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ANALYSIS OF 100 m FREESTYLE SWIMMING AT THE OLYMPIC GAMES IN 1992 – 2008. YEAR

Summary

In every athlete's career, Olympic Games are the most important competition. Almost every race in the world's biggest competition is analyzed in detail, and the results are used to improve achievements in sports, and in swimming as well. 100m freestyle swimming was one of the most exciting disciplines which attracted a lot of attention, not only with competitors but with spectators too. During the research and application of relevant statistical analysis (measures of central tendency, regression analysis and other procedures) the correlation with certain parameters of competition results and progress over time was determined.

Keywords: competition swimming, Olympics, regression analysis

INTRODUCTION

The Olympic Games are the greatest sports spectacle, especially those in Beijing, where they had been held in 2008. In addition to the largest number of participants from most countries so far, Serbia also took part (after 96 years of performing under that name).

We can find a lot of answers to the question: Why is it so?

- One of those answers is: precisely defined goal i.e. sports performance.
- Besides, modern sport has become a business and it represents the opportunity to promote every state and all athletes.
- Swimming is the mass sport in the Olympics besides athletics (sometimes over 1,000 competitors).
- All of them (as all other athletes) have a common goal:
- They give their best to achieve the best results and placements in their own sporting career.

Besides World Championship, the Olympic Games are of the highest quality and represent the maximum of a competition for a single Olympics (four-year), so winning an Olympic medal is dream of every top athlete, but for many only participation in the Olympic Games represents great success. Unfortunately, in practice, not every athlete succeeds, because excellent results are difficult to achieve and depend on many factors, such as:

- individual and functional capabilities,
- the overall conditions for the optimal preparation throughout the season (buildings and appliances) and continuous training;
- educated and skilled professional staff;
- controlled and optimal nutrition,
- and allowed funds for recovery medical and psychological treatments in continuity,
- way of athlete's life,
- financing the swimming athletes and the results achieved,
- desire to succeed and the will in demanding training process and,

- engagement of members and other relevant institutions during the competition period.

Only a small number of elite top swimmers manages to qualify for the semifinals and finals because the competition is numerous and getting more and more difficult and also because results are continually improving. It is evident that apart from great swimming schools, three have distinguished themselves: American, Australian and European school. Each school carries some specific qualities but in the end they all have the same aim of achieving better results in competitions. Qualifying for the Olympics is a great success and represents special honor for athletes. Trust, which athletes earn by passing the qualification and election contests, gives them special value (especially if it is about a multiple Olympic athlete). Olympians have a special status in sports and society. Their successful results and medals remain evident, and they often become idols for young athletes.

In most countries swimming is main sport that is very important for:

- proper development of children,
- maintaining the health of the population,
- recreation of citizens,
- forming a balanced and complete personality.

METHODS

Problem of the topic

Problem of this topic stands for an identification and analysis of the parameters that are present in each race, as well as the comparison of the variables at the last five Olympic competitions.

The aim of the topic

The main objective of this paper is an analysis of the competitive parameters in 100 m freestyle swimming during the above mentioned period.

Competitive swimmer analysis

In the last 15 years, the competitive analysis became regular analytical procedure at every major event. The purpose of competition analysis is to show the coach and the swimmer clear and detailed content of each race in the competition. It shows parts of swimming and parameters at which some swimmers are better than others. The purpose of this analysis is:

- comparing progressively competitive swimmer models after the researches,
- identifying (through analysis of parameters at every stage of swimming) and improving deficiencies in the competition performance (by applying technique, its elements, and tactics during the competition),
- comparison between the parameters of the swimmers in the race, swimming competitions and athletes, who compete in different competitions at different times,
- providing a coach with an information that helps him choose the best strategy for swimmer to win, for example, eliminating the disadvantages in the competition through training. During exercise the optimal ratio of the length and frequency of stroke in certain parts of the race can be determined.

Variable samples

Sample selection of measuring instruments (Dr. Rein Hyland default) that are used for regular analysis of European and world competitions is consisted of:

1.	The total swimming speed, m / s	UBP
2.	Clean swimming speed, m / s	BCPL
3.	Start reaction time, sec	VRKC
4.	Start time, sec	VRST
5.	Clean swimming time, sec	VČPL
6.	50 m passing time	VP50
7.	Stroke frequency, no / min	FMIN
8.	Stroke length, m	DUZZ
9.	Efficiency index	INEF
10.	Time of turning	VROK
11.	Finish time	VFIN
12.	Final result, sec	KREZ

In addition to this set of variables, we have more variables that are exclusive representatives of the longitudinal dimension of the volume and weight:

Body height, cm	AVIS
Body weight, kg	ATEZ
Age, year	UZRS

METHOD OF RESEARCH

The sample of respondents

The sample of respondents included 80 top swimmers that participated in the 100 m freestyle discipline, participants of swimming competitions in the last five Olympics between 1992-2008. and at least 16 participants of each Olympics.

