EVALUATION OF THE EFFECTIVENESS OF THE COMPETITIVE ACTIVITY OF ATHLETES

Abstract. The issue of ensuring competitive activities’ efficiency of basketball players has been considered. It has been established that the basis of this process lies in the choice of the most efficient means and methods of training based on physiological functions control data. The purpose of the study was to assess the basketball players’ activity during the competitions and to establish changes in the players’ physiological functions during training and competitions. For the experiment, highly qualified athletes – international tournaments participants – were examined.

According to the pedagogical assessment of the physiological features of basketball players activities during the competitions, changes in the players’ physiological functions during training and competitions have been found out. It has been established that physiological changes in basketball players’ bodies depend on the nature of the play activity and the protection system. The level of oxygen consumption during the game varies from 72.3 to 96.6% of the maximum oxygen consumption with an average of 85.8%. According to the results of the experiment it became clear that the functions of various organs and systems of basketball players develop during the competitions. Therefore, it is necessary to pay great attention to development of both aerobic and anaerobic qualities of athletes in the course of training, in particular of anaerobic glycolytic speed endurance depends on. The change of protection systems during the game significantly influences aerobic and anaerobic metabolism indicators. The presented empirical results of the research carried out allow us to conclude that the energy supply of sports competitions in basketball is aerobic-anaerobic in nature with high proportion of glycolysis. In general, physiological changes in basketball players’ bodies depend on the nature of the play activity and the protection system.
ОЦІНКА ЕФЕКТИВНОСТІ ЗМАГАЛЬНОЇ ДІЯЛЬНОСТІ СПОРТСМЕНІВ

Анотація. Розглянуто питання оцінки ефективності змагальної діяльності баскетболістів. Установлено, що в основі цього процесу – вибір найефективніших засобів і методів тренування на основі даних контролю фізіологічних функцій. Мета дослідження полягала в оцінці діяльності баскетболістів під час змагань й установлення змін фізіологічних функцій гравців у процесі тренування та змагань. Для проведення експерименту обстежували спортсменів високої кваліфікації – учасників міжнародних турнірів.

За результатами педагогічної оцінки фізіологічних характеристик діяльності баскетболістів під час змагань з’ясовано зміни фізіологічних функцій гравців у процесі тренування та змагань. Установлено, що фізіологічні зміни в організмі баскетболістів залежать від характеру ігрової діяльності і системи захисту. Рівень споживання кисню під час гри варіює в межах від 72,3 до 96,6% від максимуму кисневого споживання із середнім значенням 85,8%. Згідно підсумків експерименту з’ясовано, що під час змагань розвиваються функції різних органів і систем баскетболістів. Тому в процесі тренування треба приділяти велику увагу розвитку аеробних, а також анаеробних якостей спортсменів, зокрема анаеробних гліколітичних, від яких залежить швидкісна витривалість. Зміна в процесі гри систем захисту істотно відбувається на показниках аеробного і анаеробного обміну. Представлені емпіричні результати проведеного дослідження дозволяють зробити висновок про те, що енергетичне забезпечення спортивних змагань з баскетболу носить аеробно-анаеробний характер з великою питомою вагою гликолізу. Загалом, фізіологічні зміни в організмі баскетболістів залежать від характеру ігрової діяльності і системи захисту.

Ключові слова: баскетбол, змагальна діяльність, тренування фізіологічні зміни.
Problem statement. Basketball is an athletic game that places high demands on the mobile and functional capabilities of athletes [1], [2], [3]. Participation in the game requires the athlete to maximize the mobilization of his physical and functional capabilities. The functional training of basketball players in modern basketball is of particular importance due to the expansion of the range of their game actions, an increase in tension in the game, which requires maximum muscular effort from athletes in a situation that is rapidly changing on the court.

In order to effectively increase the physical abilities of athletes, in particular basketball players, you need to know the following: what requirements does the game itself place on the individual functions of the body and the physical qualities of basketball players, how great are these requirements, what are the physical abilities of basketball players, what physical and functional qualities first of all need to pay attention to in the process of training, what means and methods of training are most effective for the development of certain qualities and, finally, how to rationally build the training process, that is, how to effectively distribute the means and methods of training at certain stages of preparing basketball players for competitions. Therefore, the question of establishing criteria for the individual functions and physical qualities of basketball players and physical activity during the game still needs to be studied [1-9].

Analysis of recent research and publications. The study of the competitive activity of basketball players has been the subject of research by many specialists in this field in connection with the need to improve the training process, increase not only the technique and tactics of the game, but also the functionality of athletes [1], [2].

In particular, experts were interested in how changes took place among basketball players’ athletes under the influence of specialized training [1], the pedagogical assessment of competitive activity was investigated [2].

