World Journal of Sport Sciences 6 (1): 57-61, 2012
ISSN 2078-4724

DOI: 10.5829/idosi.wjss.2012.6.1.1109

Effect of Improving the Preliminary Level of Endurance with Reference to Individual Anaerobic Threshold on the Digital Level of Junior Swimmers

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Abstract: The current research aims at designing a recommended training program for basic endurance (En-1) to identify the basic endurance level of junior swimmers, with reference to anaerobic threshold (AT), improvement percentages of basic endurance and digital levels of junior swimmers, effects of improving basic endurance on the digital levels of junior swimmers and correlations between basic endurance and the digital levels of junior swimmers. The researcher used the quasi-experimental approach (one-group-design) with pre and post- measurements. Research community included 20 junior swimmers (male/female) from Tanta Sports Club (12-13 years) who are registered in the Egyptian Federation of Swimming. Sample of 12 male junior swimmers was purposefully chosen and 2 other swimmers from the same research community and outside the research sample were chosen to the pilot study. The researcher concludes the following: Canonizing the (En-1) training load improves the digital levels of 400m, 200m and 100m freestyle. Canonizing the (En-1) training load, with reference to anaerobic threshold, improves total distance of T-30 test as a positive indicator for improving endurance. Canonizing the (En-1) training load, with reference to anaerobic threshold, improves 100m free style digital level on (En-2). There are significant correlations among all durations of 400m, 200m and 100m and total distance of T-30 test for junior swimmers. There are significant correlations among all duration variables of 400m, 200m and 100m.

Key words: Anaerobic threshold % T-30 test % Junior swimmers

INTRODUCTION

Recent years witnessed an increasing concern with integrated preparation of athletes in all physical, technical, psychological and training aspects. As a means with the biggest contribution to digital achievement of swimmers, training and its good planning process received the biggest share of scientific trials of improvement, through multi-disciplinary research. Therefore, coaches seek the best training methods to achieve highest possible levels to break the current digital records. Various methods of training aim at affecting improvements and physiological adaptations to functional systems of swimmers according to the requirements of each swimming stroke and swimmers' age groups.

Some authors are concerned with improving aerobic work (endurance) and anaerobic work (speed) and divided them into three levels, along with methods of training for race speed, recovery, flexibility, strength and ability. If, improved, these factors affect the digital levels of swimmers significantly and positively.

Endurance levels are: First level: Basic endurance training or En-1 as a swimmer performs on a speed slower than his/her individual anaerobic threshold. Second level: Anaerobic threshold training or En-2 as the swimmer performs a speed consistent with his/her individual anaerobic threshold. Third level: Overload training or En-3 as the swimmer performs on a speed faster than his/her individual anaerobic threshold [1].

Endurance training is one of the most important parts of the training program in swimming, especially for junior swimmers, as basic endurance training improves their aerobic capacity, oxygen consumption and lactic acid relief. This, in turn, improves their performances during competitions greatly. Endurance exercises form 50-60% of the weekly training volume. Basic endurance training, either specific or non-specific, should be used more often during the early phase of the season for two reasons: first, basic endurance training increases oxygen volume provided to muscle fibers till the end of the season and second, it increases fat metabolism and decreases independence on glycogen during endurance

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performance so that swimmers can recover their muscle storage of glycogen faster and more easily. Both adaptations improve the swimmer's ability to endure more intense training needed for preparation to final phase of the season. Basic endurance training should be used during the first 8-12 weeks of the training season, representing 60-70% of total training distance. After improving aerobic capacity and increasing fat metabolism, these percentages should be reduced to 50-60%. This type of training has many uses as it increases the volume of heart beat, cardiac output, cardiovascular capacity, blood volume, numbers of blood vessels surrounding slow-twitch muscular fibers, myoglobin and mitochondria, in addition to lactic acid relief [1].

Several studies dealt with endurance training and its effects on Vo2max, speed and duration of swimming, the digital level and other physiological adaptations [2-6].Other studies dealt with improving endurance levels and its relation to the digital level of swimming and other physical components of the swimmer [7-10].A third group of studies concentrated on the anaerobic threshold of swimmers and its effects on the achievement level [11-15].

The researcher noted that most researchers used blood tests to identify the anaerobic threshold and lactic acid levels in blood as a lab-testing method. But most coaches do not have the suitable kits to make such tests, or even do not know how to do it. In addition, such tests are time- and money- consuming compared to non-lab tests.

