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AEROBIC ENDURANCE DEVELOPMENT IN 13 AND 14 YEAR-OLD SWIMMERS

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Abstract: *In the specialized literature, physical effort is considered a request of the body above the rest level, a stimulus applied in order to adapt. Sporting physical effort determines the modification of homeostasis, stabilizing it in a certain period of time, at a higher level. In swimming, the effort capacity depends on the capacity to capture, transport and use oxygen. From an energetic and biochemical point of view, the swimmers' effort falls into the predominantly aerobic type. Directing the effort in the training session is the key to success in sports performance as well as the longevity of the individual in performance sport. The purpose of this study is to demonstrate that the methods used in training have the intended effectiveness*.

Key words: *swimming, effort, cadets, endurance.*

1. Introduction

Swimming has been documented since prehistoric times. The first attestations of swimming are the 9000-year-old drawings on the walls of the Wadi Sari fortress in the Libyan Desert, showing people swimming. Written references date from around 2000 BC. In ancient Greece, swimming was practiced and used in the physical education of the younger generation, as well as for utilitarian purposes. The Greeks dived to fish for corals, sponges, oysters, etc., to check and repair the keels of the vessels, and some archaeological discoveries testify that among the Romans, swimming was practiced for military purposes as well as hygienically, in baths where pools were built in which the water had a temperature different. [15]

The paper will be drawn up in two columns, of the width 67.5 mm, separated through a space of 5 mm. Exceptions are the title of the paper, the authors and

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their affiliation, the abstract and the key words, which will be drawn along the page.

Swimming has produced great satisfaction through numerous appearances of our athletes at the Olympic Games, starting with Helsinki 1952, and an impressive number of medals: 9 Olympic medals (three gold, two silver and four bronze), 12 medals at World Championships (four gold, one silver and seven bronze) and 66 medals at the European Championships (nine gold, twenty-five silver and thirty-two bronze). [7]

In swimming, the motor quality exploited to the maximum is resistance. In the specialized literature, a series of formulations and terms can be found, which try to define the motor capacity and resistance as effectively as possible, as follows:

- "The resistance motor quality represents the human ability to face physical fatigue, caused by the muscular activity carried out in an effort of a specified intensity and a determined regime without changing the prescribed intensity" [17].
- "In the final performance of any sporting activity with a continuous duration of 60 seconds or more, resistance has not only an important but also a dominant contribution.'" [2]
- "The motor capacity enables man to resist fatigue in prolonged work" [14].
- "The ability of the human body to make efforts with a relatively long duration and a relatively high intensity, maintaining constant indices of optimal effectiveness: so it is the human ability to make efforts without the appearance of fatigue (sensory, emotional, physical) or by overcoming this phenomenon" [4].

Endurance is defined in specialized literature as the body's psychophysical ability to cope with the fatigue specific to the activity performed. [16]

Endurance refers to the time required to perform a task of certain intensity, being affected by fatigue. An athlete has endurance, if he does not get tired or if he can continue the effort in conditions of fatigue. We encounter 2 types of resistance: general, necessary for an increased volume of work and specific, present in the characteristics of certain sports, influenced by the competitive stimulus. For cycle sports (athletics, running, swimming, cycling) we find the following classification:

- Long-term endurance, necessary in sports with effort over 8 minutes, the energy provided by the aerobic system. The heart rate (over 180 bpm), the volume of blood pumped (30-40 l), and the lungs ventilate (120-140 l of air.)
- Resistance of medium duration, 2-6 minutes, higher intensity, the athlete develops an O_2 debt.
- Short-term endurance, 45 seconds and 2 minutes, anaerobic processes provide the necessary energy.
- Speed resistance, maximum intensity, effort is mostly achieved in apnea.

Resistance training is commonly used for adolescent athletes to improve performance. [9] Additionally, several scientific reviews and articles have revealed that resistance training is a safe and feasible means in adolescents to improve muscle strength and motor skills

and prevent sports injuries [10,11]. Resistance training on land has been very important for improving maximal arm strength in competitive swimmers [5], [8], [12].