Sample of variables

Sample of variables will consist of parameters of tested swimming disciplines, 13 competitive, 2 morphological and swimmers' age.

Programme and measurement procedure

Measurements and recording the results of the studied parameters of competitive analysis were made using the methodology established by Dr. Rein Hyland from Talilsky University of Estonia. He has established and refined a system for video recording and registering these competing parameters for each participant in each race. This methodology was modified and adapted for Australian conditions by Bruce Masonand and Jim Fowil at the Australian Institute of Sport in Canberra. This methodology claims that in every race results of above mentioned parameters are automatically and electronically recorded for each participant. Maximum reliability of this information is simply imposed as necessary for race analysis at all European, World and Olympic competitions. Collecting and recording data are done with the help of eight video cameras around the pool lenght at: 7.5 m, 10 m, 15 m, 20 m, 25 m, 35 m, 40 m and 42.5 m from the starting point. The accuracy of the results in each parameter is recorded when the swimmer's head comes in a certain position, and the entire system is turned on before the race. Data for each swimmer, for all required parameters are recorded in each section of 50 m, and at the end of the recorded values for each parameter separately in relation to the number of sections (50 m).

Statistical data processing

For the needs of this research and for all displayed variables, basic descriptive data are used: range, minimum and maximum score, mean, standard deviation and coefficient of

variation.

For determining prediction criterion variables based on applied system of predictor variables linear regression analysis will be applied, and it is described by the following parameters: regression factor (B), coefficient of standard regression errors (SIGMA), the ratio of the partial effects of predictor variables on the criterion variable (BETA), testing the significance of evaluated parameters of regression (t) and the level of signification (sig.).

For determining the difference in the arithmetic means of all parameters analyzed separately, (realized at various Olympic Games in period between 1992-2008 yr.) and determining their level of significance**, analysis of variance with one factor (ANOVA)** will be applied.

RESULTS OF THE RESERCH

Table 1. Descriptive analysis of finalist in 100m freestyle swimming at the Olympic Games in the period 1992-2008

VARIABLES	N	Range	Minimum	Maximum	Mean	Std. Deviation	CV %
KREZ	80	3,60	47,05	50,65	49,21	,86	1,76
UBP	80	,15	1,97	2,12	2,02	,03	1,77
BČPL	64	,12	1,88	2,00	1,92	,02	1,27
VRCK	64	,26	,62	,88	,76	,05	7,28
VRST	64	1,19	5,44	6,63	6,01	,22	3,75
VČPL	64	2,09	32,46	34,55	33,64	,42	1,26
VP50	80	2,29	22,44	24,73	23,58	,50	2,14
FMIN	64	20,80	45,60	66,40	51,68	4,10	7,94
DUŽZ	64	,81	1,79	2,60	2,26	,17	7,93
INEF	64	1,71	3,59	5,30	4,39	,44	10,14
VROK	64	,71	6,72	7,43	7,13	,14	2,09
VFIN	64	,63	2,28	2,91	2,62	,13	5,22
AVIS	32	26,00	176,00	202,00	191,75	5,84	3,04
ATEŽ	32	29,00	71,00	100,00	84,37	6,78	8,03
UZRS	80	16,00	17,00	33,00	24,47	3,22	13,16

Table 2. Regressive analysis of swimmers in final competition at Olympic Games in 100 m freestyle discipline

Variables	Not standardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(constant)	71,440	4,544		15,722	,000
UBP	-17,783	1,038	-,724	-17,132	,000
BČPL	,056	,640	,002	,087	,931
VRST	,079	,076	,022	1,042	,302
VČPL	,245	,043	,176	5,639	,000

VP50	,080	,043	,048	1,872	,066
FMIN	,001	,005	,003	,099	,922
DUŽZ	-,128	,135	-,028	-,946	,348
INEF	,016	,030	,009	,526	,601
VROK	,367	,082	,075	4,486	,000
VFIN	,305	,091	,053	3,332	,002

