

VO2 MAX VARIABILITY OF POLISH SQUASH FEDERATION PLAYERS DURING THE PREPARATORY PERIOD

Michał **TOR**^{1ABCD}, Aleksandra **ŁOŚ**^{2ABCDE}, Aleksandra **JEŃĆ**^{2ABCDE}, Nikola **KRÓL**^{2ABCDE}

¹ *Institute of Physical Culture Science, University of Rzeszow, Poland*

² *Medical College of Rzeszow University, University of Rzeszow, Poland*

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Abstract

In recent years, research and scientific work have been very important in various types of training processes. In order to improve the quality of training of racers of racket sports such as squash, we can use various types of tests to determine the level of the maximum VO2 max, which allows you to assess the intensity of the effort. The aim of the study was to evaluate the variability of the VO2 max index in Squash players during the preparatory period. The study was conducted using two tests to diagnose cardiovascular respiratory efficiency: the Cooper test and the Beep test. Our work was conducted on a group of 20 Squash players who trained under the auspices of the Polish Squash Federation. The specialized training form lasted six weeks. There has been a progression in VO2max which is induced by regular training.

Introduction

Rocket sports are characterized by a wide technical spectrum. These types of sports are characterized by overall physical development that strengthens all muscle groups. It improves the circulatory system, improves speed and agility. An important factor the training of rocket sports players beyond the technical elements becomes shaping endurance. The circulatory and respiratory capacity allows the players longer and more effectively to control the entire sport fight. The article analyzes the variability of the VO2max cardiovascular fitness index in competitors from Poland Squash Federation in preparation. VO2 max is the body's ability to absorb the right amount of oxygen. This is the primary determinant aerobic physical capacity [Beltz, Gibson, Janot, Kravitz, Mermier, Dalleck et. al. 2016]. An assessment is possible through the maximum VO2 max the intensity of the effort, represented by the percentage of the maximum effort. According to scientists, the index increases in adolescence and reaches its peak at the age of 18-20 [Scheer, Ramme, Reinsberger, Heitkamp, 2018: 456-461]. This is evidenced by changes in the maximum speed of heart contractions, the highest level of which is reached at the age of 10 [Vikmoen, Ellefsen, Trøen, Hollan, Hanestadhaugen, Raastad, Rønnestad, 2016: 384-396]. People at the age of 40 are characterized by a decrease in the efficiency diagnosed by the application of the maximum VO2 max in the range of 80-90%, and at the age of 70 this value drops below 60% [Beltz, Gibson, Janot, Kravitz, Mermier, Dalleck et. al. 2016]. Your body weight and the amount of muscle tissue also affect your VO2

max. The ability to achieve a given VO₂max value also depends on the structure of the muscles, which is a genetically acquired factor. The purpose of physical fitness tests is to assess the aspect of motor skills that can help determine progressivity training and check the training level of a given group. It can be estimated as follows: using tests or specialized measuring devices [Wasiluk, Saczuk, 2012: 8-15].

The first category indicates tests first:

Cooper test - is also one of the popular running or swimming tests diagnosing endurance. It was developed by an American physician for diagnosing the form of US soldiers [Alvero-Cruz, Alvarez Carnero, Giráldez, Cárceles, Rosemann, Nikolaidis, Knechtle, 2019: 1349]. It consists in an uninterrupted run for 12 minutes to get the highest score. The purpose of the test is to determine the maximum VO₂max, which is a measure of your fitness. Calculation of the VO₂max value is possible by using the special formula [Alvero-Cruz, Standley, Giráldez-García, Carnero, 2020: 1-6] given below:

$$VO_2\max = (\text{distance in meters} - 504,9)/44,73$$

The VO₂max value can also be verified using special devices measuring. The most popular type of such device is the cycloergometer or a specialized treadmill with an attached mask for measuring lung ventilation. These types of verifications are a very specialized and reliable method of assessing performance parameters [Golijanek-Jędrzejczyk, Ogielski, Rafiński, et. al. 2016]. The aim of the study was to evaluate the variability of the VO₂ max index in Squash players during the preparatory period. The players' tests were subjected to a specialist preparation by implementing a training plan interfering with the development of special fitness. Fitness tests were performed before the training introduction and then after the training introduction. The specialized training form lasted six weeks. In the course of the research process, the following research questions were asked, which were answered by conducting research:

1. Does your VO₂ max rate change during your period preparation of the players of the Polish Squash Federation?
2. To what extent did the maximum VO₂ max change over the period preparation of the players of the Polish Squash Federation?

In order to obtain a detailed answer to the research problems posed above, the following research hypothesis was constructed: The maximum VO₂max has changed during the period of the Polish Squash Federation players.

Materials and methods

The study was conducted on a group of 20 Squash players who trained under the auspices of the Polish Squash Federation. The players were between the ages of 20 and 25 and their experience training was a minimum of 5 years. The trainings took place in the squash club in the hotel Atena in Mielec and at the Squash Academy in Rzeszów.

