

## TRAINING EFFECT OF SPECIAL BASKETBALL EXERCISES

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### Abstract

**The study objective** is to evaluate the immediate training effect under the influence of changes in the parameters of physical activity in special exercises on the basis of physiological changes in the body of basketball players.

**Materials and methods.** The study used empirical methods of measuring heart rate during competitions, pulmonary ventilation values, O<sub>2</sub> consumption during physical work, O<sub>2</sub>-debt, "excess" CO<sub>2</sub>, methods of mathematical statistics.

**Results.** An empirical study has shown that the exercises used in the preparation of basketball players differ significantly in the nature of physiological action. The greatest physiological shifts in the body of basketball players determine the exercise, which is performed intensively or repeatedly with maximum intensity. The smallest physiological shifts were found when performing free throws.

**Conclusions.** The magnitude and orientation of the immediate 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, duration of rest, the number of repetitions.

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

### Introduction

*Problem statement.* The increase in sports scores in basketball is driven by scientifically sound management of the training process (Fort-Vanmeerhaeghe, Montalvo, Latinjak, & Unnithan, 2016). Effective management of the training process of training basketball players can be implemented if a number of key tasks are solved (Koryagin, Blavt, & Grebinca, 2016). 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 (Asadi, Saez de Villarreal, & Arazi, 2015). 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 (Anastasiadis, 2006; Gonzalo-Skok, Sánchez-Sabaté, Izquierdo-Lupón, & Sáez de Villar, 2019). All kinds of training tools should be combined as much as possible to provide integrated training (Tyshchenko, Hnatchuk, Pasichnyk, Bubela, & Semeryak, 2018). 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 (Ben Abdelkrim, Castagna, El Fazaa, & El

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Ati, 2010; Hoare, 2000; Webster, Horne, Wheelans, & Bell, 2009). It is believed that this process is based on knowledge of the demands placed on the body by certain sports (Bosco, Luhtanen, & Komi, 1983; Gonzalo-Skok et al., 2017; Ingebrigtsen, Jeffreys, & Rodahl, 2013). The most pressing issue is the definition of requirements for the physical and especially functional fitness of athletes in sports games (Kozina, Iermakov, Cretu, Kadutskaya, & Sobyenin, 2017; Koryagin & Blavt, 2018; Sallet, Perrier, Ferret, Vitelli, & Baverel, 2005).

In the modern system of sports training, the functional training section occupies one of the leading places (Anastasiadis, 2006; Ben Abdelkrim, El Fazaa, & El Ati, 2007; Khudolii, 2019). 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 (Asadi et al., 2015; Montgomery, Pyne, & Minahan, 2010).

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 immediate training effect of special basketball exercises (Ramos, Rubio, Martínez, Esteban, & Jiménez, 2010). It has been suggested (Ben Abdelkrim, El Fazaa, & El Ati, 2007) that physiological indicators that are highly informative (Green, Hughson, Orr, & Ranney, 1983).

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 (Asadi et al., 2015; Fort-Vanmeerhaeghe et al., 2016), 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 immediate training effect of special exercises of basketball players.

Given that physical training affects all components of basketball players' training and in order to gain knowledge of their performance it is necessary to have information on the impact of specific exercises used in the training process (Marchenko & Dykhanova, 2019; Matthew & Delextrat, 2009).

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

## Materials and methods

The study of the heart rate during competitions was conducted by means of the method of continuous automatic registration using the multichannel system (Koryagin & Blavt, 2019). This allowed determine the maximum mean pulse rate during the game, as well as the maximum pulse rate total during the game and during the recovery.

The level of pulmonary ventilation was determined by way of collecting expired air into Douglas bags with the sub-

sequent measurement of the volume of the air contained in the bag using a laboratory gas meter (Beaver, Wasserman, & Whipp, 1986).

The percent composition was determined by way of analyzing the samples using the gas analyzers Spirolit and ME-TAMAX that are capable of recording the concentration of O<sub>2</sub> and CO<sub>2</sub> in expired air.

All the indicators of the heart rate, as well as the level of O<sub>2</sub> consumption, total O<sub>2</sub>, the level of CO<sub>2</sub> release and oxygen pulse rate were calculated according to the method described in the works (Volkov, 1986; Zankovets, 2016).

## Results

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.

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 immediate 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

**Table 1.** The value of physiological indicators when basketball players perform special exercises in various ranges of training loads

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

values above which it becomes insensitive to the increasing impact of the load.

## Discussion

The basis of our study is based on the study of the immediate 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 (Fort-Vanmeerhaeghe et al., 2016; Gonzalo-Skok, Tous-Fajardo, Valero-Campo, Berzosa, Bataller, Arjol-Serrano, & Mendez-Villanueva, 2017).

Better to understand 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 (Cormery, 2008; Robert, McGown, Fisher, Dalsky, & Robinson, 2017; Sallet, Perrier, Ferret, Vitelli, & Baverel, 2005). Therefore, this allows them to be correlated by changing the parameters of the exercises (McArdle, Katch, & Katch, 1991; Koryagin & Blavt, 2018).

Considering that, based on the study of the immediate 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 (Asadi et al., 2015; Fort-Vanmeerhaeghe et al., 2016; Gonzalo-Skok et al., 2019).

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 (Aiken, Fairbrother, & Post, 2012; Kozina et al., 2017; Scanlan, Fox, Borges, Tucker, & Dalbo, 2018).

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 (Backman & Danielson, 2011; Ciuti, Marcello, Macis, Onnis, Solinas, & Lai, 2009; Ingebrigtsen, Jeffreys, & Rodahl, 2013). 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 (Karpowicz & Karpowicz, 2013; Bosco et al., 1983; Robert et al., 2017).

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 (Asadi et al., 2015; Erčulj, Blas, & Bračić, 2010; Vaquera, Santiago, Villa José, Morante, & García-Tormo, 2015).

## Conclusions

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

Exercises used in the preparation of basketball players differ significantly in the nature of physiological effects. The magnitude and direction of the immediate 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 of the amount of rest breaks, the number of repetitions.

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

## Conflict of interest

The authors state no conflict of interest.

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## ТРЕНУВАЛЬНИЙ ЕФЕКТ СПЕЦІАЛЬНИХ ВПРАВ БАСКЕТБОЛІСТІВ

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; Е – збір коштів

Реферат. Стаття: 5 с., 1 таб., 36 джерел.

**Мета дослідження** – на основі фізіологічних змін в організмі баскетболістів здійснити оцінку термінового тренувального ефекту під впливом змін параметрів фізичного навантаження у спеціальних вправах.

**Матеріали та методи.** У дослідженні було використано емпіричні методи вимірювання частоти серцевих скорочень під час змагань, величини легеневої вентиляції, O<sub>2</sub>-споживання під час фізичної роботи, O<sub>2</sub>-боргу, «надлишку» виділення CO<sub>2</sub>, методи математичної статистики.

**Результати.** Проведене емпіричне дослідження показало, що вправи, які застосовуються при підготовці баскетболістів, істотно розрізняються за характером

фізіологічної дії. Найбільші фізіологічні зрушення в організмі баскетболістів зумовлюють вправи, що виконуються в інтенсивному або повторному режимі з максимальною інтенсивністю. Найменші фізіологічні зрушення виявлені при виконанні штрафних кидків.

**Висновки.** Величина і спрямованість термінового тренувального ефекту спеціальних вправ в баскетболі залежать від поєднання впливів всіх основних показників фізичного навантаження – виду застосовуваних вправ, їхньої інтенсивності та тривалості, тривалості відпочинку, числа повторень.

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

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