УДК 796.012.1:796.322 DOI https://doi.org/10.26661/2663-5925-2019-2-16

DIAGNOSTIC FUNCTIONAL CONDITION IN SPORT

Sokolova O., Tyshchenko V., Mordvinov K.

69600, Zaporizhzhia national university, Zhukovsky str., 66, Zaporizhzhia, Ukraine

sokolova-znu@gmail.com

Key words:
sport; testing; functional status; reserve capacities.

The testing in actual practice an integrated approach to the assessment of the functional condition for highly qualified handball players is investigated in this article. *The purpose of the research* – the testing in actual practice an integrated approach to the assessment of the functional condition for highly qualified handball players. *Participants.* With the assistance of express-diagnosis program, D&K-test, we analyzed the functional condition of handball players, teams: HC «Motor», «ZTR», «ZNTU-ZAB». Sixty five athletes at various positions on the court participated in the experiment. The present study took place in several stages. Literature and its own experimental data on the indicators were analyzed in the first phase. In the second stage of the research, data was gathered by definition of athletes' performance. In a third step, the obtained materials were treated by methods of mathematical statistics. That allowed to follow their dynamics and to answer the question regarding their tendencies. With the assistance of complex diagnostic program, "D&K-test" anaerobic metabolic capacity, entire metabolic capacity, maximal oxygen consumption, aerobic economy, heart rate zones of physical activity for varying level of intensive work loads. *Results.* The marked increase in performance of anaerobic metabolic capacity, which characterizes the improved ability to fulfill physical activity amount in the third and fifth zones of intensity. The indicator to use efficiency of aerobic muscular activity energy source, which predetermines the direction of training in the structural stages during one year training cycle, and shows efficiency of energy substrates, characterized by coordinating ability, and the period of the experiment has been changed as well.

ДІАГНОСТИКА ФУНКЦІОНАЛЬНОГО СТАНУ В СПОРТІ

Соколова О.В., Тищенко В.О., Мордвинов К.О.

69600, Запорізький національний університет, вул. Жуковського, 66, Україна

sokolova-znu@gmail.com

Ключові слова:
спорт, тестування, функціональний статус, резервні можливості.

Досліджено інтегрований підхід до оцінки функціонального стану в гандболі. *Мета дослідження* – апробація в реальних умовах комплексного підходу до оцінки функціонального стану висококваліфікованих гандболістів. *Учасники*. 65 спортсменів команд «Мотор», «ЗТР», «ЗНТУ-ЗАБ». *Методи дослідження.* За допомогою комплексної програми експрес-діагностики «D&K-Test» отримано об'єктивні дані про стан спортсмена, рівні розвитку потужності і ємності джерел енергозабезпечення м'язової діяльності без додаткових витрат часу і зусиль спортсмена в процесі тестування. Крім того, така система дозволяє створювати моделі функціональної підготовленості спортсмена на різних етапах підготовки, а також забезпечена підказками про необхідність зміни тренувальних обсягів у відсотках при зміні окремих показників функціональних систем, що дозволяє уникнути перетренованості. *Результати*. Відзначено поліпшення показників анаеробної метаболічної ємності, що характеризує поліпшення здатності виконувати обсяг фізичного навантаження в третій і п'ятій зонах інтенсивності, та показник ефективності використання аеробного джерела енергозабезпечення м'язової діяльності, що визначає спрямованість тренувань у структурних циклах річного циклу підготовки і характеризує координаційні можливості за період експерименту.

Formulation of the problem. Analysis of recent research and publications

There are various methods for evaluating preparedness of athletes in different sports. Therefore, it is necessary to choose the appropriate method or methods that match the specificity of sport and opportunities to researchers, the theoretical validity of the requirements and its reliability of the methods. The choice of specific methods should be objective, reliable, informative, fast enough and easy to use, which is caused by each survey task and capabilities of individual methods. It would be useful to experimentally determine the factors of success of the possibility to achieve high level skills, the degree of their influence on the result, to develop performance criteria, and characterizing the level and stability of sports results or the effectiveness of sports activities [4,10]. However, there are not the same methodical installations when selecting the most informative criteria and methods diagnostics, which determined the relevance of our research.

Functional condition of qualified handball players and the state of their bodies' motor skills in the macrocycle training dynamically linked, that is explained by the substantial nature of the adaptation of the body and its systems to specific training loads. In our case, the adaptive changes in the body of handball players, which determine the condition of the body's fitness depends on the amount and direction of the training loads. Therefore, it is important to assess and analyze the level of physical performance of qualified handball players at different stages of their preparation for meso- and macrocycles [3, 7].