Table 3. Analysis of variance of swimmers in final competition in 100 m free-style discipline at OI in the period of 1992-2008

VARIJABLE	F	Sig. (in total)	OI (I-J)	Mean Difference (I-J)	Sig.
KREZ	35,21	,000	1992-1996	,20812	,795
			1996-2000	,44813	,123
			2000-2004	,11687	,970
			2004-2008	1,23125	,000
UBP	34,13	,000	1992-1996	-,00563	,950
			1996-2000	-,02000	,086
			2000-2004	-,02437(*)	,020
			2004-2008	-,05125(*)	,000
BČPL	,700	,556	1992-1996	-,02125	,082
			1996-2000	,00938	,707
			2000-2004	-,02313(*)	,049
			2004-2008	-	-
VRCK	4,677	,005	1992-1996	-	-
			1996-2000	-,00750	,976
			2000-2004	,04313	,092
			2004-2008	,01437	,857
VRST	22,30	,000	1992-1996	,31813(*)	,000
			1996-2000	-,01125	,997
			2000-2004	,13500	,088
			2004-2008	-	-
VČPL	,564	,641	1992-1996	,43000	,071
			1996-2000	-,17687	,735
			2000-2004	,46687(*)	,043
			2004-2008	-	-
VP50	26,71	,000	1992-1996	,18125	,543
			1996-2000	,26813	,165
			2000-2004	,24500	,241
			2004-2008	,40000(*)	,010
FMIN	,837	,479	1992-1996	,16875	,998
			1996-2000	-1,27500	,524
			2000-2004	1,07313	,659
			2004-2008	-	-
DUŽZ	1,096	,358	1992-1996	-,00937	,993
			1996-2000	,05250	,447
			2000-2004	-,05812	,357
			2004-2008	-	-
INEF	11,55	,000	1992-1996	-,24125	,250
			1996-2000	,65688(*)	,000
			2000-2004	-,65438(*)	,000
			2004-2008	-	-
VROK	11,75	,000	1992-1996	,02125	,960
			1996-2000	,04063	,780

			2000-2004	,16750(*)	,001
			2004-2008	-	-
			1992-1996	,18688(*)	,000
			1996-2000	,13062(*)	,000
VFIN	46,43	,000	2000-2004	-,11562(*)	,000
			2004-2008	-	-
			1992-1996		
			1996-2000		
			2000-2004	-	-
AVIS	,128	,723	2004-2008	-	-
ATEŽ	,981	,330	1992-1996	-	-
			1996-2000	-	-
			2000-2004		
			2004-2008		
			1992-1996	,37500	,997
			1996-2000	-1,25000	,809
UZRS	,857	,494	2000-2004	-,43750	,995
			2004-2008	,12500	1,000

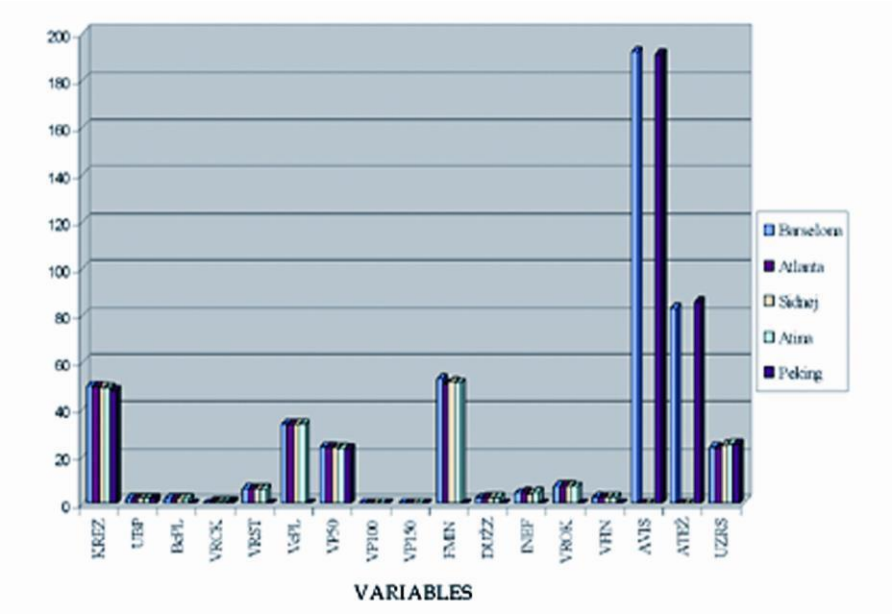
DISCUSSION

Disciplines of freestyle technique are the most mass and the most attractive among the other ones at the swimming competitions. The most successful swimmer in this discipline at 90s was the Russian swimmer Aleksander Popov, later on "The Flying Dutchman" Pieter van den Hoogenband took the champion throne. In recent years, French swimmers are the best in sprint.

