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THE INFLUENCE OF REPEATED SPRINTS OVER THE AEROBIC PERFORMANCE AT SWIMMERS

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Abstract

The aim of this study was to show the influence of speed training over the aerobic performance of senior swimmers. 15 well-trained swimmers (aged 21+-3 years) performed two times six repeated maximal 50-m sprints (RS) departing every 2 minutes, interspersed with either in or out recovery. At the beginning of the 6-month period, the swimmers performed a 2000m test, and the lactate was taken before and after the end of the test, so the heart rate. A link was made between lactate and heart rate in order to confirm the development of aerobic capacity. Due to the importance of limiting factors during a sprint exercise, certain interdependence between aerobic indices could be expected. Our study demonstrates a significant correlation between aerobic capacity and repeated sprint exercise, with an influence on aerobic capabilities, as well as a significant correlation between general endurance and anaerobic sprint power. The high correlation between them suggests that endurance and overall resistance are related, at least partially. Similarly, the best indices of general anaerobic power are observed in subjects with the highest anaerobic power indices. On the other hand, the highest aerobic indices were observed in subjects with the lowest anaerobic power indices. To conclude, the present results confirm the beneficial effect of speed training over the aerobic performance.

Keywords: Intermittent work, speed training, aerobic capacity.

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1. Introduction

This study suggests that the factors limiting aerobic exercise differ not only according to the amount of training sessions, but also according to their intensity. However, some authors report concordances between the various structures involved in the transport, diffusion and use of oxygen (Abe et al., 2006). In this hypothesis, the maximum aerobic power and anaerobic threshold indices should, on the contrary, be strongly correlated. For anaerobic exercises, no matter of the size of the muscular mass, the limiting factors should be essentially local (enzymatic equipment, types of muscle fibres), if we exclude the motor control (Costill, Sharp, & Troup, 1980). The maximum local and general anaerobic power should therefore be a priori highly correlated if the muscle groups involved are identical (Bangsbo et al., 2000). In order to clarify the relationships that may exist between the aerobic and anaerobic parameters (Dekerle & Pelayo, 2011), we studied the correlations between the indices of lactic acid and heart rate and the general maximum anaerobic power.

2. Problem Statement

Identifying the effect of training in repeated sprints on aerobic performance:

- The results of this study relies on conclusions regarding the effect of training based on repeated sprints on aerobic performances;
- Our research is based on repeated aerodynamic sprint training, also focusing on the technical side of the research, on the swimming index (psychological appearance) and the fatigue index (the biological aspect);
- A low volume of sprint training induces specific metabolic adaptations of anaerobic or non-specific aerobic capacity.

3. Research Questions

Repeated training based on sprint improves aerobic metabolism. Repeated training based on sprint has no effect on aerobic performance.

4. Purpose of the Study

Our proposal towards the study is: In addition to being an accurate reference for short intermittent training (repeated sprint exercise, which is strongly correlated with the main physiological determinants of swimming performance), it could also be used to assess the aerobic potential of swimmers overall). This relationship with all specific aerobic capabilities suggests that the 2x (6x50m L) test may be relevant for regular monitoring during the season.

5. Research Methods

Arithmetic average and standard deviation were used. A variable rate percent analysis was done to compare the early stage. In addition, a bivariate correlation was calculated based on independent variables

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(velocity and swim index) between the 2000m test phase and competitive tests. The t-Student test was used to compare heart rates. Statistical processing was performed using the SPSS 17 (2009) software.

Data were expressed in absolute values and statistical analysis. A one-way analysis of variance, followed by t-Student test, was used to compare the swimmers' results. The possible relationships between the different variables were investigated by calculating the linear correlation coefficients. The significance threshold was set at p <0.05 (Popa, 2008, p. 164).

6. Findings

Table 01. Value results that should be achieved within aerobic power

Achieved time - Aerobic power - VO_2max - Witnesses							
		Test results in seconds					P – t-Test
Date of the test	Race	Average	Standard Deviation	Minimum	Medium	Maximum	
11.02.2015	200 m initial	141.2	4.3	130.1	141.6	149.4	0.0393
15.07.2015	200 m initial	140.9	4.3	130.2	141.6	149.7	
11.02.2015	200 m final	139.3	4.2	128.4	139.7	147.5	0.0408
15.07.2015	200 m final	139.1	4.3	128.5	139.7	147.8	
11.02.2015	400 m initial	276.2	3.6	142.0	285.0	300.8	0.3625
15.07.2015	400 m initial	283.7	8.7	262.2	285.0	301.4	
11.02.2015	400 m final	282.3	8.5	260.3	283.2	298.9	0.0778
15.07.2015	400 m final	282.0	8.6	260.5	283.2	299.5	
11.02.2015	CONT	35.8	1.1	33.0	35.9	37.9	0.0315
15.07.2015	CONT	35.7	1.1	33.0	35.9	38.0	
The comparison of the results achieved on 19.07.2015 against the results obtained on 12.02.2015 was made by t-Student test for pairs.							
The test times for the 200 m initial, 200 m final and CONT dropped statistically. The test times for the 400 m initial and 400 m final decreased or increased insignificantly.							

