

observed for CG after 12 week of endurance training. An increase in the transport capacity for lactate out of the working muscles could play a role for this observation.

#### P-079

### Biomechanics and Bioenergetics of 100-m Front Crawl Swimming in Young Male Swimmers

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**INTRODUCTION:** No studies have investigated the influence of somatic, energetic and technical parameters together to determine sprint swimming performance in boys after reaching puberty. The purpose of the study was to analyze possible relationships between swimming performance, anthropometrical, physiological and biomechanical parameters in male adolescent swimmers. **METHODS:** 25 male swimmers (15.2±1.9 years; 176.1±9.2 cm; 63.3±10.9 kg) performed 100m maximal front crawl swim in the 25m pool. Oxygen consumption, swimming speed (v), stroke rate (SR), stroke length (SL) and stroke index (SI) were assessed. Blood samples for lactate were taken at the 3rd and 5th minute of recovery and energy cost (Cs) was calculated. **RESULTS:** The average 100-m performance time was 77.6±9.1 and was significantly related ( $p<0.05$ ) to height, body mass and arm span values from the measured somatic parameters and to SL, SR and SI values, and  $\dot{V}O_2$ ,  $\Delta La$  and Cs values from measured biomechanical and bioenergetic parameters. Biomechanical factors (79%) characterized best the 100m swimming performance in these young swimmers, followed by somatic (49%) and bioenergetic factors (32%). **DISCUSSION:** The most important finding was that biomechanical parameters characterized best the 100m swimming performance, while the SI was the best predictor of sprint performance in adolescent male swimmers. Therefore, learning the correct swimming technique from the early years of swimming training is important. Cs is a key parameter to evaluate performance in swimming, but there are only a few studies that have investigated the determinants of swimming economy in children and adolescents (Kjendlie et al. 2004; Poujade et al. 2002). By investigating how aerobic and anaerobic performance develops during growth and maturation, it may be possible to identify the capacity for improvement and provide guidelines to coaches for the preparation of specific training sessions for young swimmers. **REFERENCES:** 1. Kjendlie P et al. (2004) Differences in the energy cost between children and adults during front crawl swimming. *Eur J Appl Physiol* 91,473-80. 2. Poujade B et al. (2002) Determinants of the energy cost of front-crawl swimming in children. *Eur J Appl Physiol* 87,1-6.

#### P-080

### Effects Of Applying Different Work Methods At Swimming School Programme For Beginners

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**INTRODUCTION:** The main aim of this research was to establish any possible differences in learning dynamics of basic swimming skills between two homogeneous groups of children. The first group was experimental group, and this group had learning program divided into five levels. The second group was control group, which worked according to learning program divided into three levels. Both groups were given the same swimming distance. **METHODS:** The research was conducted on 50 beginners, at the sports camp of Zaostrug, Croatia (n=50, 7-10 yrs). Two groups were formed: the control group and the experimental group. Both groups consisted of 25 participants each. It was previously established that these children have no swimming abilities. The T-test was used

in order to establish differences between the two groups. **RESULTS:** The effects of applying different work methods have given statistically significant differences between the two groups. The experimental group had more significant results than the control group. The Control group results were: sig=0,1; Mean M= -3,76 and the value of the T-test was  $t=-2,67$ . **DISCUSSION:** It can be said that the experimental group was more motivated for success, since this group worked according to five level training program. The program offered faster advancement from the first level to the fifth level. The control group worked according to the three level program; however this group had to overcome the same swimming distance as the experimental group. **CONCLUSION:** The experimental group has adopted swimming abilities in greater manner and more quickly. **REFERENCES:** Jürimäe J, Haljaste K, Cicchella A, Lätt E, Purge P, Leppik A, Jürimäe T (2007). *Pediatr Exrec Sci*, 19, 70-82. Leppik A, Jürimäe T, Jürimäe J (2006). *Coll Antropol*, 30, 753-76. Torlakovic, A. (2009). Analysis of dynamics of studying basic swimming elements. 11th International Conference of Sport Kinetics (ISBN: 978-960-88403-2-4), Chalkidiki, Greece, p.83-84 (O4).

