

A KINEMATC COMPARISON BETWEEN THE SEMI-FINALS AND THE FINALS FOR 50M SWIMMING RACES OF THE FOUR STROKES

Hashem Kilani and Wasim Zeidan

Faculty of Physical Education, University of Jordan, Amman, Jordan

The purpose of this study was to identify the kinematical variables that had a significant effect on total time between Semi-finals and Finals for 50m races of the four strokes. Finalists who had their best total time registered at the Semi-finals were chosen as the subjects in this analysis and they were (44) swimmers. The term "negative swimmers" was given to these subjects. The kinematics variables used in this analysis were: total time(TT), start time (ST), free swimming speed (Av.V), last 5m of the race (5m Fin.), first half swimming speed(V1), second half swimming speed (V2), stroke length (SL) and stroke rate (SR). Results revealed that the most kinematical variables that might affected the (TT) were SR, SL and V2. An attempt of explaining the improper combination between SL and SR through the second half of the race was stated.

KEY WORDS: race analysis, negative swimmers, semi-finals, finalists.

INTRODUCTION: In the 50m freestyle race at the 9th FINA World Swimming Championships Fukuoka 2001, six finalists from eight achieved the best total time at the semi-finals which was 75% of them. The difference in total time between the semi-final and the final for those finalists was statistically significant. To facilitate the usages of terminology, the term Negative Swimmers was used to describe those swimmers. This led the authors to monitor the four strokes in three Championships (9th FINA world swimming Championships 2001, 10th FINA world swimming Championships 2003, European swimming championships 2002).The number of the Negative Swimmers and Their percentages was shown in table (1).

Table 1 the number of the Negative Swimmers and Their percentages.

	Fukuoka 2001		Berlin 2002		Barcelona 2003		Total	
	N	%	N	%	N	%	N	%
Freestyle	6	75	4	50	3	37.5	13	54.16
Butterfly	5	62.5	3	37.5	5	62.5	13	54.16
Backstroke	4	50	3	37.5	2	25	9	37.5
Breaststroke	2	25	4	50	3	37.5	9	37.5
All	17	53.12	14	43.75	13	40.62	44	45.83

Table 1 illustrates high percentages of the Negative Swimmers who achieved the best total time at the semi-finals, especially in the Freestyle and Butterfly strokes. The purpose of this study was to identify the kinematical variable(s) that had had a significant effect in total time at the final for each swimming stroke.

METHODS: Subjects were the finalists who had the best total time in the semi-finals which were called Negative Swimmers and their kinematical data were published on the web site and the Spanish Olympic Training Center,(Haljan,2003) table (1).In order to justify the selection of the above data, one-way analysis of variance (ANOVA) was used to assess the homogenous of the subjects. There were no significant differences between the finalists' total time in the three championships, except for the backstroke. However it will be used due to the fact that the swimmers were elites swimmers at that time.

The dependent variables are semi-finals and finals, and the independent variables were selected from race analysis components, and they are:

- 1) total time (TT): the official time of the whole race.
- 2) Start time (ST): the time from the gun until the swimmer's head passed through the 15m mark.
- 3) Finish time (5m Fin.): the time that it took for the swimmer's head to pass under the flags (5m from the wall) until the swimmers hands touched the wall at the end of the race.

- 4) Free Swimming speed (Av.V): the average speed without starts and finishes.
 5) First half speed (V1): from the 15m line until 25m line.
 6) Second half speed (V2): the speed from 25m line until 45m line.
 7) Stroke length (SL) (measured in meter): the distance that a swimmer travels for a complete arm stroke cycle (right hand entry to right hand entry).
 8) Stroke rate (SR) (number of arm stroke cycles per minute): the number of stroke cycles that would occur in one minute if the present rating were continued is defined as the stroke frequency. (Mason, & Cossor, 2000), (Thompson, et al, 2000)

Table 2 One-way analysis of variance (ANOVA).

