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INTEGRATED EXPRESS-ASSESSMENT OF ORGANIZM'S FUNCTIONAL CONDITION FOR QUALIFIED HANDBALL PLAYERS

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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: analysis and generalization of scientific and methodical literature; testing of functional status and reserve capacities handball players' bodies through express-diagnosis "D&K – Test". Generalization of the studied characteristics was assessed by mean arithmetic value, standard deviation, error of mean arithmetic. For statistical processing of data, we used licensed program Microsoft Excel (2010). Statistical analysis of the received results was conducted, considering recommendations on Microsoft Excel tables' usage for computer data analysis. Participants: Sixty five handball players from teams HC «Motor», «ZTR», «ZNTU-ZAB» at various positions on the court participated in the experiment. Conclusions: The marked increase in performance of

anaerobic metabolic capacity (AHAME), which characterizes the improved ability to fulfill physical activity amount in the third and fifth zones of intensity from 51 to 72 (?). Overall metabolic capacity (OMC) serves as a measure of the efficiency level of the athlete's body. The ability to carry out the planned amount of physical activity in handball players also increased from 284 s.i. to 316 s.i. The indicator to use efficiency of aerobic muscular activity energy source (W ANSP), 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. The difference in indicators Waet and HRaet of test groups is reliable and is in the range $p<0.05$, that shows a much higher degree of energy efficiency of oxygen arrangements in muscular activity in the end of the study.
Key words: handball, express-diagnostics, testing, functional status, reserve capacities.

КОМПЛЕКСНА ЕКСПРЕС-ОЦІНКА ФУНКЦІОНАЛЬНОГО СТАНУ ОРГАНІЗМУ КВАЛІФІКОВАНИХ ГАНДБОЛІСТІВ

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Мета дослідження – апробувати в реальній практиці комплексний підхід до оцінки функціонального стану гандболістів високої кваліфікації. Практичне значення цієї проблеми стало обов'язковою умовою для її вивчення. Для досягнення цілей були використані такі методи дослідження: аналіз і узагальнення наукової та методичної літератури; тестування функціонального стану та резервних можливостей організму гандболістів за допомогою експрес-діагностики «D&K – Test». Узагальнення досліджуваних характеристик оцінювалося за допомогою середніх арифметичних величин, стандартним відхиленням. Для статистичної обробки даних ми використовували ліцензійну програму Microsoft Excel (2010). Проведено статистичний аналіз отриманих результатів, враховуючи рекомендації щодо використання таблиць Microsoft Excel для аналізу комп'ютерних даних. Учасники: шістдесят пьять гандболістів із команд ГК «Мотор», «ZTR», «ЗНТУ-ЗАС» різних ігрових амплуа. Висновки: відмічено покращення показників анаеробної метаболічної ємності (АНАМЄ), що характеризує поліпшення здатності виконувати обсяг фізичного навантаження в третій та п'ятій зонах інтенсивності, з 51 у.о. до 72 у.о. Загальна метаболічна ємність (ЗМЄ) виступає як показник, що характеризує рівень працездатності організму. Здатність виконати планувальний обсяг фізичних навантажень у гандболістів також змінився з 284 у.о. до 316 у.о. Показник ефективності використання аеробного джерела енергообеспечення м'язової діяльності (W пано), який визначає спрямованість тренувань в структурних циклах однорічного циклу підготовки, і показує економічність енергетичних субстратів, характеризує координаційні можливості, за період експерименту також змінюється. Різниця в показниках Waet та HRaet тестових груп є надійною і перебуває в діапазоні $p<0,05$, що показує набагато вищий ступінь енергетичної ефективності кисневих компонентів при м'язовій активності в кінці дослідження.
Ключові слова: гандбол, експрес-діагностика, тестування, функціональний стан, резервні можливості.

FORMULATION OF THE PROBLEM. ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

In professional sport, including the men's handball, every training mesocycle has its own tasks, which effectively improves the quality of a certain movement, but may not significantly affect the improvement of the others [6]. For each training, mesocycle should design an integrated control system with a clear quantitative expression of the major components for athletes' physical preparation [3-5].

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 [1, 2].

In article, Evhen, P.&Valeria, T. conducted a longitudinal study of fitness shape and functional status of highly qualified athletes such as, handball players [4]. 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.

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].

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" [2, 3].

