SHOULD WE CHANGE THE STROKE LENGTH FOR JORDANIAN SWIMMERS?

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In order to investigate the stroke length effect on the final swimming time, an adaptation of stroke frequency was assigned, and a change of stroke length was observed in the National Youth Jordanian swimming team. Therefore, the purpose of this study was to identify the effect of the relation between stroke length and stroke rate on the final time, for 25m crawl swimmers, and to determine the kinematics variables that are related to the free swimming phase. These variables were stroke length SL, stroke rate SR, velocity V, efficiency factor EF and final time FT. Subjects were assigned to swim at their maximum speed with certain length of strokes three times during the experiment so three groups were classified: Normal Stroke NS, Long Stroke LS and Short Stroke SS. The NS was the optimum although it may increase the EF if they adopt longer SL and adapt their techniques for the new changes in the training sessions.

KEY WORDS: stroke length, stroke rate, swimming

INTRODUCTION: Swimming performances have improved noticeably in the past few years. The Russian swimmer Popov obtained in 2003 a 21.92 seconds for the 50m crawl, in the FINA, table (1).

Table 1: Stroke length and stroke rate for swimmers in the 10th FINA championships.

Name of swimmer	Final time (s)	Speed (m/s)	Stroke rate (cycle/min)	Stroke length (m)	Efficiency factor (m2/s)
Popov	21.92	2.28	55	2.35	5.04
Foster	22.20	2.25	51	2.45	5.12
VDHoogeneban	22.29	2.24	63	2.03	4.34
Kenkhuis	22.30	2.24	55	2.21	4.72
Sioct	22.38	2.23	62	2.06	4.37
Volynets	22.40	2.23	62	2.03	4.33
Hawke	22.41	2.23	69	1.58	3.89
Lezak	22.44	2.23	55	2.25	4.68

Looking at the kinematics variables related to swimming and the free swimming phase, a difference was noticed in stroke rate and stroke length values from one swimmer to another. An increase of value in one variable does not indicate the rank the swimmer will attain. Some swimmers with the longest stroke length and largest stroke rate did not obtain first places. In addition, many coaches in Jordan ask their swimmers to change their stroke length and stroke rate as to copy an international model without reasonable scientific data (Hay, 1993,). This may lead to misestimation and default technique which in turn will not enhance the performance. Based on the kinematics analyses should we change the stroke length for Jordanian swimmers? In order to find an answer to this question, this experimental study was conducted. The relation between stroke rate and stroke length and their effect on final time through change of stroke length were also investigated by assuming certain length of strokes in three groups. This study was concerned with short distance crawl swimmers in the Jordanian Youth National swim team.

METHODS: Twenty four homogenous males (average age 16.75) from the Jordanian Youth National swim team were selected as a sample for the study. Subjects were divided into three groups of eight swimmers; two groups had practices on adjusting their SL until they had achieved the required change which was standardised across subjects by virtue of count cycles. The long stroke LS had to do 3-4 cycles while the short stroke SS had to do between 4-5 cycles. The stroke length was modified in each group after the practice sessions by fixing the cycle numbers so they swam with some modification of their strokes cycles while the third group of normal stroke NS was left without modifications as a control group. Then, they were video graphed in a 25m swimming pool recorded from the side whereby they were asked to swim at their maximum speed three trials. The starting phase is from the starting signal until the swimmers head crosses the 12.5m mark from the starting wall and this was not included in the analyses. The free swimming phase incorporates the reminder of the race which is the 12.5m swimming distance. Data were analyzed during this free swimming phase including the stroke length SL, stroke rate SR, velocity V, efficiency factor EF and final time FT by using the video image and the count of the stroke in each group of the strokes. The temporal measurements were taken from the video timing device. The SL is the distance a swimmers´ head moves during a complete arm stroke from right hand entry to the next right arm entry and this formula was used: (V/SR). The SR is the number of these cycles that would occur times duration. The V denotes how far the swimmers´ head travels in one second; based on an average value for the entire free swimming phase where the SR and SL are determined V. The EF is obtained by multiplying the swimmers V by the swimmers SL. This places emphasis on having a longer stroke, rather than a short stroke, and a high frequency. The EF can effectively assess the free swimming phase of a swimmers performance. The mean and the standard deviation, one way ANOVA, post hoc test, step wise regression and person correlation were used.

