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SPECIAL EXERCISES OF BASKETBALL PLAYERS: THE NATURE OF PHYSIOLOGICAL CHANGES

Abstract. Achieving high results in sports, including basketball, is possible only with careful training of each athlete. Understanding the mechanisms of processes and patterns of functioning of body systems, allows you to use more effectively the resources of the athlete, influencing the various ways and means of motor activity on the level of his adaptation to physical activity. Physiological justification of changes in the functional state of the athlete helps to achieve the desired training effect, improve basal metabolism and ultimately increase fitness.

Training and much more competitive activities of athletes of gaming sports, including basketball, is associated with a large physical, psycho-emotional and nervous load, active muscular activity, the presence of complex-and-coordination movements. In the process of training and competitive activities, physical activity significantly affects all physiological processes occurring in the body of athletes. Increased attention is paid to the study of the operation of energy supply systems at different levels of training and competitive load.

This article presents the results of monitoring physiological variables during special exercises of basketball players, determines the value of physiological indicators such as oxygen consumption level, carbon dioxide emissions, heart rate, pulse, pulmonary ventilation, which modern methods allow to measure accurately, not interfering with physical activity. The article focuses on the comparison of variables between different zones of intensity of training loads: aerobic, mixed aerobic-anaerobic, anaerobic-glycolytic, anaerobic-alactate. Analysis of the results of physiological changes during the performance of various special exercises of basketball players will help to further optimize the training programs in order to increase their effectiveness, taking into account the individual characteristics and capabilities of the functional state of the athlete.

Keywords: basketball, special exercises, training effect, physiological changes.

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СПЕЦІАЛЬНІ ВПРАВИ БАСКЕТБОЛІСТІВ: ХАРАКТЕР ФІЗІОЛОГІЧНИХ ЗМІН

Анотація. Досягнення високих результатів у спорті, зокрема й у баскетболі, можливе лише з урахуванням ретельної підготовки кожного спортсмена. Розуміння механізмів процесів та закономірностей функціонування систем організму, дозволяє більш ефективно задіяти ресурси спортсмена, впливаючи різними способами та засобами рухової активності на рівень його адаптації до фізичних навантажень. Фізіологічне обґрунтування змін у функціональному стані спортсмена допомагає досягти необхідного тренувального ефекту, покращення основного обміну та в кінцевому результаті підвищити тренуваність.

Тренувальна та значно більшою мірою змагальна діяльність спортсменів ігрових видів спорту, у тому числі й баскетболістів, пов'язана з великим фізичним, психоемоційним та нервовим навантаженням, активною м'язовою діяльністю, наявністю складно-координаційних рухів. У процесі тренувальної та змагальної діяльності фізичне навантаження істотно впливає на всі фізіологічні процеси, що протікають в організмі спортсменів. Підвищена увага приділяється дослідженням роботи систем енергозабезпечення за різних рівнів тренувального та змагального навантаження.

У цій статті представлені результати моніторингу фізіологічних змінних в ході проведення спеціальних вправ баскетболістів, визначено значення фізіологічних показників, таких як рівень споживання кисню, рівень виділення вуглекислого газу, частота серцевих скорочень, пульс, рівень вентиляції легень, які сучасні методи дозволяють виміряти досить точно, не заважаючи фізичній діяльності. У статті увага приділяється зіставленню змінних між різними зонами інтенсивності тренувальних навантажень: аеробна, змішана аеробно-анаеробна, анаеробно-гліколітична, анаеробно-алактатна. Аналіз результатів фізіологічних змін під час виконання різних спеціальних вправ баскетболістів дозволить надалі оптимізувати тренувальні програми з метою підвищення їхньої ефективності з урахуванням індивідуальних особливостей та можливостей функціонального стану спортсмена.

Ключові слова: баскетбол, спеціальні вправи, тренувальний ефект, фізіологічні зміни.

Problem statement. Scientifically sound management of the training process drives the increase in sports scores in basketball. [1] Effective management of the training process of basketball players can be implemented if a number of key tasks are solved. [2] Understanding this determines the direction of research that is constantly being undertaken to improve the training of athletes in various sports, including basketball, for many years.

At the present level of basketball development, as competition in the international and domestic sports arenas is increasing, the skill requirements of the athlete are increasing. [3] The problem of streamlining the structure of the training process in basketball requires analysis of the sports training system, research and selection of training facilities, as well as management of athletes' fitness condition. [4], [5] All kinds of training tools should be combined as much as possible to provide integrated training. [6] More than ever, the challenge is to limit the mobilization of functional reserves and maximize their mobilization to demonstrate the highest level of sporting capabilities.

