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The dynamics of anaerobic exercise in the individualization of sports training at the level of the naval pentathlon group in the utility swimming trial

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Abstract: The research started from the desire to obtain important results at the Naval Pentathlon competitions organized by the CISM with the representative team of the Mircea cel Bătrân Naval Academy from Constanța.
The purpose of the research
The aim of this research is to identify those conditions that create anaerobic effort capacities of the athletes participating in the utility swimming test within the Naval Pentathlon.
Research objectives
In order to carry out the research, I have the following objective:
a. Identification of the most effective evaluation tests aimed at highlighting the level at which the anaerobic capacity, leading to the increase of the anaerobic capacities of the athletes in the uility swimming test.
b. Identification of the biological and motor parameters that condition the achievement of sports performance through the level of anaerobic capacities
Research subjects
This experiment was carried out on a group of performance athletes of the "Mircea cel Batrân" Naval Academy. The group of subjects consists of 16 students of the Military Section of the Faculty of Marine Engineering. They are between the ages of 19 and 21.
Keywords (3-5): Naval Pentathlon, anaerobic effort, sport performance, utility swimming

1. Introduction

[1], [2], [3] Swimming performance depends on physiological (endurance capacity and anaerobic fitness) and technical and morphological factors. The purpose of this research is to evaluate the effects of an individualized training program based on anaerobic effort on the performance of swimmers in the utility swimming event of the Naval Pentathlon. At the same time, we determined the swimmers' exercise capacity and established links between anaerobic capacity and repeated sprinting. In order to carry out the research, we established the following objectives: a. Identify tests for interval training on land and in water and establish training programs that can link anaerobic capacity and repeated sprinting in athletes undergoing the Utility swimming test in the naval pentathlon; b. Determining the value of the level of effort capacity through metabolic effort zones (Aerobic Threshold, Anaerobic Threshold, VO2 max) using the Opt jump Next device for athletes in the Utility swimming event in the naval pentathlon. Hypothesis 1 Individualized training focusing on anaerobic effort using the Critical Swim Speed CSS test significantly improves sprint performance in utility swimming athletes participating in the naval

pentathlon. Hypothesis 2 Implementing training based on Opt jump data for athletes participating in individualized training will lead to a faster increase in speed and acceleration in the utility swimming event of the naval pentathlon. This research was carried out on a group of performance athletes of the "Mircea cel Batrân" Naval Academy. The group of subjects is made up of two groups of 8 students each, the experimental group and the control group from the Military Section of the Faculty of Marine Engineering. They are between the ages of 19 and 21.

2. Materials and methods

Pedagogical observation was particularly used to test the critical speed, both in effort and for the recovery time of the athletes under conditions specific to the utility swimming test. In the experimental research I used the statistical program IBM SPSS Statistics 20 (International Business Machines, Statistical Package for Social Science) to process the recorded results. To present the results, we used graphic and tabular methods**.**

3. Basic research content

The data related to the effort required to measure the pulse were obtained using the Garmin Swim 2 device. The Garmin Swim 2 device has a heart rate monitor with wrist measurement; several functions associated with heart rate measurement are available in the default widget loop. The device guides the athlete through multi-step exercises that include goals for each exercise step, such as distance, repetitions, movement type, and other statistics. Another device used to test the subjects was the Opt jump Next platform. The Opt Jump Next optical analysis and measurement system comprises two LED bars, one for transmitting and the other for receiving the optical signal. Each of these two bars contain between 33 and 100 LEDs depending on the chosen resolution. The LEDs in the transmitting bar are constantly communicating with those in the receiving bar. The system detects any communication interruption between the two bars and calculates the duration of the interruption. This made it possible to measure the air and contact times during a series of jumps.

4. Results

Critical Swim Speed (CSS) is a measure of endurance capacity in swimmers, representing the maximum speed that a swimmer can theoretically maintain for an extended period without significant lactic acid accumulation. The proposed method provides a practical and noninvasive assessment of swimming performance and endurance. The critical velocity test is a valuable tool for evaluating endurance capacity in swimmers and planning personalized training. Regular use of CSS can lead to significant performance improvements and help optimize sports training.

Table no. 1 CSS critical speed values in the experimental group - Initial testing

Initial subject names	Time at 200m (min)	Time at 400m (min)	$CSS = \frac{D2-D1}{T2-T1}$	CSS (m/sec)
A.B.R.C	2:42	4:50	200/128	1,56
C.E.E.D	2:57	4:48	200/111	1,80
C.F.D.A.C	2:52	4:49	200/117	1,70
D.V.A	2:59	5:00	200/121	1,65
G.D.D.A	2:53	5:03	200/130	1,53
O.S.V.R.G	2:54	5:01	200/127	1,57
O.R.T.A.E.V	2:58	5:02	200/124	1,61
L.V.A.I	2:53	4:56	200/123	1,69

Table no. 2 CSS critical speed values in the experimental group - Final testing

Initial subject names	Time at 200m (min)	Time at 400m (min)	$CSS = \frac{D2 - D1}{T2 - T1}$	CSS (m/sec)
A.B.R.C	2:27	4:45	200/138	1,44
C.E.E.D	2:52	4:37	200/105	1,90
C.F.D.A.C	2:31	4:30	200/119	1,68
D.V.A	2:38	4:30	200/112	1,78
G.D.D.A	2:35	4:28	200/113	1,76
O.S.V.R.G	2:36	4:31	200/115	1,73
O.R.T.A.E.V	2:33	4:25	200/112	1,78
L.V.A.I	2:30	4:16	200/106	1,88