Stroke		Sum of squares	Df	Mean square	F	Sig.
Freestyle	Between groups	0.195	2	0.0975	2.239	.131
	Within groups	0.915	21	0.0615		
	total	1.111	23			
Butterfly	Between groups	0.301	2	0.150	2.741	.88
	Within groups	1.153	21	0.0547		
	total	1.453	23			
Backstroke	Between groups	1.139	2	0.570	4.110	.031*
	Within groups	2.910	21	0.139		
	total	4.049	23			
breaststroke	Between groups	0.066	2	0.0334	0.361	.701
	Within groups	1.939	21	0.0923		
	total	2.006	23			

* Significant at the 0.05 level

ANALYSIS METHODS: paired t-test was used to compare between the variables at the semi-finals and the finals through the independent variables. These comparisons were conducted separately for each swimming stroke. (Table 3) & (Table 4)

RESULTS:

Freestyle: As stated in the introduction, there was a significant difference between semi-finals and finals in the total time. Total time and free swimming speed had a significant difference at (0.01) level. SL and V2 had a significant difference at (0.05) level. The difference between semi-finals and final through the variables were a mean of: 0.11 sec in TT, 0.016m/s in Av. V, 0.05m in SL and 0.015m/s in V2.

Butterfly: The significant differences between semi-finals and final were in TT and ST at the (0.01) level and in SL, SR, V1 and V2 at the (0.05) level. The difference between semi-finals and final through the variables were a mean of: 0.12 sec in TT, 0.07 sec in ST, 0.03m in SL, 1.19S/min in SR, 0.018m/s for V1 (swimmers were faster in the finals at the first half of free swimming speed) and 0.018m/sec for V2.

Backstroke: Significant differences between semi-finals and final were in TT only at the (0.01) level and in SL and SR at the (0.05) level. The difference between semi-finals and final through the variables were a mean of: 0.21sec in TT, 0.06m in SL and 1.44 S/min in SR.

Breaststroke: Significant differences between semi-finals and final were in TT only at the (0.01) level and in SL, SR and V2 at the (0.05) level. The difference between semi-finals and final through the variables were a mean of: 0.13sec in TT, 0.07m in SL, 2.77 s/min in SR and 0.018m/sec in V2.

Table 3 means for semi-finals and finals, means difference and standard deviation for semi-finals and finals.

Stroke	Statistic	TT	ST	Av. V	SL	SR	V1	V2	5m fin.
Free style	Semi M	22.30	5.75	2.102	2.10	60.23	2.176	2.057	2.24
	Final M	22.41	5.71	2.086	2.05	61.09	2.151	2.042	2.27
	M diff.	0.11	0.04	0.016	0.05	0.86	0.025	0.015	0.03
	Semi SD	0.25	0.13	0.018	0.17	4.87	0.040	0.028	0.06
	Final SD	0.22	0.09	0.029	0.17	5.19	0.042	0.028	0.06
Butterfly	Semi M	23.79	5.80	1.936	1.80	64.38	1.954	1.924	2.48
	Final M	23.91	5.87	1.930	1.77	65.57	1.972	1.906	2.49
	M diff.	0.12	0.07	0.006	0.03	1.19	0.018	0.018	0.01
	Semi SD	0.21	0.22	0.015	0.10	3.38	0.034	0.021	0.10
	Final SD	0.24	0.22	0.015	0.10	3.67	0.038	0.016	0.08
Backstroke	Semi M	25.64	6.52	1.813	1.94	56.18	1.848	1.792	2.55
	Final M	25.85	6.64	1.807	1.88	57.62	1.856	1.779	2.58
	M diff.	0.21	0.12	0.006	0.06	1.44	0.008	0.013	0.03
	Semi SD	0.34	0.18	0.026	0.11	3.15	0.033	0.026	0.06
	Final SD	0.42	0.32	0.036	0.11	3.73	0.042	0.036	0.09
Breaststroke	Semi M	27.94	6.72	1.634	1.62	60.27	1.647	1.623	2.84
	Final M	28.07	6.78	1.631	1.55	63.04	1.670	1.605	2.84
	M diff.	0.13	0.06	0.003	0.07	2.77	0.023	0.018	0.00
	Semi SD	0.29	0.13	0.014	0.12	4.36	0.033	0.008	0.11
	Final SD	0.29	0.20	0.017	0.11	3.89	0.049	0.022	0.07

Table 4 Paired t-test between the kinematics variables at the semifinals and the finals.

