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YOUNG SWIMMERS' KINEMATIC AND HYDRODYNAMIC DETRAINING BETWEEN A TWO SEASONS' BREAK

INTRODUCTION

Young swimmers usually have several weeks of school break in the summer. During such period no swim training is conducted until the beginning of the next season.

According to training principles, the prolonged absence of a regular external load may decrease the form status built up in a previous training period. Since the major focus of swim training in children is their technical enhancement, it is expected that some adaptations will occur namely in kinematics and hydrodynamic outcomes.

Due to biological development, young swimmers also experience regular anthropometric changes in their daily life. Increases in height and therefore in limbs´ lengths are some of the aspects of growth process. Nevertheless, it still remains the question if such break between seasons affects their biomechanical profile acquired in the past season.

The aim of this study was to analyze the effects of the two seasons' break period on young swimmers' biomechanics taking into account their biological development.

METHODS

Twenty-five young competitive swimmers (overall: 12.45 ± 0.94 years of age) with regular participation in regional and national level competitions participated in the study. Coaches, parents and/or guardians gave their consent for the swimmers participation on this study. Subjects were submitted to anthropometric, kinematic and hydrodynamic tests at the end of the 2011-2012 season (TP_1) and 10 weeks later at beginning of the 2012-2013 season (TP_2). No specific swim training was conducted during such period. Height (H) and arm spam (AS) were considered as anthropometrical features. The mean swimming velocity (*v*), stroke frequency (SF), stroke length (SL), stroke index (SI) and speed fluctuation (dv) were determined as kinematic variables [5]. The active drag coefficient (C_{da}) was computed as hydrodynamic variable using the velocity perturbation method [8, 9]. Within-subjects mean differences were analyzed with paired Student's t-Test ($p \leq 0.05$). Cohen *d* was selected as effect size index [4].

RESULTS AND DISCUSSION

Table 1 presents the differences in anthropometric, kinematic and hydrodynamic variables during the detraining period. At the beginning of the new season (TP_2) the swimmers were taller and increased the AS. As part of their normal development, young swimmers should expect several anthropometric changes in their formative years [2].

While the *v*, SL and SI increased, the SF, dv and C_{da} remained unchanged. It is known that increases in *v* can be reached using different combinations between SF and SL [6]. At earlier ages, increases in SF by maintaining SL are limited, mainly due to muscle proprieties of the swimmers. Higher strength levels only are reached after the appearance of the H peak that is around the 14 years [3]. So, it is possible that the swimmers from the present study have not reached H peak yet, and the increases in SF while maintaining SL were not possible. Instead, the improvement in *v* was based on SL increases. This can be explained by an increased AS which had also influence in their biomechanical efficiency.

The C_{da} remained unchanged during the summer break. Similar result was previously reported during an 8 weeks' general training phase [9]. Conversely, one week of hydrodynamics training mainly with specific visual and kinesthetic feedbacks, was sufficient to decrease C_{da} of pubescent swimmers [7]. So, decreases in young swimmers' C_{da} might be strongly related to a rigorous hydrodynamics training design.

Table 1. Variation in anthropometric, kinematic and hydrodynamic variables during the detraining period.

	TP_1	TP_2	p	*d*
H [m]	1.59 ± 0.08	1.62 ± 0.07	< 0.01	-0.40
AS [m]	1.63 ± 0.11	1.64 ± 0.10	< 0.01	-0.10
v [m.s^{-1}]	1.20 ± 0.21	1.36 ± 0.12	< 0.01	-0.94
SF [Hz]	0.84 ± 0.07	0.82 ± 0.21	0.16	0.04
SL [m]	1.42 ± 0.24	1.68 ± 0.19	< 0.01	-1.20
SI [m^2.c^{-1}.s^{-1}]	1.74 ± 0.59	2.30 ± 0.41	< 0.01	-1.10
dv	0.09 ± 0.02	0.09 ± 0.02	0.84	0.0
C_{da}	0.35 ± 0.16	0.41± 0.16	0.13	-0.38