In the works of S. Shutov, O. Abrosev (2016) studies of indicators of game activity in the attack of qualified basketball players are shown. Important aspects of competitive activity are covered by such specialists as V.Danilov (1972), L.Poplavskyi (2004), L.Kostikova (1973), R.Sushko (2017), O.Mitova (2021). However, the issue of assessing competitive activity due to changes in the rules of the game and the intensification of physical activity requires further research.

Purpose of the research: The task of the study was to study the indicators of game activity of basketball players in the process of competitions at the present stage of basketball development.
Materials and methods. We strived to assess the physiological features of basketball players’ activities during the competitions and find out changes in the players’ physiological functions during training and competitions. We examined highly qualified athletes – international tournaments participants. The players’ activity among men's teams was evaluated using timing. The duration of the active and passive phases of the game was recorded. The active phase – from the moment the player touches the ball on the site and until the ball has gone out of bounds, and the passive phase – since stopping the stopwatch which counted the period of the active phase until the ball is returned into the game. At the same time, the content of these phases and reasons for stopping the game have been analyzed. The games were timed during the experiment.

The volume of shifts in the bodies of basketball players was being detected in various ways. Thus, the heart rate (HR) was recorded by four-channel system «Sport» and one-channel system «Nec–spurt». In parallel, samples were taken using the Douglas-Holden method to determine the volume of oxygen consumption and oxygen debt in the course of work [6].

Presentation of the main material. The results of the game timing during the national championship and in international basketball tournaments are shown in Table 1.

Basketball players are in very tense condition during the game for quite a long time. According to our observations, the game lasts for 69 minutes 27.7 seconds on average, not taking the breaks between the two halves into account. Other authors recorded values close to our results (65 min 53.6 sec) [7,8,9,10]. Average duration of the first half is 34 min 20.6 sec, of the second half – 35 min 7.1 sec.

<table>
<thead>
<tr>
<th>Indices</th>
<th>First half</th>
<th>Second half</th>
<th>Total for the game</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of active phases during the game</td>
<td>45.5±1.25^ 6.5^</td>
<td>43.5±1.34 7.0</td>
<td>89.0±1.34 7.0</td>
</tr>
<tr>
<td>Total number of passive phases during the game</td>
<td>44.5±1.25 6.5</td>
<td>42.5±1.34 7.0</td>
<td>89.0±1.34 7.0</td>
</tr>
<tr>
<td>Average duration of the active phase of the game, sec</td>
<td>26.9±0.77 4.02</td>
<td>28.4±0.84 4.37</td>
<td>27.7±0.84 4.37</td>
</tr>
<tr>
<td>Average duration of the passive phase of the game, sec</td>
<td>19.3±0.55 2.87</td>
<td>21.5±0.7 3.65</td>
<td>20.4±0.7 3.65</td>
</tr>
<tr>
<td>Game total duration</td>
<td>34 min 20.6 sec</td>
<td>35 min 7.1 sec</td>
<td>69 min 27.7 sec</td>
</tr>
<tr>
<td>Fraction of “net” playing time in the total duration</td>
<td>58.3</td>
<td>57.0</td>
<td>57.5</td>
</tr>
</tbody>
</table>

Note: the numbers given in the table mean: 1 average, 2 standard error of average, 3 standard deviation.
The active phase lasts on average for 27.7 sec. The periods of active activity are repeated after every 20.4 seconds of the passive phase. In the course of the game with ball running out, with technical errors, playing out a jump ball, personal remarks, for which foul shot are not assigned, the passive phase lasts, as a rule, 2–10 seconds. Provided minute breaks, performance of foul shots and replacements its duration increases to 0.5–2.5 min.

As for the indices of the average number of active and passive phases of the game, certain differences have been identified (P<0.01). The same applies to average duration of the active and passive phases of the game between the first and second parts. Longer duration of the passive phase in the second half, apparently, is partly due to the fact that as a result of athletes’ increased fatigue 35.7% of the fouls received by the team are hit here, and only 25.7% in the first half of the game.

The time structure of the game somehow indicates the nature of the energy supply of basketball players during the work. During the gaming activity period lasting for about 30 seconds, the aerobic process fails to reach its maximum power, while the anaerobic one is meanwhile being exhausted in the working muscles [11-12]. The most important role in the energy supply of the exercise at such time intervals is played by anaerobic glycolytic process [5], [13]. However, since active pauses with significant reference to glycolysis are multiply repeated (89 times per game) through relatively short (20 sec) rest intervals, then during the game the conditions for aerobic process reference are also created. It may be assumed that the energy supply of basketball players during the game will have a mixed aerobic-anaerobic character with high specific gravity of glycolytic reactions.

The direct answer to the question of which functions are most often used in the course of game can only be obtained by direct recording of the volume and nature of physiological changes in the bodies of basketball players during the matches (Table 2).