Independent variables	Freestyle N=13	Butterfly N=13	Backstroke N=9	Breaststroke N=9
	Sig.	Sig.	Sig.	Sig.
TT	.002**	.000**	.001**	.004**
ST	.241	.005**	.128	.158
Av. V	.004**	.055	.489	.563
SL	.046*	.014*	.048*	.030*
SR	.235	.035*	.016*	.023*
V1	.111	.020*	.325	.098
V2	.052*	.014*	.141	.028*
5M Fin.	.197	.890	.129	.999

* Significant at (0.05) level.

** Significant at (0.01) level.

DISCUSSION: In the four strokes of 50m races, there was a significant difference between semi-finals and final in TT and SL. With the exception of 50m freestyle race, there was also a significant difference in SR. (Maglischo, 2003) stated that "when swimmers want to go faster they increase their stroke rate, even though their stroke length decreases. At first, their stroke length will decrease by only a small amount with each increase in stroke rate. Therefore, swimming velocity will continue to increase reaching 60 cycles per minutes which are very high stroke rate. The drop-off, however in the stroke length would be so great with every additional increase in the stroke rate that swimming velocity would decrease". Therefore, the improper relationship of SL and SR at the final could be decreased the Av. V of free swimming part (the biggest part of the race). But this improper combination seems to be at the second half of the race. In table (3), it was found that V1 was better in finals for (butterfly, backstroke and breaststroke), and that explains none the significant difference in Av. V for those strokes and the significant difference in freestyle race.

Mason & Crosser, (2000) found that the second half of the longer freestyle races (400m, 800m and 1500m) significantly correlated with the race result than the first half. It seems that the

second halves of short distance races are similar to long distance races. This conclusion was supported by the statistical significant of the variable (V2) in the three mentioned strokes.

In the butterfly stroke, there was a significant difference in ST. There were no available data to interpret this finding. Sanders, (2002) indicated that the time from 0 to 15m can be used as an indication of proficiency in starts. In the literatures start was divided in to 4 phases (block, flight, below surface and swimming). So, a further study is needed to clarify this problem.

From these statistical analyses, it could be advisable to consider finalists performance at the semi-finals, especially if best performance is sought. Another reason may be added her as physiological and psychological stresses interference. Finally, other swimming distances could be evaluated.

CONCLUSION: An identification of the kinematical variables that had a significant effect in total time between semi-finals and final of the four strokes in 50m races was determine. Variables that might caused total time to decrease in finals than the semi-finals, in general, were SL, SR and V2. This was explained by the improper combination between SL and SR in the second half of the race. It was suggested that finalists' performance at the semi-finals should be addressed in further studies in which physiological and psychological variables can be included and with other race distances.

REFERENCES:

- Haljand R. L. swimming competition analysis-European championships, Berlin 2002: 50m freestyle, butterfly, backstroke and breaststroke races, men [on line] available from URL: www.swimm.ee [accessed May, 2003].
- Japan swimming federation, Medical and Scientific Committee, Race Analysis Project, the 9th FINA world Swimming championships Fukuoka 2001, 50m freestyle, butterfly, back stroke and breaststroke races, men [on line] Available from URL: <http://race-analysis.qgpop.net/2001> [accessed October, 2002]
- Maglischo, E. W. (2003). *Swimming Fastest*. Revision edition of: *swimming even faster*, ©1993. Human Kinetics Publisher, USA.
- Mason, B. and Cossor, J. (2000). What can we learn from competition analysis at the 1999 Pan Pacific swimming championships? In R. Sanders and Y. Hong (Eds.) *Proceedings of XVIII symposium on biomechanics in sports: Applied Program: Application of biomechanical study in swimming (pp75-82)*. Hong Kong: Department of sports science and Physical education, the Chinese university of Hong Kong.
- Olympic Training Center, Spain. The 10th FINA world swimming championships Barcelona 2003, 50m freestyle, butterfly, backstroke and breaststroke races, men [on line] Available from URL: www.car.edu/finabcn03 [accessed December, 2003].
- Sanders, R. (2002). *New analysis procedures for giving feedback to swimming coaches and swimmers*. XX international symposium on biomechanics in sports-swimming. Caceres, Spain.
- Thompson, K., Haljand, R and MacLaren, D. (2000). An analysis of selected kinematic variables in national and elite male and female 100-m and 200-m breaststroke swimmers. *Journal of sports sciences*, 18, 421-431.