Some characteristics of puberty:

- Puberty begins for both sexes around the age of 10-11 years and lasts for girls until 12-13 years and for boys until 14-15 years.
- growth intensifies, which can take various forms: sudden and violent; arrhythmic and long; arrhythmic and short; slow and gradual;
- the growth is disproportionate, emphasizing the growth of the upper and lower limbs;
- the skeletal musculature develops especially through elongation, but the relative strength does not register obvious increases;
- mobility registers low values for both girls and boys;
- changes in the functioning rhythm of some glands with internal secretion: the thymus atrophies but the thyroid gland and sexual glands develop. [6]

During this period, the most characteristic phenomenon is that of growth. This acceleration of growth in height and weight begins in girls at 11 years and lasts until 13 years for height and 14 years for weight. [1]

Swimming was one of the first sports where it was shown that girls can train in the same way as boys, and children can train according to the same principles as adults. [13]

Table 1

Resistance periodization within the annual plan [3]

Preparation phase	**Preparatory period**		**Competitive period**		**Transition period**
Preparation subphase	general	specific	pre-competitive	main	transition
Resistance periodization	Aerobic endurance	Aerobic endurance Specific resistance (ergogenesis)	Aerobic endurance Specific resistance (ergogenesis)	Specific resistance (ergogenesis)	Aerobic endurance

- Aerobic endurance - develops for 2-3 months, during the preparatory and transition period, through the (steady state) method, with moderate to medium intensity, but along the way the volume must increase.
- Aerobic resistance and specific resistance - the emphasis will be on aerobic resistance but we move on to sport-specific resistance in which the rhythm and cadence of the activity become specific to the respective sport, the volume reaching the highest level in this stage.

-Specific resistance - occurs in the pre-competitive and competitive periods

where the intensity of training exceeds the intensity of the race.

2. Methodology of Research

2.1. The purpose of the research

The aim of the research is to determine the training methods based on the development of resistance, adapted to the effort capacity of pubertal swimmers.

2.2 Research objective

The objective of the research is to determine the threshold of influence of resistance development in training on a group of adolescent swimmers. The use of the T-2000 test will determine the zoning of the effort and guide the training towards increasing the effort capacity.

2.3. Description of the T-2000 test

It assumes that the athlete swims as fast as possible a distance of 2000 meters and that the intermediate times from each hundred meters are equal to each other.

The times in which each distance of 100 m is achieved must correspond to those of the anaerobic threshold, the swimmer being obliged to maintain this speed throughout the test. The final time is after completing the 2000 meters. This test indicates both aerobic and anaerobic capacity.

With the help of the final time obtained at T-2000, the effort zones adapted to the athlete's effort capacity can be calculated.

2.4. Sampling

Twenty participants in this study are students/performance athletes, boys, aged between 13 and 14, from the "Emil Racoviță" National College in Bucharest. (see Table 2)

3. Materials and Methods

3.1. Research methods used

- Studying the specialized bibliography
- The method of the experiment
-Graphic method
- Test method
  - T-2000 aerobic exercise capacity evaluation test
-The statistical-mathematical method
  - Deviation / standard deviation
  - Median

– The coefficient of variability

3.2. Experimentation program development

The 2 groups were defined, the experimental EG (12 subjects E1…E12) and the control group CG (8 subjects C1…C8) the T-2000 test was applied to both groups at the beginning and end of the study.

The experiment was carried out during 8 weeks from 6 March to 28 April 2023 and consisted in the introduction of aerobic swimming sets, the crawling procedure, with an intensity of 50-60%, of 2 times a week, like this:

- ✓ week 1 and 2 (2x1500m);
- ✓ week 3 and 4 (3x1000m);

- ✓ week 5 and 6 (4x800m);
- ✓ week 7 and 8 (8x400m).