### Table 2

Results of study of the training and competitive games influence on the bodies of basketball players (n=50)

<table>
<thead>
<tr>
<th>Indices</th>
<th>Game time'</th>
<th>Range of variability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total time of participation in the game, min.</td>
<td>18.39</td>
<td>5.5–38.16</td>
</tr>
<tr>
<td>Maximum heart rate during the game, bpm</td>
<td>198.9</td>
<td>180–230</td>
</tr>
<tr>
<td>Average heart rate during the game, bpm</td>
<td>114.0</td>
<td>90.5–147.6</td>
</tr>
<tr>
<td>Maximum pulse sum, bpm</td>
<td>2346.7</td>
<td>637–4450</td>
</tr>
<tr>
<td>Maximum recovery sum, bpm</td>
<td>3396.9</td>
<td>1991–4059</td>
</tr>
<tr>
<td>O₂-consumption level, l/min</td>
<td>85.8</td>
<td>72.3–96.6</td>
</tr>
<tr>
<td>O₂-consumption, % from the maximal index</td>
<td>3.25</td>
<td>28.7–3.78</td>
</tr>
<tr>
<td>Total O₂ – debt, l</td>
<td>5.87</td>
<td>4.49–7.51</td>
</tr>
<tr>
<td>CO₂-emission level, l/min</td>
<td>2.9</td>
<td>2.53–3.4</td>
</tr>
<tr>
<td>Pulmonary ventilation level, l/min</td>
<td>79.5</td>
<td>59.5–105.1</td>
</tr>
<tr>
<td>Oxygen pulse, ml per beat</td>
<td>17.0</td>
<td>15.0–19.9</td>
</tr>
</tbody>
</table>

'Net' time of participation in the game in the numerator and total time of the game in the denominator.
It has been found out that basketball players spend a lot of energy during the game. The level of oxygen consumption during the game varies from 72.3 to 96.6% of the maximum oxygen consumption with an average value of 85.8%.

Significant activation of aerobic changes in the exercised muscles is evidenced by high level (2.51 l/min) of alactic O₂-consumption. Indicators of lactic O₂ consumption are also moderately high (0.42 l/min.), which shows the degree of myocardium metabolic activity. Significant activation of cardiac activity is confirmed by the maximum heart rate – 198.9 bpm on average within the range from 180 to 230 bpm.

Participation in a tense game along with significant activation of aerobic functions leads to considerable use of anaerobic energy sources. This, in particular, is confirmed by the value of O₂-debt, which reaches 4.5-7.9 liters at the end of the game. The corresponding value of heart rate insufficiency in these conditions varies from 1991 to 4058 bpm. «Excess» of carbon dioxide reaches 1.32 l/min.

The change in protection systems in the course of game is significantly reflected in the indicators of aerobic and anaerobic metabolism. Most often this is observed at the application of «pressing» protection system. The oxygen and heart rate debt of the player, who played the role of the attacker, changes the most. The level of O₂-consumption did not change significantly during the game.

Interpretation of the received data about the changes in the players’ physiological functions in the process of training and competition makes it possible to better understand them. The result obtained during the pedagogical control of the physiological features of basketball players was consistent with the information [8],[10],[14],[15] that basketball players spend a lot of energy during the game.

The experiment analysis showed that the functions of various organs and systems of basketball players develop during the competitions. Therewith, we state it is necessary to pay great attention to development of both aerobic and anaerobic qualities of athletes in the course of training, in particular of anaerobic glycolytic the speed endurance depends on. It is as well necessary to develop aerobic capacity because the efficiency of the gaming activities implementation in oxygen supply of the body is somewhat affected by the recovery rate of energy processes’ disturbed balance, and this property is determined by the level of development of players’ aerobic capabilities. This confirms the information available in the literature [5],[16-18].

We reconcile our results [1],[9],[19] that defenders and attackers move more during the game than the center players. However, the center players
are actively involved in the fight for the ball under the shield. Therefore, the load on the body of basketball players of various game functions is approximately the same players with different roles have the same requirements for functional training [2],[3],[15],[20].

The results of the study supplement the information on the pedagogical control of competitive and training activities of basketball players regulating the expediency of pedagogical influences to ensure the efficiency of the basketball players’ competitive activities [2],[6],[14].

Conclusions. Thus, the energy supply of basketball sporting events is of aerobic-anaerobic nature with high specific gravity of glycolysis. Physiological changes in basketball players’ bodies depend on the nature of the play activity and the protection system. The «pressing» system is accompanied by considerably greater strain than personal and zone protection systems.

The authors of this study confirm that the research and publication of the results were not associated with any conflicts regarding commercial or financial relations, relations with organizations and/or individuals who may have been related to the study, and interrelations of co-authors of the article.

References:

Література:


