APLICATION OF REGRESSION EQUATIONS IN THE ANALYSIS OF 50 AND 100 M SWIMMING RACES OF 1992 OLYMPIC GAMES

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INTRODUCTION

The objective of swimmers in swimming competitions is to cover the race distance in the least time possible. This race time can be divided into four parts: the time spent starting (ST), the time spent stroking, the time spent turning and the time spent finishing (FT) (Pai, Hay, & Wilson, 1984). The time spent stroking is governed by the distance covered while stroking and by the average speed (MS). The turning time is composed by the turn-in time (Tin) plus the turn-out time (Tout).

Swimming training has to be oriented to improve all the race components but the lack of a specific model made it difficult to know which are the best and weakest race component of any individual. Absaliamov and Timakovoy (1990) published the regression analysis of the race components obtained from the participants in the 1980-Moscow Olympic Games. The western contries boycot and the time which has passed since then reduces the current aplication of these data.

Our research aim was to find the regression equations between each variable described and the race time using the large international sample of participants in the Barcelona Olympic Games.

METHODS

The data was collected from the 1992 Barcelona Olympic Games 50 and 100 m swimming events. All the participants (male and female) were analyzed in their best race.

TABLA 1
Means of event times and age of swimmers analyzed

Event	Male n	Time (s)	Age (years)	Female n	Time (s)	Age (years)
50 Freestyle	72	24,30	22,6	44	27,05	20,1
100 Freestyle	75	52,97	22,0	48	58,23	19,9
Backstroke	53	58,22	21,3	45	64,61	19,2
Breaststroke	58	65,57	22,1	42	73,39	19,0
Butterfly	61	56,24	21,9	48	63,07	20,1

Three S-VHS (60 Hz) cameras were located above the top row of permanent spectator seats. One covered the start and finish time, another the middle of the race and the last recorded the turning phases in 100 m events or start in 50 m events.

The start time was measured from when the starting flash was activated by the starting pistol until the head crossed a interpolated 10 m line. Turn-in time was measured from when the swimmer's head crossed the 42.5 m line until first contact to the turning wall. The turn-out time was measured from the first contact with the turning wall until the swimmer's head crossed the 57.5 m line. Finish time was

measured from when the swimmer's head crossed the 40 m line (in 50 m events) or the 90 m line (in 100 events) until the first contact with the finish wall. The mean speed was calculated by taking the average of the swimming speed of the first and second lap (32.5 m and 32.5 m).

Correlations coeficients and simple linear prediction equations were calculated for all events, being the results of A (slope) and B (y-intercep) shown in a table in the results part. The type of equations obtained were:

Race Component = (A · Race Time) + B

For example: in 50 m freestyle if a swimmer wants to make 23 s the calculated race component will be:

Start Time = (0,177 * 23 s) + (0,492) ---> ST = 3,58 s
Mean Speed = (-0,071*23 s) + 3,728 ---> MS = 2,09 m/s
Finish Time = (0,231*23 s) + (-0,268) ---> FT = 5,04 s

RESULTS

All the correlation coeficients and the slope and y-intercep are shown in the Table 2 for 50 and 100 male and female events.

TABLE 2
Slope (A), Y-intercep (B) and coeficients of correlation between race time and race components

		Male				Female			
Var.	Stroke	A	B	r	p	A	B	r	p
ST	50 Fr	0,177	-0,492	0,93	**	0,203	-1,055	0,90	**
MS	50 Fr	-0,071	3,728	-0,99	**	-0,067	3,618	-0,97	**
FT	50 Fr	0,231	-0,268	0,96	**	0,194	0,693	0,83	**
ST	100 Fr	0,093	-0,870	0,91	**	0,054	1,266	0,62	**
MS	100 Fr	-0,029	3,391	-0,96	**	-0,029	3,363	-0,98	**
Tin	100 Fr	0,068	0,648	0,93	**	0,069	0,694	0,90	**
Tout	100 Fr	0,084	-1,119	0,91	**	0,086	-1,181	0,71	**
FT	100 Fr	0,145	-1,877	0,70	**	0,089	1,012	0,77	**
ST	Back	0,111	-1,741	0,80	**	0,078	0,500	0,70	**
MS	Back	-0,025	3,142	-0,98	**	-0,023	2,992	-0,98	**
Tin	Back	0,080	0,102	0,91	**	0,059	1,374	0,76	**
Tout	Back	0,085	-1,429	0,84	**	0,045	1,043	0,63	**
FT	Back	0,104	0,292	0,86	**	0,168	-3,783	0,88	**
ST	Breast	0,070	-0,526	0,75	**	0,072	-0,030	0,81	**
MS	Breast	-0,021	2,802	-0,98	**	-0,016	2,490	-0,97	**
Tin	Breast	0,079	-0,318	0,94	**	0,081	-0,543	0,94	**
Tout	Breast	0,065	0,265	0,67	**	0,069	0,200	0,82	**
FT	Breast	0,096	0,819	0,84	**	0,122	-0,868	0,75	**
ST	Butt	0,073	-0,063	0,67	**	0,076	0,039	0,74	**
MS	Butt	-0,029	3,393	-0,98	**	-0,023	2,988	-0,99	**
Tin	Butt	0,078	-0,212	0,86	**	0,075	-0,046	0,85	**
Tout	Butt	0,091	-0,926	0,82	**	0,073	0,197	0,80	**
FT	Butt	0,099	0,673	0,71	**	0,153	-2,603	0,81	**

** $p<0,01$

Using fixed distances to obtain the race components resulted in high correlation values, in most cases, with the race time. This result was drastically different than (Chow, Hay, Wilson, & Imel, 1984) they analyzed the turns in the 1982 British Commonwealth Games but using a different approach, calculating the turn-in and turn-out times from the distances to cover-in or covered-out individually for each swimmer in each turn, this different method has as a result very low correlation values between turn-in, turn-out total turn and the race time.

Our coefficients in comparison with (Absaliamov & Timakovoy, 1990) showed a decrease of the time utilized by the swimmers in the starts and turns in 100 m events. We also included coefficients for turn-in and turn-out (they did for total turn only) and finish time (not included by them).

CONCLUSION

The quality and large number of swimmers analyzed plus the high values of coefficients of correlation obtained between variables, in most cases, enabled us to calculate the recommended times in each phase in relation to the race time, so allowing the swimmers to train specifically in their weakest race component or to plan the next season more specifically knowing not only the race target time but also all the target race components.

REFERENCES

Absaliamov, & Timakovoy (1990). Aseguramiento Científico de la Competición (A.I. Zvonarev, Trans.). (1 ed.). Moscú: Vneshtorgizdat.

Chow, W.-C., Hay, J. G., Wilson, B. D., & Imel, C. (1984). Turning techniques of elite swimmers. Journal of Sports Science(2), 241-255.

Pai, Y.-C., Hay, J. G., & Wilson, B. D. (1984). Stroking Techniques of Elite Swimmers. Journal of Sports Sciences(2), 225-239.