Table 1. Numerical characteristics of the body height of the respondents.

| N | X | Min | Max | SD |
|----------|----------|------------|------------|-----------|
| 20 | 176,34 | 165,00 | 186,00 | 5,01 |

Source: Based on own research

Table 2. Numerical characteristics of the body weight of the respondents.

| N | X | Min | Max | SD |
|----|-------|-------|-------|------|
| 20 | 74,15 | 62,00 | 87,00 | 8,56 |

Source: Based on own research

Table 3. Numerical characteristics of the BMI values of the respondents.

| N | X | Min | Max | SD |
|----|-------|-------|-------|------|
| 20 | 22,50 | 20,72 | 25,15 | 1,74 |

Source: Based on own research

The study was carried out using two fitness tests to diagnose cardiovascular and respiratory efficiency. The first was the Cooper test. It was carried out on a treadmill. Using a special formula based on the test results the VO₂max index was calculated.

$$VO_2\max = (\text{distance obtained in the Cooper test in meters} - 504,9)/44,73$$

The second test was the Beep Test multi-stage shuttle. The result was presented in the form of the number of episodes run. A special formula was used to calculate the VO₂max.

$$VO_2\max = 61,1 - 2,2 * 1 - 0,462 * \text{age} - 0,862 * \text{BMI} + 0,192 * \text{total number of segments covered}$$

Results

Table 4. Presentation of the sum of the distances run in the Beep Test before the training introduction.

| N | X | Me | Min | Max | SD | V |
|----|-------|-------|-----|-----|------|------|
| 20 | 73,55 | 73,50 | 69 | 79 | 3,02 | 4,10 |

Source: Based on own research

Table 5. Presentation of the sum of the distances run in the Beep Test after the entered training.

| N | X | Me | Min | Max | SD | V |
|----|-------|-------|-----|-----|------|------|
| 20 | 74,40 | 74,50 | 69 | 80 | 3,28 | 4,41 |

Source: Based on own research

Table 6. Comparison of the results of the number of Beep Test segments run in two trials.

| N | X | Me | Min | Max | SD | V | t | p |
|----|-------|-------|-----|-----|------|------|-------|-------|
| 20 | 73,55 | 73,50 | 69 | 79 | 3,02 | 4,10 | -0,77 | >0,05 |
| 20 | 74,40 | 74,50 | 69 | 80 | 3,28 | 4,41 | -0,77 | >0,05 |

Source: Based on own research

The result improved on average by one section, the minimum value did not change, while the maximum value increased by one. Both tests showed no significant statistically differences.

Table 7. Presentation of VO₂max values based on Beep Test before training introduction.

| N | X | Me | Min | Max | SD | V |
|----|-------|-------|-------|-------|------|------|
| 20 | 38,73 | 38,85 | 36,40 | 39,60 | 0,82 | 2,12 |

Source: Based on own research

Table 8. Presentation of VO₂max values based on Beep Test after training introduction.

| N | X | Me | Min | Max | SD | V |
|----|-------|-------|-------|-------|------|------|
| 20 | 39,01 | 39,20 | 37,20 | 39,80 | 0,68 | 1,75 |

Source: Based on own research

Table 9. Comparison of VO₂max values in the Beep test in two trials.

| N | X | Me | Min | Max | SD | V | t | p |
|----|-------|-------|-------|-------|------|------|-------|-------|
| 20 | 38,73 | 38,85 | 36,40 | 39,60 | 0,82 | 2,12 | -1,15 | >0,05 |
| 20 | 39,01 | 39,20 | 37,20 | 39,80 | 0,68 | 1,75 | -1,15 | >0,05 |

Source: Based on own research

In the trial after the introduction of the training, the VO₂max value increased by 0,72ml/kg/min. The sample showed no statistically significant differences $p > 0,05$.

Table 10. The sum of the distance run in the Cooper test (m) before the training introduction.

| N | X | Me | Min | Max | SD | V |
|----|---------|---------|---------|---------|--------|------|
| 20 | 2481,75 | 2426,50 | 2238,00 | 2730,00 | 159,24 | 6,42 |

Source: Based on own research

Table 11. Comparison of the distances obtained in the Cooper test in two trials

| N | X | Me | Min | Max | SD | V | t | p |
|----|---------|---------|--------|--------|--------|------|-------|-------|
| 20 | 2481,75 | 2426,50 | 2238,0 | 2730,0 | 159,24 | 6,42 | -1,06 | >0,05 |
| 20 | 2536,20 | 2505,00 | 2249,0 | 2784,0 | 164,69 | 6,49 | -1,06 | >0,05 |

Source: Based on own research

You can notice a better result obtained in the second attempt, which took place after the introduced training. The average result was better by 54,45m. Both samples showed no statistically significant differences $p > 0,05$.

Table 12. VO₂max values based on Cooper's test before training

| N | X | Me | Min | Max | SD | V |
|----|-------|-------|-------|-------|------|-------|
| 20 | 41,67 | 40,21 | 36,11 | 49,52 | 4,43 | 10,63 |

Source: Based on own research

Table 13. Presentation of VO₂max values based on the Cooper test after training introduction

| N | X | Me | Min | Max | SD | V |
|----|-------|-------|-------|-------|------|-------|
| 20 | 42,00 | 41,17 | 36,10 | 50,23 | 4,47 | 10,64 |

Source: Based on own research

Table 14. Comparison of VO₂max values in the Cooper test in two trials

| N | X | Me | Min | Max | SD | V | t | p |
|----|-------|-------|-------|-------|------|-------|-------|-------|
| 20 | 41,67 | 40,21 | 36,11 | 49,52 | 4,43 | 10,63 | -0,23 | >0,05 |
| 20 | 42,00 | 41,17 | 36,10 | 50,23 | 4,47 | 10,64 | -0,23 | >0,05 |

Source: Based on own research

Conclusions

The VO₂max value showed a better result after the training. The value improved by 0,33 ml/kg/min. The trials showed no statistically significant differences $p > 0,05$.

The analysis of the research results allowed to answer the specific questions posed:

The VO₂max maximum indicator in the preparation of Polish Squash Federation players has changed. VO₂max progression was noted which was induced by the regular training that was the cornerstone of the squash preparation period.

The VO₂max index varied in the preparation period by 0,34 ml/kg/min. Values were recorded during the Beep Test and the Cooper Test. The results show that the development of the VO₂ max was induced by the appropriate training mortar.

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Disclosure statement

No potential conflict of interest was reported by the authors.