

ASSOCIATION BETWEEN 30SEC MAXIMAL TETHERED SWIMMING AND SWIMMING PERFORMANCE IN FRONT CRAWL

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INTRODUCTION

Tethered swimming has been in use for long in order to measure and evaluate swimmers propulsive force (Magel, 1970; Yeater et al., 1981). Besides being a valid and reliable test (Dopsaj et al., 2003 and Kjendlie & Thorsvald, 2006) its relationship with performance in swimming is questioned (Smith et al., 2002), mainly because changes of arm and hand action seem to occur (Maglischo & Maglischo, 1984). Gathering these factors, studies developed with elite swimmers are required. The aim of the present study was to analyze the relationship among forces and velocity produced by elite swimmers in tethered and free swimming.

METHODS AND PROCEDURES

Sample included elements of the Portuguese national swimming team: (i) Group 1 – 6 swimmers with an age range of 18 to 21 years and (ii) Group 2 – 13 swimmers with 14 to 17 years. Basic descriptive characteristics were: (i) Group 1 – high = 179.3±12.1cm; body mass = 73.6±6.2kg; (ii) Group 2 – high = 171.3±9.1cm; body mass = 60.6±10.9kg. After a 1200m warm-up each subject performed a 30sec maximum intensity crawl tethered swimming. Individual force to time - F(t) - curves were obtained with swimmers attached by a non-elastic cable to a strain-gauge system (Globus, Italy). The load cell had a data cable connected to a PC computer that uses a data acquisition system – Ergometer Globus. SPSS v15.0 was used in order to obtain average pulling force in 30sec (AvgF), average maximum peak force

(MaxF), average minimum force (MinF) and average of MaxF minus MinF (Ran_{max-min}). 24 hours later, the same swimmers performed a normal swimming test. Group 1 did a 50m maximum freestyle and Group 2 a 200m one. Both distances were covered in a long course pool. Time was registered in order to calculate average velocity of the 50meters (V50m) and of the 200meters (V200m).

RESULTS

Table 1 includes basic descriptive and inferential statistic results showing the differences obtained between groups. As expected, older swimmers (Group 1) got higher values for all variables calculated. However no statistical difference was obtained in Ran_{max-min}.

Variable	Group 1 (n=6)	Group 2 (n=13)
AvgF (N)**	121.7 (13.7)	61.4 (22.8)
MaxF (N)*	257.4 (33.9)	194.8 (66.2)
MinF (N)*	159.2 (26.8)	110.6 (38.1)
Ran _{max-min} (N)	98.2 (22.1)	84.1 (32.1)
V50m (ms ⁻¹)	1.86 (.07)	-
V200m (ms ⁻¹)	-	1.47 (.10)

Table 1. Mean and standard deviation of each variable studied. **represents p<.01 and *p<.05

In Table 2 the correlation values obtained within studied variables according to Pearson product moment can be observed. Only positive correlations were found meaning that increasing variables correspond to improved performances.

	AvgF	MaxF	MinF	Ran _{max-min}
MaxF	.87**			
MinF	.87**	.94**		
Ran _{max-min}	.68**	.87**	.64**	
V50m	.93**	.81*	.47	.69
V200m	.94**	.93**	.82**	.94**

Table 2. Correlations obtained among parameters. **represents $p < .01$ and * $p < .05$

DISCUSSION

In the present study, differences between groups were obtained for AvgF ($p < .01$), MaxF and MinF ($p < .05$), meaning that older swimmers present higher strength producing capacity in tethered swimming. As expected, mean velocity of the 50meters freestyle was superior to the 200meters one. Statistical significant differences weren't found in the Ran_{max-min}, indicating that the decrease shown in strength curves is similar within groups. As referred earlier, AvF is highly correlated with all variables, getting higher values on V200m and V50m respectively ($r = .94$, $r = .93$). These results point out that mean force calculated in 30sec maximal tethered swimming can induce performance results for crawl stroke in short and middle distance events. D'Acquisto & Costill (1998) have shown high correlations for power and performance in 100 and 400yard events. However those data refers to breaststroke and evaluation were performed using partially tethered swimming. Another result to point out is the high correlation of Ran_{max-min} with MaxF meaning that swimmers who reach higher peak forces aren't able to keep their pulling force values for so long. For each distance, there was a higher correlation for MaxF than for MinF, suggesting that the first half of the tethered swimming event is a stronger predictor than the second half. Obtained data seems to indicate the possibility of the mean force obtained through a 30 s fully tethered swimming test predict the mean velocity correspondent to a 50m front crawl ($v = 0.004 * \text{tethered force} + 1.331$), and 200m

front crawl ($v = 0.004 * \text{tethered force} + 1.208$). In the near future we will focus on analyzing the slope obtained from MaxF point to MinF point.

SUMMARY

Association between AvF and mean velocity in 50m and 200m events was found. Tethered swimming seems to be a tool for results prediction in front crawl swimming.

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