Streamlining the structure of the training process will solve the problem of improving the process of training basketball teams masters and managing their activities in responsible games. Therefore, the issue of comprehensive training for highly skilled basketball players determines the importance of research aimed at ensuring the effectiveness of the training process.

Analysis of recent research and publications. In today's sports science, a vast amount of objective knowledge has been accumulated concerning the selection of the most effective training tools and methods aimed at enhancing athletes' functionality. [7-9] It is believed that this process is based on knowledge of the demands placed on the body by certain sports. [10-12] The most pressing issue is the definition of requirements for the physical and especially functional fitness of athletes in sports games. [13-15]

In the modern system of sports training, the functional training section occupies one of the leading places. [4], [16-17] The literature has intensified the scientific search for alternative approaches to assessing the functional preparedness of basketball players as a basis for managing the training process. [3], [18]

Nowadays in basketball, the question of evaluating the training effect of special exercises of basketball players is mainly solved on the basis of the experience and intuition of the coach. In finding new tools and methods to improve the training process of skilled basketball players, it is of paramount importance to establish the urgent training effect of special basketball exercises. [19] It has been suggested [16] that physiological indicators that are highly informative. [20]

The available scientific research, conclusions and recommendations are of great value for solving the problem of training high-end basketball players. Based on the current interpretation of sports training, [1], [3] the choice of methodology in the planning and planning process should be maximally considered, availability of evaluation of the training process as a basis for its management.

In the theory and practice of basketball, the issues of planning and managing the modern training process have not been sufficiently studied and do not have adequate scientific substantiation. In the modern scientific and practical literature there are no works that would systematically and comprehensively cover the theory, methodology and practice of establishing the urgent training effect of special exercises of basketball players.

Given that, physical training affects all components of basketball players' training and it is necessary to have the information on the impact of specific exercises used in the training process in order to gain knowledge of their performance. [21,22]

Purpose of the research: on the basis of physiological changes in the body of basketball players, to evaluate the urgent training effect under the influence of changes in the parameters of physical activity in special exercises.

Presentation of the main material. The study used empirical methods of measuring the physiological indicators. Measuring of the heart rate during competitions was conducted by means of the method of continuous automatic registration using the multichannel system measuring. [23] This allowed to determine the maximum mean pulse rate during the game, as well as the maximum pulse rate total during the game and during the recovery time.

The level of pulmonary ventilation was determined by way of collecting expired air into Douglas bags with the subsequent measurement of the volume of the air contained in the bag using a laboratory gas meter. [24]

The percent composition was determined by way of analyzing the samples using the gas analyzers Spirolit and METAMAX that are capable of recording the concentration of O₂ and CO₂ in expired air.

All the indicators of the heart rate, as well as the level of O₂ consumption, total O₂, the level of CO₂ release and oxygen pulse rate were calculated according to the method described in the works of Volkov N. [25]

Studies have shown that special exercises used in the preparation of basketball players differ significantly in the nature of physiological effects on the body (Tab. 1).

It was found that the smallest physiological shifts were detected when performing free throws. The average heart rate was 128 ± 2.24 bpm. Oxygen consumption level – 31% of the maximum carbon dioxide value is 0.18 ± 0.17 l/min. When performing other special exercises with moderate intensity, the heart rate is in the range of 140-150 beats per minute (in tall players within the range of 160 beats per minute), the level of oxygen consumption varies from 53.7 to 55.1 % of the maximum value (2.3 l/min on average), carbon dioxide evolution reaches 0.5 l/min, pulmonary ventilation 45 l/min.

The training effect of these exercises is predominantly aerobic. Physiological indicators, when performed by basketball players special exercises, belong to different ranges of training loads. The results of the studies that led to these conclusions are presented in Table 1.

The greatest physiological shifts in the body of the basketball players cause exercises that are performed in an intense or repeated mode with the maximum intensity and duration of each repetition of the exercise from 20-30 s to 2 min.

The amount of oxygen consumption when performing such exercises reaches the maximum possible values of oxygen debt – increases to 10 liters.

Somewhat less pronounced physiological shifts are observed when performing game exercises (1x1 with the ball and without the ball, 2x2, 3x3, 5x5 on one shield). Here, the oxygen consumption is 65.2 to 82.4 % of the maximum; the average heart rate is 172-187.5 bpm. The value of the oxygen debt is in the range from 5.8 to 7.2 l, carbon dioxide emission is 0.67-0.89 l/min. These exercises are characterized by a

complex effect on the body of athletes, that is, they contribute to the development of speed-power qualities and endurance.