#### P-081

### 13th FINA World Championships: Analysis of Swimsuits Used By Elite Male Swimmers

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**INTRODUCTION:** The polyurethane swimsuits has become the notice around the pools in the past couple years. A better body position and the reducing of drag are believed to be some of the reasons that allow the swimmers wearing these swimsuits to go faster (Kainuma et al., 2009). The purpose of this study was to verify the distribution of different swimsuits used by male swimmers during the finals at the last world championships being held at Rome in 2009. **METHODS:** Results databases from the 13th FINA World Championships, in Rome 2009 were used. Only the male swimmers participating in the finals were analyzed, for a total number of 24 individual swimming events. The wearing swimsuits were observed from video recorded of the television broadcast. **RESULTS:** Male swimmers participating in the finals limited their choice to seven types of swimsuits, of four different brands. Jaked01 Full® was the most used (47%), followed by the Powerskin X-Glide Full® (35%), the Powerskin X-Glide Pants® (7%) and the LZR Racer Full® (5%). Less used were the Jaked01 Pants® (3%), the Hydrofoil Full® (1%) and the LZR Racer Pants® (1%). Powerskin X-Glide Full® was the most used in freestyle events (56%), followed by Jaked01 Full® (29%). In backstroke, male swimmers share a preference between Powerskin X-Glide Pants® and Jaked01 Full® (33% each). All the swimsuits used in the breaststroke finals were distributed by the Jaked01 Full® (79%) and the Powerskin X-Glide Full® (21%). In medley finals, the Jaked01 Full® remained in the preferences (56%) followed by Powerskin X-Glide Full® (25%). We also could verify that 41% of the swimmers wearing Powerskin X-Glide Full® reached the podium, as well as 29% with Jaked01 Full®. **DISCUSSION:** Male swimmers preferentially used full swimsuits, covering both the torso and legs, probably contributing for a higher drag decrease. We can observe a clear preference for two swimsuits types: the Powerskin X-Glide Full® and the Jaked01 Full®. It seems these swimsuits had greater success rate for achieving podium places. One can speculate that in backstroke swimmers used more swimming pants because they are in a dorsal position, where a full swimsuit could not allow much benefits of the torso cover. The existence of selected preferences by the swimmers highlights the importance of the

swimsuits until the inclusion of the new swimsuit rule and might have on performances in the near future. REFERENCES: Kainuma E et al. *Biomed Res* 2009; 30(1):69-70.

#### P-082

### Swimsuits Used By Elite Male Swimmers in the 13th FINA World Championships: Analysis of Freestyle Events

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**INTRODUCTION:** Several world records have been broken in recent years. Swimming community speculates this fact is partly related due to the changes in swimsuits characteristics. To swim faster one need to increase the thrust and reduce drag, which can be achieved wearing the new polyurethane swimsuits (Marinho et al., 2009). The purpose of this study was to verify the distribution of different swimsuits used by male swimmers during all the freestyle finals, according to the different distances swum, at the last world championships being held at Rome in 2009. **METHODS:** Results databases from the 13th FINA World Championships, in Rome 2009 were used. Only the male swimmers participating in the freestyle finals were observed and analyzed, for a total number of six individual swimming events (50 m, 100 m, 200 m, 400 m, 800 m, 1500 m). The wearing swimsuits were observed from video recorded of the television broadcast. **RESULTS:** In freestyle swimming events most of the male swimmers participating in the finals choose to wear full body swimsuits. Three different swimsuits brands were used by the swimmers: Powerskin X-Glide Full® (56.25%), Jaked01 Full® (29.17%) and LZR Racer Full® (10.42%). Only 2.08% of the sample used pants. In the shortest event, 50 m, Jaked01 Full® was predominant with 62.50% of the swimmers choices. This value decreases to 25.00% analyzing the 100 m swimming event, and remained similar over the longer distances events. Contrarily, the Powerskin X-Glide Full® was used for 37.50% of the swimmers in 50 m swimming event, and it increased to 62.50% in the 100 m freestyle. This value remained similar over distances up to 1500 m. The maximum value of wearing reached by the LZR Racer Full® was 25.00% in the 400 m, being less used in the other swimming events, even reaching zero values in the 50 m and in the 1500 m events. **DISCUSSION:** The distribution of swimsuits wearing found in this study leads us to speculate that the Jaked01 Full® was preferred for the shorter distances and Powerskin X-Glide Full® was the choice for longer distances. The LZR Racer Full® was the least suit used and thus it seems it is not a preference for freestyle swimming events at this specific competition. These results seem to demonstrate that swimmers have some preferences regarding swimsuit type according to the distance of the swimming event. REFERENCES: Marinho DA et al. *Lecture Notes in Computational Science and Engineering – CFD for Sport Simulation*. Berlin: Springer. 2009.