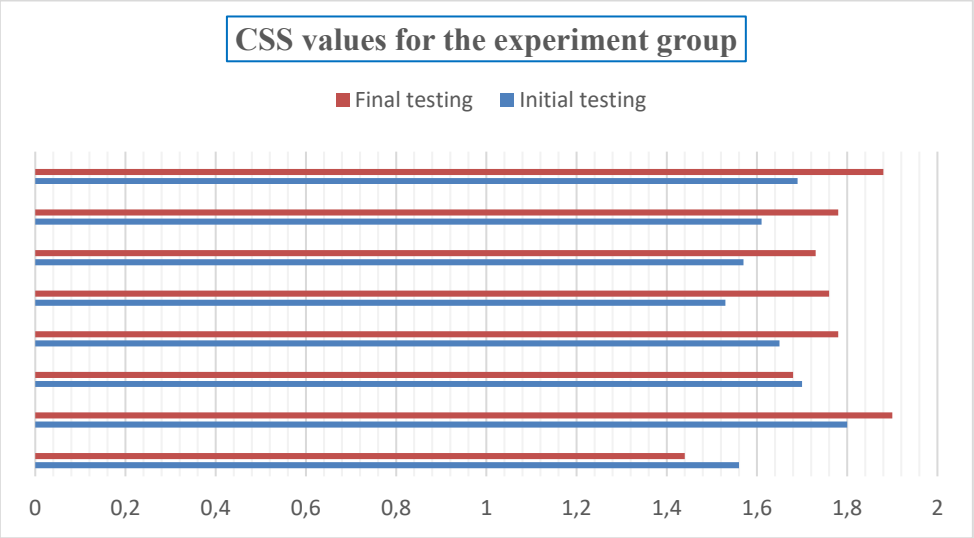
The data collected at the initial testing of the experimental group (table no. 1) and those from the final testing (table no. 2) were analysed and interpreted statistically in table no. 3.

Table no. 3 Statistical indicators of the CSS critical speed for the experimental group

Crt No.	Initial T.	Final T.	CSS Critical Speed (m/sec)			
1	1,56	1,44	Number of subjects- N1 – Initial T.	8		
2	1,80	1,90	Number of subjects - N2 – Final T.	8		
3	1,70	1,68	Median - M0 – T.i	1,77		
4	1,65	1,78	Median - M0 – T.f	1,615		
5	1,53	1,76	Asymmetry coefficient - β1 – T.i	-0,182	Normal asymmetry	
6	1,57	1,73	Asymmetry coefficient - β2 – T.f	0,172	Normal asymmetry	
7	1,61	1,78	M1 ± DS1 - T.i	1,744 ±	0,143	
8	1,69	1,88	M2 ± DS2 - T.f	1,63 ±	0,087	
			Scattering of values - M1 ± DS1 - T.i	M1 ± 3DS1	Wide spread of values	
			Scattering of values - M2 ± DS2 - T.f	M2 ± 2DS2	Normal distribution of values	
			Coefficient of variability - CV1 - T.i	8,2	%	Group of values homogeneous
			Coefficient of variability - CV2 - T.f	5,337	%	Group of values homogeneous
			Independent "t" test	**1,926**		
			Significance threshold	p<0.05		

As can be seen in table 7, for both the initial testing and the final testing, the asymmetry coefficients - β1 and β2 present values that highlight a normal asymmetry. The spread of values is large - M1 ± 3DS1 – for the initial testing and – M2 ± 2DS2 – for the final testing shows us a normal distribution. The

values of the coefficient of variability CV1 (5.139%) - for the initial testing and CV2 (4.196%) - for the final testing prove to us that there is a homogeneous group of values. The values obtained for the experimental group at the initial and final testing are shown in graph no. 1.



In swimming disciplines, anaerobic training plays a crucial role in the development of athletic performance, especially in sprint and utility swimming events. Anaerobic efforts focus on high-intensity activities performed for short periods that do not allow full oxygenation of the muscles, and the use of Opt jump on land promotes strength and speed development.

Table no. 4 Statistical indicators of the utility swimming test in the control group Initial testing to final testing

Initial subject names	Initial testing (sec)	Final test (sec)
A.S.M.V	141	137
B.E.E.F	136	132
D.M.M.M	142	138
P.M.S.S.A	145	140
O.F.A.I.V	141	138
V.A.A.M.A	140	137
G.M.R.I.B	146	142
I.F.R.D	142	138

5 Statistical indicators of the utility swimming sample for the experiment group - Initial testing - Final testing

Initial subject names	Initial testing (sec)	Final test (sec)
A.B.R.C	131	107
C.E.E.D	126	96
C.F.D.A.C	132	106
D.V.A	132	107
G.D.D.A	131	109
O.S.V.R.G	130	109
O.R.T.A.E.V	130	104
L.V.A.I	132	107

5. Conclusions

In conclusion, our study succeeded in achieving the proposed demonstrating the effectiveness of our research method. We have identified certain patterns that may be useful for future studies in our area of interest. The results showed that the players in the experimental group achieved significant improvements in terms of playing techniques, tactical strategies and physical condition.

Based on the results of the initial tests, I identified each player`s strengths and weaknesses and was able to develop customized strategies to improve their performance.

During the final tests, players were put through simulated game situations where we applied techniques and strategies to execute forehand and lefthand shots effectively.

Therefore, the implementation of experimental programming in tennis training can be beneficial for improving the performance of players. Special care is needed in the analysis and continuous adjustment of training methods to ensure the continuous progress of athletes.

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