T-30 is an easy-to-apply swimming test that can be performed inside the swimming pool. This test requires to swim for 3000m on sub-maximum speed or to swim for half an hour. Using special tables, we can identify each swimmer's individual anaerobic threshold for different distances in the training program.Duration of swimming for the first and third levels of endurance can be identified using the same test after identifying the anaerobic threshold for different distances. This led the researcher to perform the current research, using the anaerobic threshold as a training concept to canonize training loads for basic endurance (En-1) in a direct, non-expensive way.

The current research aims at designing a recommended training program for basic endurance (En-1) to identify:

- The basic endurance level of junior swimmers, with reference to anaerobic threshold (AT).
- Improvement percentages of basic endurance and digital levels of junior swimmers.
- Effects of improving basic endurance on the digital levels of junior swimmers.
- Correlations between basic endurance and the digital levels of junior swimmers.

Hypotheses:

- There are statistical significant difference between the pre- and post-measurements of basic endurance for junior free style swimmers in favor of the post-measurements.
- There are statistically significant difference between the pre- and post-measurements of the digital levels of 400m, 200m and 100m freestyle for junior free style swimmers in favor of the post-measurements.
- There are improvement percentages of the digital levels of 400m, 200m and 100m freestyle for junior free style swimmers.
- There are correlations between basic endurance and the digital levels of 400m, 200m and 100m freestyle for junior free style swimmers.

MATERIALS AND METHODS

The researcher used the quasi-experimental approach (one-group-design) with pre- and post- measurements. Research community included 20 junior swimmers (male/female) from Tanta Sports Club (12-13 years) who are registered in the Egyptian Federation of Swimming. Research sample included 12 male junior swimmers, was purposefully chosen and 2 other swimmers, from the same research community and outside the research sample were chosen to the pilot study.

Equipments:

- A rest meter for measuring heights.
- A medical balance for measuring weights.
- A Casio 30W stopwatch
- A dynamometer for measuring grip strength (left-right)
- Dry Spiro meter for measuring vital capacity.

Tests: The researcher used T-30 test with 30 min swimming protocol. Total swimming distance is computed and divided into 100m units. Duration for each (100m) is calculated with seconds to calculate distance duration for anaerobic threshold. Basic endurance duration is calculated through adding 2-6 seconds to 100m swimming duration on the anaerobic threshold, or on sub-maximal heart rate (30-60 BPM).

Pilot Study: Pilot study was performed from 18-5-2010 to 25-5-2010 at the swimming pool of Tanta Sports Club on a pilot sample of 2 junior swimmers to identify any difficulties that may face the main application.

The Recommended Training Program: The recommended training program included 8 weeks. The first 3 weeks were during the general preparation phase and included 6 training units. The second 5 weeks were during the specific training phase and included 7 training units. Thus, the program included one macro-cycle (8 weeks), two miso-cycles (33 weeks and 5 weeks respectively) and several micro-cycles. Total basic endurance was 129.6km (55.2km during the first phase and 77.4km during the second phase). Weekly basic endurance volume was 16.2km.

Pre-Tests: Pre-tests were performed as follows

- Digital records of 100m and 200m free style swimming on 18-5-2010.
- Digital records of 400m free style swimming on 20-5-2010.
- T-30 test on 25-5-2010.

Main Application: The recommended training program was applied to the research sample from 1-6-2010 to 1-8-2010.

Post-Tests: Post-tests for 100m, 200m and 400m free style were taken on 2-8-2010.

RESULTS AND DISCUSSION

Table 1 indicates statistically significant differences on the digital variables as their values were higher than their table values, except for total distance of T-30 test and (AT) duration for 100m.

Table 2 indicates that improvement percentages ranged between 2.18% and 8.50.

Table 3 indicates significant correlations among all duration variables and total distance of T-30 test, while duration variables have non-significant correlations among each others.

Discussion: Table 1 indicates statistical significant differences on the digital variables for 400m, 200m and 100m as their (t) vales were 6.11, 15.80 and 11.15 respectively. These values are higher than (t) table value (2.201).

Table 2 indicates that improvement percentages of 400m, 200m and 100m were 8%, 8.21% and 4.85% respectively. The researcher thinks that this is due to the recommended training program for improving En-1 according to individual anaerobic threshold duration for each swimmer. This helped the researcher to calculate specific distances, rest intervals, repetition distances and load intensity for the first level of endurance.