#### P-083

### Effect of Subjective Effort on Stroke Timing in Breaststroke Swimming

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**INTRODUCTION:** Competitive swimmers require the capacity to change swimming speed to control their output. Nevertheless, control-

ling their own motion is difficult for athletes. They attempt to control their own motion depending on subjective sensations. This study examined the relation between stroke motion and subjective efforts during breaststroke swimming (BR) in comparison with front crawl swimming (FC). **METHODS:** In this study, 22 well-trained college swimmers participated after giving their consent. Eight 25-m swim trials were conducted, consisting of two styles (FC and BR) and four levels of subjective effort. The levels were four steps from 70–100% effort with the same clearance for one fs maximal effort. The swimming velocity (SV, m/s) was calculated with each swimming record. The stroke rates (SR, strokes/min) were calculated from videotaped data of the swimmers. A second camcorder was placed underwater to record the swimmers for at least one complete stroke cycle, supporting analyses of the stroke phases (divided into three phases). Data were presented as mean  $\pm$  standard deviation (SD). A stroke  $\times$  grading level (2  $\times$  4) repeated measures ANOVA was used to assess the significance of changes with grading level between strokes. Tukey fs post hoc test was used. **RESULTS** and **DISCUSSION:** A significant positive correlation was found between subjective effort and SV. The regression equations of FC and BR were, respectively,  $Y=0.67X+0.335$  ( $r=0.99$ ,  $p<0.01$ ) and  $Y=0.42 X+0.587$  ( $r=0.97$ ,  $p<0.01$ ). Increasing and decreasing the swimming velocity depends remarkably upon SR, not only for FC but also for BR. However, a significant interaction ( $p = 0.011$ ) was found for SV. No significant interaction ( $p = 0.821$ ) was found for SR. Both strokes have the same ratio of SR increase as stepping up the subjective effort, but not the same ratio of SV increase. Results show that the degree of SV increase by SR increase in BR is less than in FC, which might be attributed to technical characteristics: the difference between the alternate arm stroke in FC and in the simultaneous arm stroke in BR. **CONCLUSION:** In conclusion, increasing and decreasing the swimming velocity depends remarkably upon SR, not only in FC but also in BR. However, the degree of the SV increase by the SR increase in BR is expected to be less than in FC. These results suggest that changing SV with subjective effort in race and training is available as a difference of style.

#### P-084

### Technical and Physiological Changes During Continuous vs. Intermittent Swims at and Above Maximal Lactate Steady State

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**INTRODUCTION:** Most endurance training sessions are prescribed using intermittent exercise, which allow maintaining higher intensities with the same metabolic condition. In swimming, stroke technique (i.e., stroke rate - SR and stroke length - SL) and physiological potential may equally contribute to performance. When exercising above maximal lactate steady state (MLSS), a significant reduction in SL (Deckerle et al., 2005) has been found. Therefore, this study aimed to verify whether MLSS determined using continuous (MLSSc) or intermittent (MLSSi) protocols represent a boundary above which not only physiological but also technical changes occur. **METHODS:** Thirteen endurance swimmers (23  $\pm$  9 yr) performed four to eight 30-min sub-maximal tests, to determine the MLSSc and MLSSi (12  $\times$  150 s with 30 s of passive recovery). The time to complete 5 stroke cycles was used to calculate one SR value per 100 m. SL was calculated as the ratio between speed and SR. The blood lactate, SR, and SL were analyzed at minute 10 and 30 of each test. **RESULTS:** The speed at MLSSi (1.17 $\pm$ 0.09 m.s<sup>-1</sup>) and MLSSc (1.13 $\pm$ 0.08 m.s<sup>-1</sup>) were significantly different (3.2%) while the blood lactate concentration was similar (4.3 $\pm$ 1.1 and 4.4 $\pm$ 1.5 mmol.L<sup>-1</sup>, respectively). SR increased during MLSSi (32.5 $\pm$ 3.2 and 33.8 $\pm$ 3.2 cycles.min<sup>-1</sup>, 3.9%), 102.5% MLSSc (32.0 $\pm$ 3.7 and 34.2 $\pm$ 3.6