Maximal power of football players in preparation period

Rafal Buryta¹, Prof. Dr. Habil. Albertas Skurvydas², Dr. Vitaïlis Novikovas², Dr. Vytautas Streckis², Dr. Krzysztof Krupecki¹, Maciej Buryta¹, Piotr Lesiakowski¹
Institute of Physical Education, University of Szczecin, Poland¹
Academy of Physical Education in Kaunas, Lithuania²

Summary
Continuous monitoring in football training is a very important element and it is closely connected with fitness tests. The Running-based Anaerobic Sprint Test (RAST) was developed to test an athlete’s anaerobic performance. It is similar to Wingate Anaerobic 30 cycle Test, but RAST can be used with athletes where running forms the basis of the movement. This work is aimed at defining maximal power of organisms of football players.

This test was carried out in the Academy of Physical Education in Kaunas. The research has been carried out with football players of Lithuanian first division – LKKA Kaunas.

After warm-up players performed six 35-meter sprint runs at maximum speed with 10 seconds allowed between each sprint for a turnaround. All of the players were monitored during the test by Sport tester Polar S610 (Heart Rate), before and after the test by dr. Lange (Lactate).

Obtained results were placed in tables and subjected to statistical analysis based on calculation of arithmetic mean and standard aberration.

The results of Running-based Anaerobic Sprint Test on a track provide football coaches with better information than Wingate Test, as far as running in comparison to cycling is concerned.

Keywords: maximal power, RAST test, Wingate, football players.

Introduction
In football we can notice the lack of direct reference of fitness tests results to the players’ performance. Some coaches claim that fitness tests are useless since even the best results of such tests do not guarantee the success in a direct contact with the opponent (Talaga 2004, Ulatowski 2002).

The most important issue here appears to be estimating and evaluating the exact diagnostic possibilities of particular tests in order to use the results of physiological tests in practice and in an optimal way. Registering physiological parameters (heart rate and blood lactic acid concentration in particular) shall help to enrich the information about physical fitness of a player (Ryguša 1998).

There are many reasons why fitness tests should be carried out, their results are essential during e.g. introducing changes into training programmes, optimizing training loads and motivating the players to produce high power output as well as assessing physical fitness of a player after injuries and after a recovery period (Bangsbo 1999).

In team games, which are played in the open space, including football, interval effort dominates. When the intensity of a game increases the preparation in the area of anaerobic changes in players is of a great importance (Bangsbo 1999, Reilly 1987). A methodological problem in the area of monitoring the effort adaptation of the players, which has not been thoroughly studied yet and is still adequate to the nature of the effort made during match play, is the correct choice of proper fitness tests. The most commonly used tests are cyclogeometric tests (Test 10-s, Test Wingate 30-s and Test 3x60-s). However, they do not reflect a player’s performance on the field, since different muscles are used during cycling and running. The Running-based Anaerobic Sprint Test (RAST) was developed at the University of Wolverhampton (United Kingdom) to test an athlete’s anaerobic performance. The Wingate test is more specific for cyclists whereas the RAST provides a test that can be used with athletes where running forms the basis of the movement.

Research methods and organizing
The research has been carried out in a sports hall on a running track at the Academy of Physical Education in Kaunas with 13 Lithuanian first division football players LKKA Kaunas. All of the players were at the age of 20,2 ± 1,09 ranging from 19 years old to 22 years old, with an average height of 182,2 cm ± 5 ranging from 174 to 192 cm and an average body mass of 73,8 kg ± 6,16 ranging from 61,1 kg to 82,3 kg. The percentage of fatty tissue FAT% was approx. 7,06% ± 2,21 ranging from 3,7% to 10,1%.

All of the players were put under RAST in preparation period. After a warm up conducted by the coach and before the test itself, the level of blood lactic acid concentration was measured by a device dr. Lange Plus LP 20. During the whole test all of the players were being monitored by sport tester Polar S610.

The RAST consisted of six high-speed 35-metre intervals, with each 35 m burst starting at a 10-second interval which means that each player started at time
zero, ran 35 metres as fast as possible and then rested for 10 seconds before he begun the next 35-metre interval. The time was recorded with a photoelectric cell TS – F11.

