Kinematic/ dynamic indicators of breaststroke technique of junior swimmers

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Abstract

Objective of the study was to test benefits of the new swimming technique excellence training model for the 10-11-year-old breaststroke groups facilitated by integrated structuring of special technical indicators of physical fitness.

Methods and structure of the study. In the new swimming technique excellence training model testing experiment, we combined and analyzed benefits of the integrated structuring of special technical indicators of physical fitness to facilitate progress of the sample. We sampled for the tests the 10.5 ± 0.4 year-old swimmers (n=42, 24 boys and 18 girls) and split them up into Reference (RG, 10 boys and 8 girls) and Experimental (EG, 14 boys and 10 girls) Groups. The integrated training model was geared to offer the most efficient combinations of training methods, tools and aspects for fast competitive progress facilitated by the integrated structuring of special technical indicators of physical fitness. The elementary technical progress was harmonized with the physical qualities building elements to prudently sequence the training stages for success. The progress tests enabled us to develop a set of the age-group progress benchmarks and test benefits of the integrated structuring of special technical indicators of physical fitness tests for efficiency of the breaststroke excellence model.

Experimental assumptions and effects were verified by the strength, physical fitness and swimming technique rating tests in practical trainings.

Results and conclusion. The new swimming technique excellence training model for the 10-11-year-old breaststroke groups facilitated by the integrated structuring of special technical indicators of physical fitness was found beneficial for competitive progress and in many other aspects including metabolic plastic transformations due to synchronization of endogenous processes.

Keywords: *ijunior swimmer, swimming technique, physical fitness indices.*

Background. Modern swimming theory and practice with concern to the swimmer training issues give fairly comprehensive accounts of the swimming style specific training methods [1]; although the sport community still needs more detailed analysis of the style-unspecific (convergence) training models for junior groups, sets of the progress/ fitness benchmarks ('model characteristics'); and combinations of the training models and tools most beneficial for the beginner trainings and early specialization stage [4]. As things now stand, the relevant study data and practical recommendations for physical progress depending on the vocational swimming styles are rather fragmented in fact with little if any consideration for the synergy/ mutual influences of the style-specific trainings and competitive progress depending on the training combinations and components [7]. It should be mentioned, however, that the same progress in physical fitness elements with consolidation of the technical skills in trainings may be differently efficient in practice [8]. These are the reasons for the sport community to prefer integrated/ synergized sports training models that secure the technical and other special progresses on a synchronized/ harmonized basis.

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Methods and structure of the study. In the new swimming technique excellence training model testing experiment, we combined and analyzed benefits of the integrated structuring of special technical indicators of physical fitness to facilitate progress of the sample. We sampled for the tests the 10.5 ± 0.4 year-old swimmers (n=42, 24 boys and 18 girls) and split them up into Reference (RG, 10 boys and 8 girls) and Experimental (EG, 14 boys and 10 girls) Groups. The integrated training model was geared to offer most efficient combinations of training methods, tools and aspects for fast competitive progress facilitated by the integrated structuring of special technical indicators of physical fitness. The elementary technical progress was harmonized with the physical qualities building elements to prudently sequence the training stages for success. The progress tests enabled us to develop a set of the age-group progress benchmarks and test benefits of the integrated structuring of special technical indicators of physical fitness tests for efficiency of the breaststroke excellence model.

Experimental assumptions and effects were verified by the strength, physical fitness and swimming technique rating tests in practical trainings. Stroke power was rated by a 10s top-intensity leash-swimming dynamometry with zero speed [5] to obtain a force kinematic impulse using the following formula: I=F×t, where I is the force kinematic impulse; F is the stroke power; and t is the stroke time. We also computed a stroke power ratio as the total stroking impulse (legs + arms) to the free swimming/ coordinated stroke power [2]. Significance of the pre- versus post-experimental test data differences was rated by the Student's t-test using the formula:

$t = x_1 - x_2 / \sqrt{m_1^2 + m_2^2}$. The above stroke test rates were used to rate the swimming technique efficiency.

Results and discussion. The synchronized stroke power progress in the coordinated swimming tests and elementary stroke power test rates helped excel the swimming techniques and dynamics in the training. Trainings at the early specialization stage gave a special priority to the swimming style energy-efficiency achieved by the optimizing the special strength, general and high-speed endurance of every swimmer, i.e. the ability to maintain the stroke power on the distance. Tables 1 and 2 hereunder give the pre- versus post-experimental test data of the sample in the special strength, general and special endurance tests and in the test exercise.

The above tests and analyses were proved efficient for the swimming technique excellence model in application to the 10-11-year-old swimmers' trainings, particularly for the progress benchmarking and promising prospects' selection missions [3, 9]. The integrated trainings of special strength, general and spe-

Table 1. *Pre- versus post-experimental breaststroke swimming technique dynamic test data: female swimmers*

Test rates	EG			RG		
	Pre-exp.	Post-exp.	t	Pre-exp.	Post-exp.	t
Force kinematic impulse, kgs	4,99±0,4	6,61±0,3	1,4	3,89±0,4	6,00±0,4	1,5
Coordinated swim stroke power, kg	6,45±0,8	8,26±0,5	2,7	6,90±0,4	8,43±0,6	0,8
Stroke power ratio	0,68±0,04	0,75±0,03	3,7	0,66±0,03	0,73±0,05	4,2
Leg stroke power, kg	5,78±0,2	6,95±0,3	0,6	4,62±0,3	6,19±0,4	0,5
Arm stroke power, kg	4,45±0,4	5,96±0,5	1,7	4,44±0,4	5,51±0,5	2,1
Test exercise, s	107,2±0,9	90,5±0,8		108,4±1,5	93,2±1,3	

Table 2. *Pre- versus post-experimental breaststroke swimming technique dynamic test data: male swimmers*

Test rates	EG			RG		
	Pre-exp.	Post-exp.	t	Pre-exp.	Post-exp.	t
Force kinematic impulse, kgs	4,97±0,4	6,65±0,3	1,8	4,89±0,2	6,04±0,2	1,9
Coordinated swim stroke power, kg	8,45±0,6	9,26±0,5	1,3	8,90±0,5	8,93±0,5	1,5
Stroke power ratio	0,68±0,04	0,77±0,03	2,5	0,66±0,03	0,73±0,05	3,7
Leg stroke power, kg	6,92±0,4	7,95±0,3	2,3	6,60±0,3	7,19±0,4	1,4
Arm stroke power, kg	6,23±0,2	6,96±0,5	1,4	5,94±0,4	6,51±0,5	2,6
Test exercise, s	96,4±1,4	80,6±1,7		95,7±1,2	92,7±1,6	

cial endurance to make the swimmers able to maintain the stroke power on the distance, with a special priority to the swimming style efficiency were found beneficial, provided the special physical fitness is developed in every aspect.

It should be emphasized that training overstress in the adolescent age, when they exceed the training standards and progress benchmarks in the vocational swimming style, may be associated with high multiple health risks. At the same time, it was found that a range of aerobic capacity building trainings of this age group facilitate progress both in the speed endurance in the test exercise and swimming technique efficiency. Benefits of such trainings are further increased by the balanced progress in the technical and physical fitness and, hence, competitive accomplishments. The new swimming technique excellence model was found beneficial as verified by the EG progress in qualifying for Class II – versus the RG that could qualify only for Class III.

Conclusion. The new swimming technique excellence training model for the 10-11-year-old breaststroke groups facilitated by the integrated structuring of special technical indicators of physical fitness was found beneficial for competitive progress and in many other aspects including metabolic plastic transformations due to synchronization of endogenous processes.

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