RESULTS: Table (2) illustrates the mean and Standard deviations of kinematic variables for the subjects in this study, depicted for all subjects in the three groups, the NS, LS, and SS. Comparing SL in this table with those presented in table 1, only one swimmer Hawke has had similar SL and was ranked seventh despite the huge difference in the velocity. This is due to different distance analyzed and the vast level of swimmers. The SR variable was the most significant variable between the three groups, table (3). The post hoc test showed that there was a significant difference between NS group and LS group in the SR for NS group, also a significant difference between SS group and LS group for SS group, table (4). These results were in agreements with Kilani & Zeidan (2004, 2005) study and it's been supported by Mason & Cosser (2000) research. Stepwise regression showed that the EF affected the groups. Although, mean velocity is the main factor that determines the contribution of finishing first and this velocity is achieved as a by-product of LS & SR (Maglischo, 2003, Sanders, 2002), the efficiency factor was the most effective variable in SS group by 75.1%, table (5).While the EF contributed by 80% to the 25m swim time & 82% to the 12.5m swim time. The relationship between EF & SL was greater and significanz reached 0.861.Thus, if the swimmers increase their SL with the conservation of velocity, this would increase their level of performance, table (6).

Table 2: Mean & deviation for the three groups

Variable	Group	Mean	SD
Stroke length (m)	NS	1.57	0.17
	LS	1.70	0.16
	SS	1.47	0.18
Stroke rate (no/min)	NS	1.07	0.07
	LS	0.92	0.10
	SS	1.10	0.14
Velocity (m/s)	NS	1.68	0.19
	LS	1.57	0.25
	SS	1.61	0.14
Efficiency factor (m^2/s)	NS	2.65	0.55
	LS	2.69	0.65
	SS	2.38	0.42
12.5m Time	NS	7.23	0.88
	LS	7.81	1.22
	SS	7.50	0.70
Final Time (s)	NS	14.27	1.49
	LS	14.76	1.74
	SS	14.47	1.41

Table (3) Results of one way ANOVA analysis for variable in this study for the 3 groups

Variable	Source of ANOVA	Square sum	Degree of freedom	Square average	F Value	Index Level
	SL	0.20	2	0.1		
SL	Error	0.61	21	0.03	3.44	0.051
	Total	0.81	23			
	SL	0.15	2	0.07		
SR	Error	0.23	21	0.01	6.68	0.006*
	Total	0.38	23			
	SL	0.05	2	0.02		
V	Error	0.82	21	0.04	0.6	0.548
	Total	0.87	23			
	SL	0.45	2	0.23		
EF	Error	6.3	21	0.3	0.75	0.484
	Total	6.75	23			
	SL	0.96	2	0.48		
FT	Error	50.62	21	2.41	0.2	0.821
	Total	51.58	23			

Table (4) Results of post hoc test

Indicative variable	SL	LS	SS
SR	NS	0.15* (normal)	0.03
	LS	-	0.18* (short)

* Illustrates the differences between the NS group and the LS group in favor of the NS group while the other difference was between the LS and SS groups in favor of the short group.

Table (5), Results of regression analysis using (Step-Wise approach)

Group	Model variables	Coefficient	Constant	F Value	Probability	variance proportion
NS	Velocity	-7.103	26.195	*33.47	0.001	82.3%
LS	Velocity	-6.374	24.753	*26.70	0.002	78.6%
SS	Efficiency Factor	-21.955	21.510	*22.16	0.003	75.1%

Table (6) Pearson correlation coefficient with the total time

Variables	SL	SR	V	EF	Time of 12.5m	Final time
SL	-	-0.517*	-0.502*	+0.861*	-0.454*	+0.534*
SR		-	+0.475*	0.018	-0.517	-0.519*
V			-	+0.869*	-0.989	-0.879*
EF				-	-0.829	-0.803*
Time of 12.5m					-	+0.896*

*Significant at (0.05), tabulated r value = 0.4227

Table (6) indicates the results of person coefficient with the total time; all the relation ships were significant except for the EF with stroke rate (0.018)

CONCLUSION: It was concluded that the NR group recorded best time for 12.5m crawl with the effective combined variables (SR, SL, and V). The most important factor that affects final time in the groups is the efficiency factor. In addition, if the Youth National Jordanian swim team were to change the SL, they would have to strengthen the upper extremity in order to increase the EF and change their techniques by increasing the SL without losing average speed. The NS group was the optimum although it may increase the EF if they adopt longer SL and adapt their techniques for the new changes in the training sessions.

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