In article, Evhen, P.&Valeria, T. conducted a longitudinal study of fitness shape and functional status of highly qualified athletes such as, handball players [5]. Dynamics of physical performances and energy systems condition shows positive influence on the work-out processes during and before the contest seasons as well as shows relative lack of tools for maintaining the high level of physical efficiency, and as well as preventing the signs of fatigue in energy supply systems during the contest season. Substantiated functional state of the nervous system in handball players related to the degree of manifestation of individual and typological properties of nervous processes [4]. The results of the study clearly demonstrated that the inclusion in the training program for basketball players training with functional loops contributed to a significant increase in the level of their overall physical performance and aerobic capacity of the body [9].

Scientists proved that maintaining a high level of vegetative homeostasis indicates the certain fitness level of athletes, sufficient to maintain the high potential of sympathetic-adrenal system and to overcome fatigue processes during activity [5-7]. Moreover the findings suggest the necessity to search for the methods and tools that can adjust and optimize the athletes' performance capabilities at more effective level just at the right period of competitions [8]. Thus, that let us to obtain a reliable and objective evaluation of our proposed solutions of scientific and applied problems of the system of training athletes and highly qualified handball teams, and on the other hand – opposite effect of the proposed action control system of training and competitive activity of highly qualified handball teams [10].

Goal, objectives, methods of the research

The purpose of the research – the testing in actual practice an integrated approach to the assessment of the functional condition for highly qualified handball players.

The practical significance of this problem has become a prerequisite for the study. To achieve the objectives in the following research methods were used:

1. Analysis and conception of scientific and methodical literature.

2. The testing of functional condition and reserve capabilities in handball players' bodies through express-diagnosis "D&K – Test" [1, 2].

Physical training of qualified handball players is strongly correlated with the morphofunctional state of the athlete's body.

Participants. With the assistance of express-diagnosis program, D&K-test, we analyzed

the functional condition of handball players, teams: HC «Motor», «ZTR», «ZNTU-ZAB». Sixty five athletes at various positions on the court participated in the experiment.

The present study took place in several stages. Literature and its own experimental data on the indicators were analyzed in the first phase. In the second stage of the research, data was gathered by definition of athletes' performance. In a third step, the obtained materials were treated by methods of mathematical statistics. That allowed to follow their dynamics and to answer the question regarding their tendencies. With the assistance of complex diagnostic program, "D&K-test" [1, 2], some indicators were set:

anaerobic metabolic capacity (AMC) which characterizes the ability to perform various types of intense stresses on the capacity limit of the body. Measured at resting electrocardiogram with the help of the sum of relative percentages (R × 100%) / (R + S) in leads V3R, V1 V2 (V3R% + V1% + V2% = AMC). This data defines the ability to carry training load in the anaerobic power mode;

entire metabolic capacity (EMC) of one of the most important parameters of functional readiness of the body. Measured at rest ΔEKG with the help of the sum in relative percentages (R × 100%) / (R + S) in leads V3R, V1, V2, V4, V5, V6 (V3R% + V1% + V2% + V4% + V5% + V6% = EMC) and characterizes the ability to perform high workload;

maximal oxygen consumption (MOC);

aerobic economy (Waet), which characterizes the efficiency of aerobic muscular work energy source. Measured amplitude R and S in leads V2 and V6 are the ratios (R × 100%) / (R + S) in these leads. The indicator shows the efficiency of aerobic source;

heart rate zones of physical activity for varying level of intensive work loads (HRaet).

Indicators of the functional condition and reserve capacity of the organism was evaluated twice – before and after the pedagogical experiment.

Statistical Analysis. Mathematical and statistical analysis of the survey results have been conducted using computer files with programs MS Excel "Statistic 6.0". The following methods have been applied: the method of averages and selective method. Calculated arithmetic mean (X), the deviations from the arithmetic mean (m). The value of $p<0.05$ was considered statistically significant.

Ethical approval. The research was approved by the Institutional Ethics Committee. The research was conducted in compliance with WMA Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects.

Results of the research

The meaning, PWC170, which is an integral indicator is widely has been used to evaluate functionality of the athlete's body, by the center back position players in in the end of the study had reached 16.4 kgm min-1 kg-1, while the center back players in the beginning of the study, his data was 18.8 kgm min-1 kg-1. Pivot positions players in the end of the study, indicators, PWC170, were low as well (14.8 kgm min-1 kg-1) than the group I (16.1 kgm min-1 kg-1). Among all handball players, the highest level of physical performance on this parameter was detected in wing players (17.8 kgm min-1 kg-1) in the end of the study, but their performance was significantly lower than the players of the same position at the beginning of the study (19.5 kgm min-1 kg-1). Physical performance data of right and left back players in the in the end of the study defined in 15.02 kgm min-1 kg-1, however, the players of the same positions at the beginning of the study specified in 16.7 kgm min-1 kg-1.

Analysis of indicators PWC170 for handball players in the beginning of the study indicated that wing and center players were playing at the high level of physical performance, but the lowest level of this indicator – pivot players. A similar pattern was observed in terms of physical performance for qualified handball players in the end of the study. The average meaning of the indicator AMC at the beginning of the study for handball players was set at the level 51 s.i., and in the end of the study for the same players, the average meaning was set at the level 72 s.i. to analyze the handball players' individual capabilities.

In our opinion, that emphasizes significantly higher stability in functional systems, the size of the available substrate to use of the funds and allowable volume of aerobic and anaerobic metabolic changes during intense muscular activity of handball players.

Our research has shown that average indicator of AME was at the level 284 s.i. for handball players who were at the beginning of the study, and 316 s.i. in the end. This demonstrates the highest aerobic-anaerobic capacity of highly qualified handball players. A similar pattern is observed based on data MOC, which is set at the level of 69.2 s.i. for handball players at the beginning of the study, and 77.4 s.i. at the end for the same handball players.

Indicators Waet and HRaet also were significantly different at the macrocycle of the participants. Therefore, these indicators of handball players in the beginning set at the levels 72 s.i. – Waet and 173 s.i. – HRaet. Indicators were set up at the level 64.4 s.i. and 168 s.i. for some handball players in the end of the study. The difference in terms of testing groups is reliable and is in the range $p<0.05$, that shows higher degree of energy efficiency of oxygen arrangements in muscular activity in the end of the study.

The volume's data of physiological work load for handball players is very important, due to the fact that it allows objectively evaluate and plan the players' physical activity for the every day's practice. Using these indicators, the coaches can on certain days to operate the corresponding series of the training exercise. The amount of heart rate corresponding to the competitive stress, allows control the volume of the work load performed by handball players based on their playing positions on the court. At the same time, it should be noted that it is also possible to determine rationally and plan players training load (aerobic, anaerobic and mixed).

Determining the work efficiency based on the factors of PWC170, AMC, AME, MOC, Waet and HRaet can reasonably regulate the workloads of the training, faster assess the effectiveness of the means and methods of anaerobic and aerobic capacity, speed-strength, the degree of the handball players' body's recovery and their physical condition of preparation for the next practice.

Informed consent has been obtained from all individuals included in this study.

Conclusion

The proposed concept of an integrated quick-assessment of the functional condition in qualified handball players' bodies, in high and extreme physical exertion, allows them to make determination for the functional condition of the systems to ensure their game actions. Modern diagnosis of the functional condition of certain methodic can not only adjust the parameters in the training process for highly qualified handball players, but also to determine their level of functional readiness for a particular game, and the whole competitive season as well.

REFERENCES

1. Душанин С.А. Система многофакторной экспресс-диагностики функциональной подготовленности спортсменов при текущем и оперативном врачебно-педагогическом контроле. Москва : Физкультура и спорт, 1986. 24 с.
2. Карленко В.П. Использование компьютерной технологии «D&K TEST» в практике подготовки квалифицированных спортсменов. *Физическая культура и спорт в условиях современных социально-экономически преобразований в России* : мат. науч.-практ. конф. Москва, 2003. С. 134-136.
3. Кушнирюк С.Г. Диагностические комплексы определения уровня физической подготовленности гандболистов высокой квалификации на ключевых этапах тренировочного макроцикла. *Физическое воспитание студентов*, 2003. № 7. С. 26-32.
4. Gatzemann, T., Schweizer, K., & Hummel, A. (2008). Effectiveness of sports activities with an orientation on experiential education, adventure-based learning and outdoor-education. *Kinesiology,* 40(2). P. 146-152.

5. Evhen, P., & Valeria, T. (2017). Peculiar properties and dynamics of physiological indicators in handball team. *Journal of Physical Education and Sport*, 17(1), Art 49, 335-341.

6. Valeria T., & Olexander, P. (2015). Control of general and special physical preparedness by qualified handballers. *Journal of Physical Education and Sport*, 15(2), Art 43, 287-290.

7. Yuriy B., Maryan, P., & Valeria, T. (2016). Dynamics of changes in the functional state of qualified handballers during macrocycle. *Journal of Physical Education and Sport*, 16(1), Art 8, 46-49.

8. Tishchenko V.A. (2016). Skilled handball player functionality variation in annual macrocycle. *Theory and Practice of Physical Culture*, 3, 72-73.

9. Tyshchenko V., Hnatchuk Y., Pasichnyk V., Bubela OO., Semeryak Z. (2018). Factor analysis of indicators of physical and functional preparation for basketball players. *Journal of Physical Education and Sport*, 18(4), Art 269, 1839-1844.

10. Tyshchenko V., Lisenchuk G., Odynets T., Cherednichenko I., Lytvynenko O., Boretska N., Semeryak Z. (2019). The concept of building control for certain components of the system for training handball players. *Journal of Physical Education and Sport*, 19(4), Art 200, 1380-1385.