Table 1. represents the relationship between the basic descriptive statistical parameters of the variables (studied at the total sample of male finalists enrolled in OI in 100m freestyle discipline), standard deviation (SD) and coefficient of variation (CV%). High level of homogeneity of these parameters can be determined from that relatioship. (Figure 1) The biggest discrepancy in the total analyzed period can be seen in the following variables: reaction time at the start (VRCK), start time (VRST), the frequency of strokes per minute (FMIN), stroke length (DUZZ) the time of the turn performing (VOKR) finish time (VFIN), lap time at 50m (VP50), swimming efficiency (INEF) and age (UZRS). Among the morphological variables applied, the largest dispersion is seen at: anthropometric height (AVIS) and anthropometric weight (ATEZ).

The different tactical plans are noted in the planning of the race which is reflected in the diversity of parameters VRST, VP50, VOKR and VFIN.

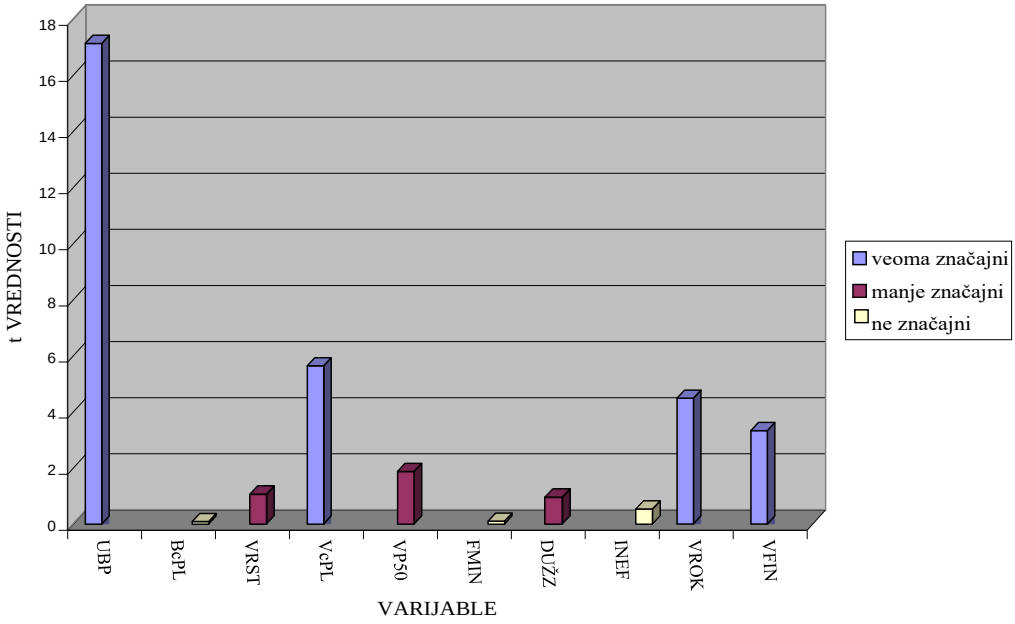
Figure 1. Descriptive analysis of finalist in 100 m freestyle swimming



By the analysis of regression on the total sample of respondents in 100 m freestyle, the parameters that most influence the final result of the race are separated: (Figure 2), and these ones are: the overall swimming speed (UBP), time of swimming (VCPL), swing time (VROK) and time of final swimming. (VFIN) Parameters that significantly less influence the result are: start time (VRST), lap time at 50 m (VP50) and the length of stroke (DUZZ). Variables that affect alternatively the result are: swimming speed (BCPL), stroke frequency (FMIN) and swimming efficiency (INEF).

After examining the regressive analysis of 100 m freestyle discipline, we conclude that for achieving better results is important significantly higher swimming speeds and shorter time needed to finish and turn. that less significantly affect swimmers results in 100 m freestyle are: Start improving speed up to 15 m and the first 50 passages and maintain of a constant length of stroke.