After regular warm-up the level of blood lactate was ranging from 2,37 to 4,76 mmol/l, on average 3,0 ± 0,7 mmol/l. Next, each player completed performance sets of RAST and after that their blood samples were taken in no more than 3 minutes. 3 minutes after their performance the level of lactate was up to 11,5 do 18,9 mmol/l, on average 15,19 ± 2,3 mmol/l (Fig. 2).

The data concerning heart rate can constitute a basis for evaluating a player’s output as well as realization of training tasks. Such data is extremely useful during high intensity exercise. Measuring the heart rate in a few minutes after the exercise shows how fast an organism recovers to its resting level (Fig. 1).

An average heart rate during the test was HR\textsubscript{max} 186,4 ± 6,1 beats/min. Heart rate restitution after 5 minutes was HR 119,4 ± 8,8 beats/min (Picture 1). The heart rate was increasing from the very beginning of the test to its end, and was eventually recovered. Recovery was measured for the period of 5 minutes after completing the exercise.

Maximal power (P\textsubscript{max}) obtained by players during the test was 10,99 W/kg ± 1,2 ranging from 8,65 W/kg to 12,52 W/kg. An average power (P\textsubscript{av}) was 9 W/kg ± 1, ranging from 7,7 W/kg do 9,3 W/kg.

### Table 1

<table>
<thead>
<tr>
<th>Rates</th>
<th>LA resting [mmol/l]</th>
<th>LA after warm up [mmol/l]</th>
<th>LA 3 min after RAST [mmol/l]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average rates</td>
<td>1,75±0,78</td>
<td>3,0±0,7</td>
<td>15,19±2,3</td>
</tr>
<tr>
<td>Minimal rates</td>
<td>0,9</td>
<td>2,37</td>
<td>11,5</td>
</tr>
<tr>
<td>Maximal rates</td>
<td>3,43</td>
<td>4,76</td>
<td>18,9</td>
</tr>
</tbody>
</table>

#### Discussion of the results

The results of research carried out with football players using a 30-second test Wingate by Gabryš (2004) were only slightly different in comparison to those obtained after applying RAST to Lithuanian football players of LKKA Kaunas. The age as well as training experience of the players in both groups were similar. When comparing the level of lactate concentration in blood after RAST and after the
30 – second test Wingate (Gabryš 2004) it can be stated that the nature of workout is similar. In the first case an average La was 15,19 mmol/l, while in the second 13,16 mmol/l. When comparing maximal power (Pmax) and average power (Pav) the results are also similar. Maximal power reached by the players during RAST test was 10,99 W/kg, and during Wingate test was 10,72 W/kg, an average power in the first case was 9,0 W/kg, and in the second 8,94 W/kg. The argument for applying RAST is that the nature of movement is similar to field performance (run) in comparison to Wingate test (cycloergometre), which allows making an immediate evaluation of the power used for performing various tasks during a match.

**Conclusion**

The analysis of the research results allows us to reach the following conclusions:

1. The level of lactate concentration in blood after applying Wingate test was considerably higher than after RAST test, which indicates that in this specific movement (run), the players used anaerobic sources of energy in a more effective way.

2. Maximal power reached by the players after completing both RAST and Wingate tests was similar, however the outlet of energy during Wingate test was much bigger taking into consideration the level of lactate concentration in blood.

3. The application of RAST to test football players provides us with the real assessment of maximal power of football players.

**REFERENCES**


**SANTRAUKA**

Nuolatinė futbolininkų treniruotės stebėsena yra labai svarbus elementas, kadangi jis glaudžiai susijęs su fizinio parengtumo testais. Siekiant ištirti sportininko anaerobinį parengtumą, buvo parengtas anaerobinis sprinto testas (bėgimo pagrindu) RAST. Jis panašus į Vingeito anaerobinį 30-ies ciklø testą, tačiau RAST gali būti naudojamas sporto šakose, kur bėgimas sudaro judėjimo pagrindą.


Gauta rezultatai apdoroti statistinišnė analizės būdu: apskaičiūotas aritmetinis vidurkis ir standartinis nuokrypis.

Anaerobinis sprinto testas (bėgimo pagrindu), atliekamas bėgimo takelyje, suteikia treneriams vertingą informaciją bei Vingeito testas (atliekamas veloergometru).

**RASTUODŽIAI:** maksimalus galinumas, RAST testas, Vingeito testas, futbolininkai.