Participants Physical training of qualified handball players is strongly correlated with the morphofunctional state of the athlete's body. 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 (65) athletes at various positions on the court participated in the experiment.

Handball players of both genders volunteered to participate in the test. Prior to the testing, the procedures were explained to the athletes, including the possible risks involved, and signed an informed consent form. The sportsmen's were free from any injury or neuromuscular disorder. 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, 2013 [9].

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" [2, 3], 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.

RESULTS OF THE RESEARCH

The meaning, PWC_{170}, 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, PWC_{170}, 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 PWC_{170} 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 data obtained leads to the conclusion that physical performance of qualified handball players in the end of the study significantly implemented the players' individual capacity ($p>0.05$), and was different from the same indicators of players that were at the beginning, regardless of their position on the court. This indicates that significant physical workloads, typical for handball players in the end of the study, and significantly improve their level of physical performance in comparison with in the beginning of the study.

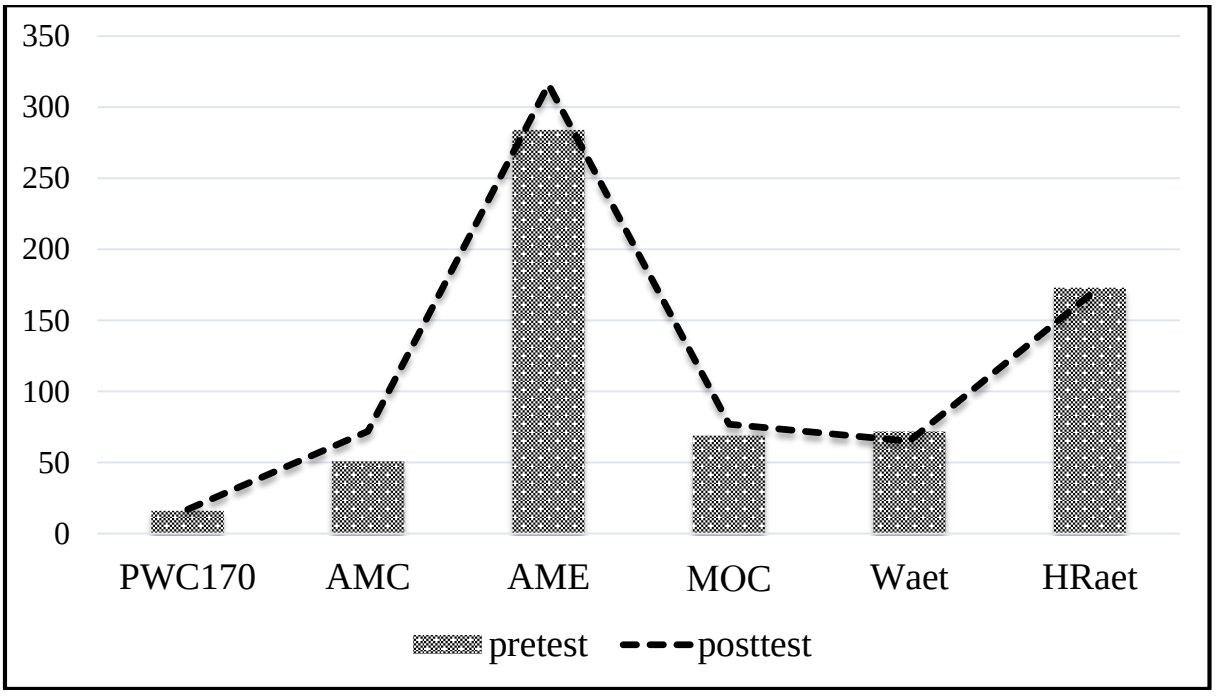

Fig. 1 Dynamics of the performance indicators

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.

CONCLUSIONS

The proposed and tested in the actual practice an integrated approach to the assessment of the functional state of highly qualified handball players can draw the following conclusions:

1. The obtained results of indicators in the functional state for highly qualified handball players determine dynamics of power and energy sources, capacity of muscular activity and the individual balance in the body functions of reproduction and utilization, predominately predetermine the high level of athletes' achievements.
2. 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).
3. Determining the work efficiency based on the factors of PWC_{170}, 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.
4. 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.
5. 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.

THE PROSPECT OF FURTHER RESEARCH

It is believed that in further studies, we need to analyze the possibility of individualization in training programs, including the intensity and amount of physical activity, types and variety of exercise, as well as the duration and manner of rest.

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