When performing short-term exercises of 5-15 duration with an intensive or repeated method, the value of physiological shifts is negligible: the level of oxygen consumption was 68.1 % of the maximum value. These exercises are characterized by the highest rate of formation of alactate oxygen debt – 68.5 ± 17.5 ml/min.

Table 1.

The value of physiological indicators when basketball players perform special exercises in various ranges of training loads

Focus of the trainer	Level O ₂ consumption l/min	Alactate O ₂ -debt, l	Lactate O ₂ -debt, l	Total O ₂ -debt, l	“Nonmetabolic surplus” CO ₂ , l/min	Level of pulmonary ventilation, l/min	Heart rate, bpm	Pulse amount of recovery, beats	Average heart rate bpm
Mostly aerobic	0.9-2.3 1.6	0.5-1.5 0.75	1.3-3.3 2.3	1.8-4.8 3.2	0.14-0.5 0.32	16-45 20	120-160 140	300-900 600	50-90 70
Mixed aerobic-anaerobic	2.3-3.6 2.95	1.5-2.0 1.75	3.3-6.0 4.65	4.8-7.5 6.15	0.5-1.2 0.85	45-80 62	100-190 175	900-1900 1400	90-115 102
Anaerobic glycolytic	3.6-4.3 3.95	2.0-2.6 2.3	6.0-6.8 6.4	7.5-9.5 8.5	1.2-1.8 1.5	80-140 110	180-190 185	1900-2300 2115	90-110 100
Anaerobic alactate	2.3-3.1 2.7	1.3-1.9 1.6	2.3-4.4 3.35	5.1-6.2 5.65	0.35-0.8 0.55	50-75 62	170-190 180	730-1500 1100	94-103 98.5

As can be seen from the results in the table, performing the same exercise with different combinations of physical activity indicators can cause different physiological shifts in the body.

Thus, it was found that the physiological indicators, which can serve to evaluate the urgent training effect of the exercises, have different informativeness. With the change of physical activity parameters, each indicator changes in a specific way. These changes occur until it reaches the limit values above which it becomes insensitive to the increasing impact of the load.

Our article is based on the study of the urgent training effect of special exercises basketball players on the nature of physiological action on the body of athletes, as the basis for effective planning of the training process. The results of the empirical study complement the ideas of managing the training process based on the control of the

impact of the means used in the training of qualified athletes. [1], [11]

Better understanding the data obtained changes in the physiological functions of basketball players in the course of performing special exercises, allows their interpretation. The results of the study of physiological shifts in the body of basketball players in the performance of special exercises were consistent with the information that the parameters of physiological changes are correlated with the influence of different exercises. [15], [26-27] Therefore, this allows them to be correlated by changing the parameters of the exercises. [14], [28]

Considering that, based on the study of the urgent training effects of special exercises of basketball players, it is possible to systematize the exercises used in the training process of basketball players, the conducted research integrates the existing ideas in this direction. Therefore, information on improving the training system for skilled basketball players has been supplemented. [1], [3], [5]

The obtained results expand and supplement the data on the effectiveness of the use of scientifically-based planning in the training of highly skilled basketball players, which involves the management of sports uniforms, the search for new rational means of special training. [13], [29-30]

The researchers note the potential of using information on the impact of special exercises on the effectiveness of the training process in sports games in general. [12], [31-32] Thus, the study provides a further understanding of the factors that influence the effectiveness of training activities in training players. We have expanded the available data on the use of physiological control in the planning of the training process. Proper planning of the training process with the use of the data obtained from the study will allow rational use of training time, reaching a high level of basketball players.

The obtained results extend and supplement the data that increase of efficiency of a training process is possible on the basis of deep analysis of influence of physical activity on an organism of athletes. [10], [27], [33]

The study results complement the information on pedagogical control of basketball players' training activities, which is the basis for appropriate regulation of planning and management of training of highly qualified basketball players to ensure its effectiveness. [3], [34-35]

Conclusions. The first step in the creation of an effective system for managing the training process of basketball players is to establish an urgent training effect of special exercises. The most acceptable in assessing the urgent training effect of exercise may be physiological indicators that are highly informative.

An empirical study has shown that the exercises used in the preparation of basketball players differ significantly in the nature of physiological effects. The magnitude and direction of the urgent training effect of special exercises in basketball depend on the combination of the effects of all the main indicators of physical activity – the type of exercises used, their intensity and duration, the amount and duration of the rest breaks, the number of repetitions.

The practical implementation of the formulated provisions will allow coaches and athletes to build rationally and effectively a multi-year process aimed at training skilled basketball players.

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