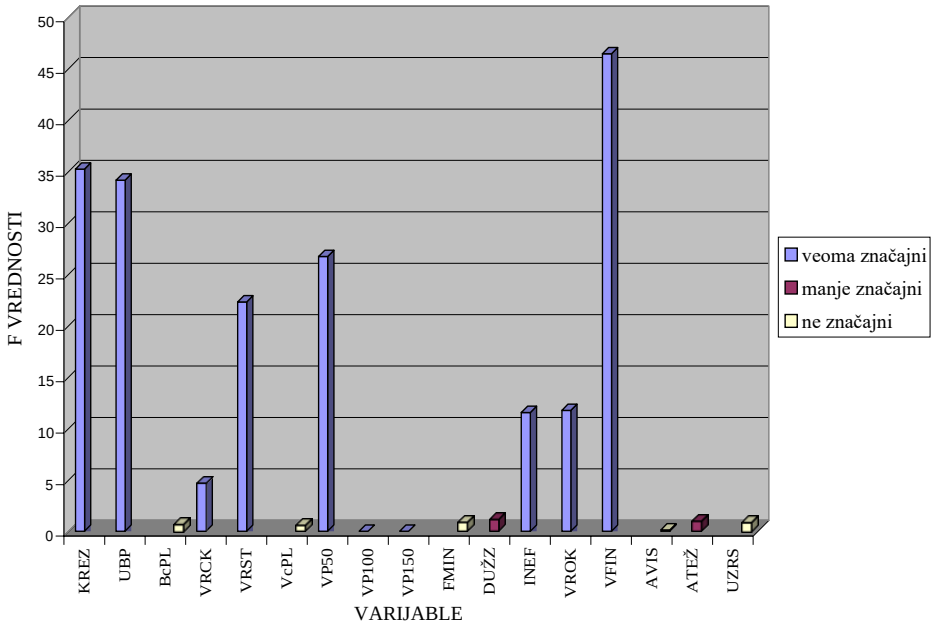
Figure 2. Regression analysis of finalist in 100m freestyle swimming



Analysis of variance 100 m freestyle discipline at OI in the period of 1992 – 2008 (Figure 3) we have determined that some parameters are changed throughout period analysed: final result – KREZ (mostly in period 1992 - 2008), total swimming speed – UBP (mostly in the periods 2004 - 2004 and 2004 - 2008), start time – VRST (mostly in the periods 1992-1996),a lap time on the 50m – VP50 (mostly in the periods 2004-2008), swimming efficiency - INEF (mostly in periods 1996 - 2000 and 2000 - 2004) time of turn performing - VOKR (mostly in periods 2000 - 2004) and finish time – VFIN (durinf the first three OI). This analysis leads to the conclusion that the 100m freestyle discipline advanced the most throughout the analyzed period in speed parametres – UBP, VRST and VP50, in a better performance of the technical elements (VOKR) and in better resistance of the fatigue in finish of the race (VFIN). Parameters which were less changed throughout the time are: the length of the stroke (DUZZ) and anthropometrical geight (ATEZ). These parameters show that the freestyle technique has been mostly changed in increasing of the stroke length and with that, the efficiency of swimming has been improved. Since the speed is associated with the power and with the amount of muscle tissue, constitution of the freestyle swimmer has been changed throughout the time.

Parameters of swimming speed (BCPL), stroke frequency (FMIN), antropometric height (AVIS) and age (UZRS) have not been significantly changed during the analyzed period.

Figure 3. Analysis of variance 100 m freestyle discipline at the OI in the period 1992-2008



CONCLUSION

The Olympic Games represent the best achievement in the career of one athlete. Because of the complex competition in the 100 m freestyle discipline, result depends on a number of details that determine who will advance to the finals and who will win the medal. Competitive analysis certainly helps us to view and analyze the swimming parameters in the race. Such an analysis is an ideal opportunity for the correction of errors and suggestion on

how to repair the defects. It also contributes to the quality improvement of **competitive strategy**.

Competitive strategy,or as it is also called, tactical preparation for a performance,has been developing and improving in the process of trainning. During that process, both the coaches and the swimmers have the opportunity to choose the more effective preparation for participation in competition. In 100m freestyle swimming discipline, result was significantly influenced by the overall speed and the time of swimming, as well it was influenced with the good quality of turn during swimming and crossing the finish line. The result in this discipline has been improved throughout the time and the progress in technical and teshnolgical parameters is obvious. Sport has become increasingly scientific and because of that, stationary technology and results will be improved in future.

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