Table 02. Value results that should be achieved within aerobic threshold

Achieved time - Aerobic threshold - Anaerobic - Witnesses							
		Test results in seconds					P – t-Test
Date of the test	Race	Average	Standard Deviation	Minimum	Medium	Maximum	
12.02.2015	200 m initial	148.6	4.5	137.0	149.0	157.3	0.0400
19.07.2015	200 m initial	148.3	4.5	137.1	149.0	157.6	
12.02.2015	200 m final	146.6	4.5	135.2	147.0	155.2	0.0386
19.07.2015	200 m final	146.4	4.5	135.3	147.0	155.5	
12.02.2015	400 m initial	303.1	16.9	275.7	300.1	354.8	0.9400
19.07.2015	400 m initial	302.6	15.8	275.9	300.1	350.0	
12.02.2015	400 m final	297.2	9.0	274.0	298.1	314.6	0.0401
19.07.2015	400 m final	296.8	9.1	274.2	298.1	315.2	
12.02.2015	CONT	37.7	1.1	34.8	37.8	39.9	0.0512
19.07.2015	CONT	37.6	1.2	34.8	37.8	40.0	
The comparison of the results achieved on 19.07.2015 against the results obtained on 12.02.2015 was made by t-Student test for pairs.							
The test times for the 200 m initial, 200 m final and 400 m final decreased statistically. The test times for the 400 m initial and final CONT increased or decreased insignificantly.							

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Statistical data processing

In the case of quantitative (continuous) quantities, the arithmetic mean, standard deviation, median, minimum and maximum values were calculated. The comparison of quantitative quantities was done using the t-Student test for paired observations. The association between lactic acid and heart rate was tested with linear regression. All tests used were bilateral. The threshold for statistical significance will be P ≤ 0.05. The statistical analysis was done using the STATA 13/MP software (Table 03).

Table 03. Value results that should be achieved within aerobic resistance

Achieved time - Aerobic resistance - Witnesses							
		Test results in seconds					
Data of the test	Race	Average	Standard Deviation	Minimum	Medium	Maximum	P – t-Test
12.02.2015	50 m initial	38.0	2.0	34.7	37.7	44.1	0.2847
19.07.2015	50 m initial	37.5	1.2	34.7	37.7	39.9	
12.02.2015	50 m final	35.5	1.1	32.7	35.6	37.6	0.8587
19.07.2015	50 m final	35.5	1.1	32.7	35.6	37.7	
12.02.2015	100 m initial	77.2	2.3	71.1	77.4	81.7	0.0386
19.07.2015	100 m initial	77.1	2.4	71.2	77.4	81.8	
12.02.2015	100 m final	75.2	2.3	69.3	75.4	79.6	0.0393
19.07.2015	100 m final	75.1	2.3	69.4	75.4	79.8	
The comparison of the results achieved on 19.07.2015 against the results obtained on 12.02.2015 was made by t-Student test for pairs.							
The test times for the 100 m initial and 100 m final significantly decreased statistically. The initial test time for the 50 m decreased insignificantly; the one for the 50 m final test did not change.							

Table 04. Correlation between heart rate and lactic acid level

Correlation between heart rate and lactic acid level						
Right linear regression Y = α + β × X						
Y = Heart rate or heart rate increase (heart rate difference after test - heart rate before test) X = Lactic acid level Y = Heart rate difference after heart rate before test X = Lactic acid level						
Date of the test	Size Y	Coefficient β (slope of the regression line)	95% confidence interval of b β	P for β	R^2 Square of the regression coefficient	P for regression
11.02.2015	HR before the race	-0.50	-0.24; -0.14	0.576	0.024	0.576
15.07.2015	HR before the race	0.13	-0.07; 0.34	0.178	0.135	0.178
11.02.2015	HR after the race	-0.43	-0.21; 0.12	0.585	0.024	0.585
15.07.2015	HR after the race	0.13	-0.13; 0.28	0.070	0.230	0.069
11.02.2015	HR increase after test	0.02	-0.11; 0.10	0.970	0.001	0.970
15.07.2015	HR increase after test	0.05	-0.10; 0.19	0.516	0.033	0.516
There was no correlation between heart rate and lactic acid. A weak positive association trend at the limit of statistical significance with lactic acid level was observed for heart rate after the test on 15.07.2015.						

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7. Conclusion

For a relatively inhomogeneous population in terms of energy capabilities, the results of this study argue for a concordance between general aerobic power and endurance and, on the other hand, between local aerobic power and endurance abilities. The high correlation between them suggests that endurance and overall resistance are related, at least partially. Similarly, the best indices of general anaerobic power are observed in subjects with the highest anaerobic power indices. On the other hand, the highest aerobic indices were observed in subjects with the lowest anaerobic power indices.

Due to the importance of limiting factors during a sprint exercise, interdependence between aerobic indices could be expected. For example, in our subjects, there is certain interdependence between aerobic indices and anaerobic power. Indeed, it has been demonstrated a significant correlation between aerobic capacity and repeated sprint exercise on aerobic capabilities. On the other hand, a significant correlation between general endurance and anaerobic sprint power was found.

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