

## REFERENCES

- Fernandes RJ, Cardoso CS, Soares SM, Ascensão AA, Colaço PJ, Vilas-Boas JP (2003). Time limit and  $\text{VO}_2$  slow component at intensities corresponding to  $\text{VO}_{2\text{max}}$  in swimmers. *Int. J. Sports Med.* 24: 576-581.
- Vilas-Boas JP (1996). Speed fluctuations and energy cost of different breaststroke techniques. In J. P. Troup, A. P. Hollander, D. Strasse, S. W. Trappe, J. M. Cappaert, T. A. Trappe (Eds.) *Biomechanics and Medicine in Swimming VII*. E & FN Spon. London, 167-171.

---

**ACUTE EFFECTS OF THE USE OF A BIOFEEDBACK SYSTEM FOR THE TECHNICAL TRAINING IN BREASTSTROKE SWIMMING.**

Lima, A<sup>1,2</sup>, Capitão F<sup>1</sup>, Morouço P<sup>1</sup>, Gonçalves P<sup>1</sup>, Fernandes R<sup>1</sup>, Barbosa T<sup>2</sup>, Correia M<sup>4</sup>, Tani G<sup>5</sup>, Vilas-Boas JP<sup>1</sup>

<sup>1</sup>University of Porto, Faculty of Sport, Porto, Portugal

<sup>2</sup>University of Ceará and University of Fortaleza, Fortaleza, Brazil

<sup>3</sup>Department of Sports Sciences, Polytechnic Institute of Bragança, Portugal

<sup>4</sup>University of Porto, Faculty of Engineering, Porto, Portugal

<sup>5</sup>University of São Paulo, São Paulo, Brazil.

**INTRODUCTION**

The purpose of this research was to develop, validate, and evaluate a biofeedback system for the technical training in breaststroke swimming. The system lied on the assessment of speed fluctuation curves of an anatomical landmark of the swimmer (hip).

**METHODS**

The research developed through the informations displayed by a cable speedometer, specifically produced for the study, which signal was synchronized with dual media video images of the swimmer's performance. The velocimetric signal was graphically registered, and acoustically provided to the swimmer and coach during the performance. For the appreciation of the utility of the biofeedback solutions proposed for the technical training of breaststrokers, the acute effect of their use was analysed. For that purpose, the acute biomechanical response of five homogeneous (speed fluctuations and sex) groups to five different technical training programs with one hour of duration were studied. All the groups intended to minimize the speed fluctuations within a stroke cycle ( $dv$  = variation coefficient (VC) of the instantaneous velocity distribution) at the mean velocity correspondent to the race pace of the 200m breaststroke event. The sample was composed by 50 swimmers distributed by five groups of 10. Group 1 used only informations provided by the swimmer's coaches, Group 2 used also the graphical data provided by the speedometer, Group 3 included also dual media video images, and groups 4 and 5 accumulated concomitant acoustic informations (Group 4 every cycle, and Group 5 once in each two cycles).

**RESULTS & DISCUSSION**

VC ranged from 0.40 to 0.43, without statistical significant differences between groups. The mean values of stroke length (SL) were between 1.41m and 1.65m, with less homogeneity

between groups. The cycle duration (T) ranged between 1.5sec and 1.7sec. The mean velocity per cycle (V) was between  $0.9\text{m}\cdot\text{s}^{-1}$  and  $1.0\text{m}\cdot\text{s}^{-1}$ , and the Stroke Index ( $SI=V\cdot SL$ ) varied between 1.4 and  $1.8\text{m}^2\cdot\text{s}^{-1}$ . The higher positive acceleration values were observed, in all groups, during the propulsive leg action, and ranged between  $4.8\text{m}\cdot\text{s}^{-2}$  and  $5.7\text{m}\cdot\text{s}^{-2}$ . Among the main conclusions of this research, it is possible to state that: (i) the use of the biofeedback devices (graphical and acoustic displays of the speedometer, and dual media video images) influenced the motor learning processes associated to the acute effect of the swimming technical training provided - this effect is as larger, as higher and frequent the quantity of information provided; (ii) the swimming technical training of one hour of duration, complemented or not by additional technological means, has as acute effect a depression of the subjects' technical ability; (iii) the technical changes with training, at least during a one hour process, are not temporal, but spatial, or derived ones (velocity, and acceleration), and each group distinguished from the others, in each evaluation moment, from very detailed and changing technical variables.

---

**EVOLUTION OF BUTTERFLY TECHNIQUE WHEN RESISTED SWIMMING WITH PARACHUTE, USING DIFFERENT RESISTANCES.**

Llop F<sup>1</sup>, Tella V<sup>2</sup>, Colado J<sup>3</sup>, Diaz G<sup>1</sup>, Navarro F<sup>1</sup>

<sup>1</sup>Department of Physical Education of the University of Castilla La Mancha, Spain

<sup>2</sup>University of Valencia, Spain

<sup>3</sup>University Alicante, Spain.

**INTRODUCTION**

The use of resistance training with parachute, modifying posterior diameter, produces variations in the stroke frequency (SF), the stroke length (SL), speed (S) and stroke index (SI) during swimming. It is necessary to observe the progressive modifications produced in these parameters as the resistance swimmers must drag is increased. With this data trainers can decide the type of load and period of preparation in which it should be used, in order not to negatively affect swimmers' performance. It will also permit him to know which parameters have greater variation and must be controlled during training.

**METHODS**

The study was carried out with 18 swimmers of national level between 19 and 22 years of age. They carried out 6 tests consisting in swimming butterfly style 25 meters at maximum intensity using normal swimming (NS) and resisted swimming with parachute (RSWP) with a front diameter of 30cm and a posterior diameter of 30cm, 22.5cm, 15cm, 7.5cm and 0cm. The lap times and number of cycles in the central 10 meters, of the 25 meter distance were registered. SF, SL, S, and SI variables were analyzed in these tests. An intra-subject design was applied and the study of the data was carried out by means of a variance analysis for repeated measures.

**RESULTS**

The results obtained showed how the SF does not significantly differ with different spans, but there are significant differences between NS and 0cm ( $p=0.015$ ), 15cm ( $p=0.001$ ) and 30cm