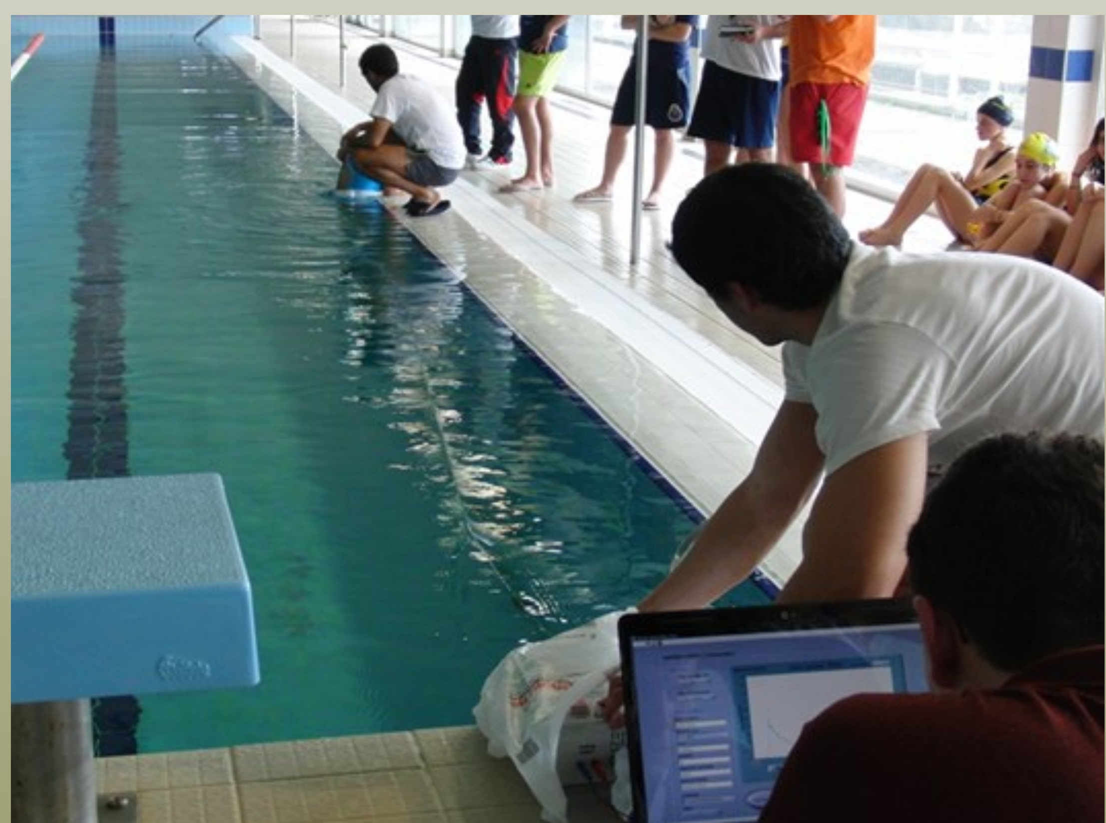

Figure 1. Mechanical speedo-meter [1] to acquire and process pair wises velocity-time data on-line during the swim trial .

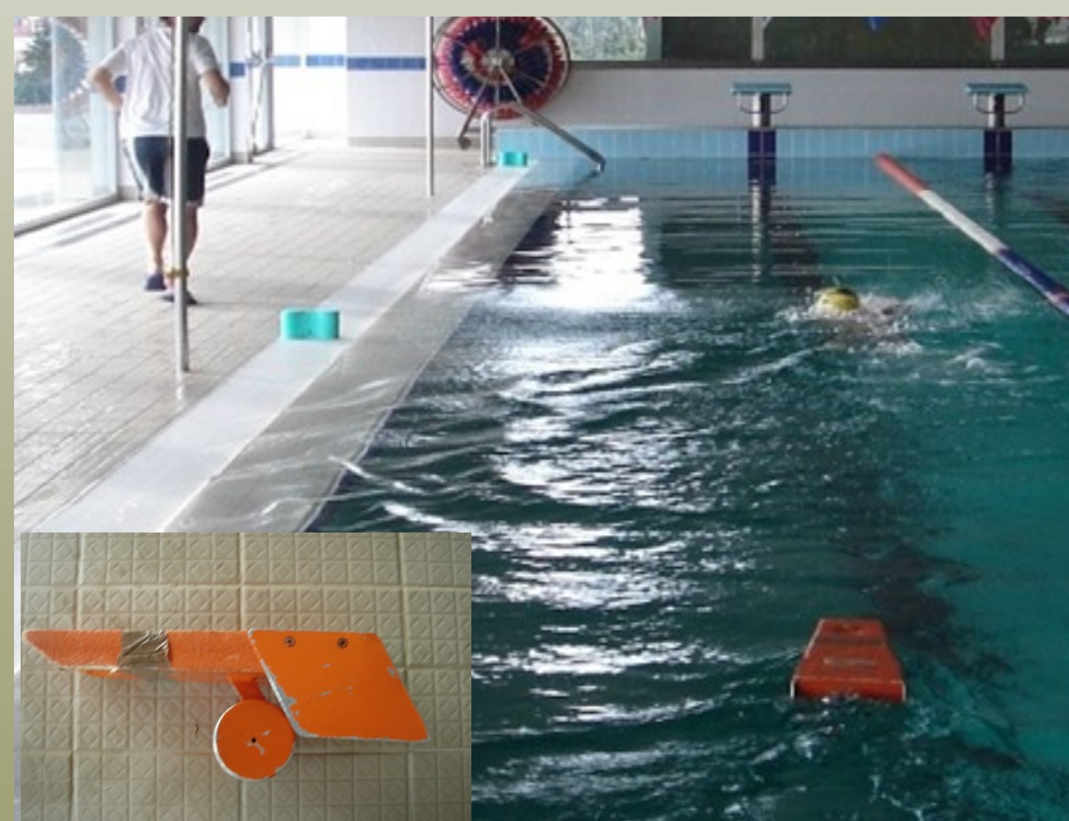

Figure 2. Velocity perturbation method for the hydrodynamic assessment.

CONCLUSIONS

It can be concluded that young swimmers can still improve their swimming biomechanics despite the absence of swim training between a two seasons' break. Those improvements can be explained by their biological development (i.e. anthropometrics).

REFERENCES

[1] Barbosa TM et al. *International Journal of Sports Medicine*. 34:507-513, 2013.

[2] Baxter-Jones ADG et al. *Annals of Human Biology*. **22**:381-394, 1995.

[3] Bloomfield J et al. *Australian Journal of Science and Medicine in Sport*. **22**:4-12, 1990.

[4] Cohen J. *Statistical power analysis for the behavioral sciences*. Hillsdale NJ, Lawrence Erlbaum Associates, 1988.

[5] Costil DL et al. *International Journal of Sports Medicine*. **23**:371-377, 1985.

[6] Craig A et al. *Medicine and Science in Sports and Exercise*. **17**:625-634, 1985

[7] Havriluk R. Proceedings of BMS X, Porto, Portugal. Proceeding 218-220, 2006.

[8] Kolmogorov S et al. *Journal of Biomechanics*. **25**:311-318, 1992

[9] Marinho DA et al. *Journal of Sports Science and Medicine*. **9**:71-78, 2010.

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