electronic version of this article is the complete one and can be found online at: <http://www.sportpedagogy.org.ua/html/arhive-e.html>

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (<http://creativecommons.org/licenses/by/3.0/deed.en>).

---

Received: 14.12.2012

Published: 31.01.2013