Study participant data Table 2

ID	Year of birth	Height (cm)	Weight (kg)
E1	2010	158	50.4
E2	2010	167	55.8
E3	2010	174	61.1
E4	2010	165	56.2
E5	2009	180	62.4
E6	2009	168	53.5
E7	2009	152	40.9
E8	2009	174	58.6
E9	2009	164	57.2
E10	2009	155	50.8
E11	2010	172	63.6
E12	2010	165	56.9
C1	2010	178	72.4
C2	2010	156	51.1
C3	2010	166	56.0
C4	2010	172	61.7
C5	2010	163	56.6
C6	2009	177	61.2
C7	2009	153	42.4
C8	2009	170	63.3

4. Results

At the beginning and at the end of the 8 weeks the T-2000 test was applied, the data being collected during the initial (see Table 3) and final (see Table 4) testing and the documentation being as follows:

In the case of the control group, even if it did not participate in the training program, an improvement of 12 seconds is seen in the arithmetic mean determined after the initial testing and that obtained after the final testing, but still insignificant for aerobic swimming, instead in the case the experimental group, the difference is 2 minutes, as well as the case of the coefficient of variability in the experimental group changed by 1%, and in the control group by 0.2%.

Initial test results Table 3

		Mean	Standard deviation	Coefficient of variability
Test T-2000	EG	35,85	1,56	4,3%
	CG	35,01	1,03	3%

Final test results Table 4

		Mean	Standard deviation	Coefficient of variability
Test T-2000	EG	34,18	1,62	5%
	CG	34,48	1,11	3,2%

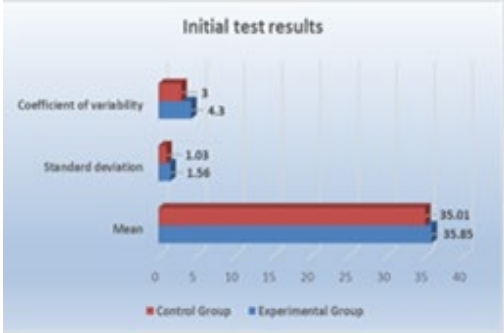

Fig. 1. *The results of the initial testing of the 2 groups*

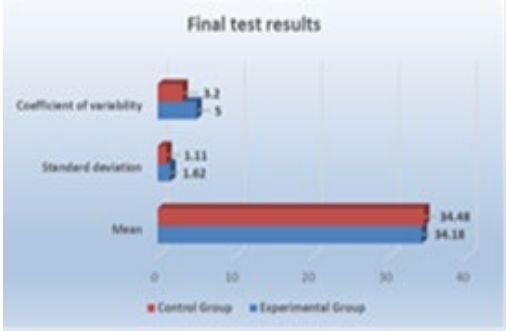

Fig. 2. *The results of the final testing of the 2 groups*

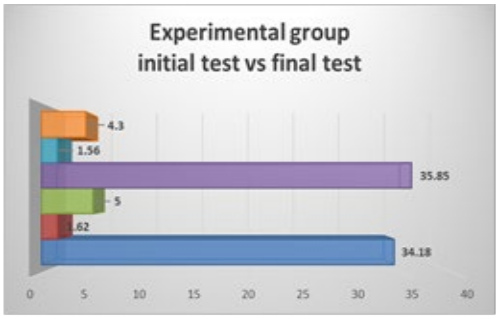

Fig. 3. *Experimental group (initial test vs final test)*

Fig. 4. *Control group (initial test vs final test)*

5. Discussion

In the pubertal period, when growth is disproportionate, skeletal muscles develop through elongation, training should be based on resistance development and strength development should be avoided as much as possible. It is the optimal age when we can develop aerobic endurance, through high volume of work with low intensity.

6. Conclusions

Our research started by analyzing and accumulating information about the theoretical concepts and notions realized on the discussed problem. We presented the essential aspects regarding the somatic, physiological, motor and psychosocial characteristics of children. To complete the experiment, the final tests were applied.

The results obtained at the initial and final tests by comparison between them and

between the participating groups are presented in the figures above.

The progress recorded is also due to the athletes' constant participation in training, their dedication and determination, and I had the opportunity to accumulate direct experience in terms of presenting and interpreting some data, which will certainly be useful to me in the future.

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