This is in agreement with previous studies in that endurance training is a major part of any swimming training program as it improves aerobic capacity and Vo2max. Also, training intensity, endurance training and speed training affect digital records of 100m and 400m free style [1,2, 7,8,11].

Table 1 indicates no statistical significant differences between the pre- and post- tests of T-30 distance as (t) calculated value was under its table value. Also, there are significant differences between the pre- and post- tests of for 100m anaerobic threshold duration for the very same reason.

Table 1: Difference significance between the pre and post- tests of the sample on duration variable and T-30 (n=12)

		Pre-test		Post-test			
Variables	Measurement	Mean	SD±	Mean	SD±	Difference	(t) value
400m	Sec	348.17	13.37	318.58	9.87	29.59	6.11*
200m	Sec	160.33	4.10	147.17	2.69	13.16	15.80*
100m	Sec	72.17	1.80	68.67	1.30	3.50	11.15*
T-30 total distance	M	2029.29	195.67	2073.57	182.08	54.28	0.29
(AT) duration for 100m	Sec	89.26	1.12	87.81	1.44	1.45	1.12

(t) table value on P=0.05 = 2.21

Table 2: percentages of improvement in the digital levels

	Measurements		
Variables	Pre-	Post-	Improvement (%)
400m	348.17	318.58	8.50%
200m	160.33	147.17	8.21%
100m	72.17	68.67	4.85%
T-30 total distance	2029.29	2073.57	2.18%
(AT) duration for 100m	89.26	87.81	2.34%

Table 3: Correlation coefficients (R) among post-tests, digital records and T-30 total distance

Variables	400m	200m	100m	T-30 total distance	(AT) duration for 100m
400m	--	0.362	0.204	-0.685*	0.639*
200m		--	0.014	-0.536*	0.653*
100m			--	-0.274*	0.751*
T-30 total distance				--	-0.758
(AT) duration for 100m					--

(R) table values on p=0.05 = 0.576

Table 2 indicates that improvement percentages of 400m and 200m were 8% and 8.21% respectively. This is logically acceptable as basic endurance training increases oxygen provided for muscular fibers till the end of the season, along with fat metabolism. This decreases body dependence on glycogen and enables the body to restore glycogen levels quickly and easily. All this has positive effects on improving total distance of T-30 test from 2029.29m to 2073.57m (2.18%) and 100m anaerobic threshold duration from 89.26 sec to 87.81 sec (2.34%).

Table 3 indicates significant correlations among all duration variables and total distance of T-30 test as these values were 0.685, 0.536 and -0.274 for 400m, 200m and 100m respectively. This indicates that the longer the distance covered in T-30 test, the better 400m duration becomes.

The researcher thinks that the recommended program improved endurance level and in turn increased T-30 distance. These relations look negative, but in fact they are positive as swimming duration, as a digital level, is improved with the decrease of time consumed.

These results are consistent with other studies in that improving endurance is related to improvements in the digital levels of 100m, 200m and 400m digital levels.

The same table indicates a significant correlation between the digital levels of 400m, 200m and 100m and 100m anaerobic threshold duration according to T-30 test as these values were 0.639, 0.652 and 0.751 respectively. There is also a positive correlation between total distance of T-30 test and 100m duration on the individual anaerobic threshold (-0.758). The researcher thinks that these correlations are due to the recommended training program, as its loads were canonized according to the individual anaerobic threshold of each swimmer [10].

CONCLUSION

The researcher concludes the following:

- Canonizing the En-1 training load improves the digital levels of 400m, 200m and 100m freestyle.
- Canonizing the En-1 training load, with reference to anaerobic threshold, improves total distance of T-30 test as a positive indicator for improving endurance.
- Canonizing the En-1 training load, with reference to anaerobic threshold, improves 100m free style digital level on En-2.
- There are significant correlations among all durations of 400m, 200m and 100m and total distance of T-30 test for junior swimmers.
- There are significant correlations among all duration variables of 400m, 200m and 100m.

Recommendation: The researcher recommends the following:

- Using T-30 test results as a guide to plan training programs.
- Using the individual anaerobic threshold value for each swimmer in planning basic endurance training
- Performing the same study on other age groups.
- Performing other studies on other distances and strokes.

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