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Differences in decreasing of swimming pace in elite swimmers in the 100 meter backstroke discipline

Isidora Trboljevac[1], Stefan Mijalković[1], Marko Đurović[1]

[1]Faculty of sport and physical education, University of Niš, Serbia

Abstract

The aim of this research was to determine the differences in swimming pace between the finalists and semi-finalists of the 2019 World Championships in the discipline of 100 m backstroke held in the South Korean city of Kwangju in 2019. The research was carried out on 16 swimmers (8 finalists and 8 semi-finalists), using 8 variables for evaluating swimming pace. Differences between groups were determined using the Student's T-test of independent samples. No statistically significant differences in swimming pace were found between the finalists and semi-finalists of the World Championships, but there was a statistically significant difference in passing times in favor of the finalists. The finalists were faster in the first and second passing times than the semi-finalists, while their pace drop is numerically smaller compared to the semi-finalists, but not statistically significant.

Keywords: *pace, backstroke, elite swimmers*

Introduction

Backstroke is the only competitive swimming technique where the swimmer starts in the water and it is similar to the crawl technique only in terms of certain technical characteristics. (Cornett 2011; Marković 2021). Swimmers, especially younger ones, often make and repeat identical mistakes due to the specific position of the body (on the back), starts, turns and strokes (Marković 2021; Okičić et al., 2007). Over time, the technique was upgraded and improved, acquiring today's characteristics that professional swimmers constantly supplement, adjust and modify, with the aim to make it more effective (Marković 2021). The pace of top swimmers can also be explained by physiological aspects. A swimming pace profile is usually characterized by measuring split times or speeds at each turn. The allocated times from the competition are easily accessible on the Internet through online results that allow insight into the elapsed time as well as the final result achieved by the swimmer at the turn and the finish of the race (Abbiss, Laursen & Describing, 2008).

It has been shown that shorter start and turn times have the greatest impact on swimming results (Veiga & Roig 2017; Šiljeg, Leko, & Mikulić, 2011). Also, Šiljeg, Leko, & Mikulić, (2011) suggest that there are smaller changes in the pace of the backstroke in the second section in older swimmers compared to younger ones. With regards toswimming pace, it can be established that females in younger age categories achieve higher speed in the discipline of 100 m backstroke (Kollarz, Knechtle, Rüst, Rosemann & Lepers, 2013), while Unterweger, Knechtle, Nikolaidis, Rosemann & Rust, (2016) concluded that changes in swimming pace exist in all age categories regardless of gender. Namely, Vasic, Djurovic, Madic, & Okicic, (2021) concluded that there was no statistically significant difference in split time between finalists and semi-finalists, but swimmers with better abilities were more dominant in the second part of the race.

Considering the fact that few studies have investigated the problem of decreasing in swimming pace in the discipline of 100 m backstroke, we aimed to test the differences in decreasing of swimming pace between finalists and semi-finalists of the World championship 2019 in the 100 m backstroke discipline.

Method

Sample of respondents

The sample of respondents consisted of 16 swimmers, 8 finalists and 8 semi-finalists, of the World Swimming Championship held in the South Korean city of Gwangju in 2019. All respondents swam the 100 m backstroke race and were ranked in the semi-final and final groups based on their swimming times. The average

Correspondence:

Montenegro Sport

S. Mijalković
University of Niš, Faculty of Sport and Physical Education, Čarnojevića 10A, 18000 Niš, Serbia
Email: stefimijalkovic@gmail.com

chronological age of the semi-finalists was 22±2.51 years, and the finalists' average chronological age was 26.13±5.17 years. The total swimming time of the semi-finalists was 53.82±0.23, and the finalists' total swimming time was 52.98±0.39.

Procedures

The World Swimming Championship in a 50 m pool was held in 2019 in South Korea. All results are taken from the official website (http://www.fina.org/event/18th-fina-world-championships/results-1).

The following variables were used to evaluate the scores in swimming: time of the first 50 m finalists in the 100m backstroke discipline (Pace1_finalist (s)), time of the second 50 m finalists in the 100 m backstroke discipline (Pace2_finalist (s)), the difference between the second and first times of the 50 m finalist in the 100m backstroke discipline (Dropoff_finalist (s)), total time of the finalists in the 100 m backstroke discipline (T100_finalist (s)), time of the first 50m semi-finalists in the 100 m backstroke discipline (Pace1_semifinalist (s)), time of the second 50 m semi-finalists in the 100 m backstroke discipline (Pace2_semifinalist (s)), the difference between the second and first times of the 50m semi-finalists in the 100m backstroke discipline (Dropoff_semifinalist (s)), total time of the semi-finalists in the 100m backstroke discipline (T100_semifinalist (s)).

Dropoff_finalist = Pace2_finalist – Pace1_finalist

Dropoff_semifinalist = Pace2_semifinalist – Pace1_semifinalist

The 100 m backstroke swimming race consisted of two 50 m sections connected by a somersault turn. Timing was electronic (Omega timing) at the World Championships and all passing times were recorded in the official results. The final score and passing times were taken from the official results.

Statistical data processing

All data obtained in this study were processed with the statistical program IBM SPSS Statistics 20. First, descriptive statistics of the variables were presented. The Kolmogorov-Smirnov test was used to examine the normality of the distribution, while the Student's T-test of independent samples was used to determine statistically significant differences in decreasing of swimming pace between finalists and semi-finalists in 2019 at the 100 m backstroke World Championship (Malacko & Popović, 2001).

Results

Table 1 presents the descriptive statistics and the differences in decreasing swimming pace in the 100 m backstroke of semi-finalist and finalist of the 2019 World Swimming Championship. Finalists' mean age was 26.13±5.17, while semi-finalists' mean age was 22.00±2.51.

Table 1. Descriptive statistics and Student's T-test results of monitored variables.

Variables	Mean	Std. Dev.	Min.	Max.	CV	T-test	
						t	p
Pace1_finalist	25.64	0.34	25.01	26.06	1.3%	5.534	0.034*
Pace1_semifinalist	26.02	0.31	25.43	26.25	1.2%		
Pace2_finalist	27.34	0.30	26.87	27.89	1.1%	9.978	0.007*
Pace2_semifinalist	27.80	0.28	27.47	28.28	1.0%		
T100_finalist	52.98	0.39	52.44	53.44	0.7%	27.098	<0.001*
T100_semifinalist	53.82	0.23	53.56	54.20	0.4%		
Dropoff_finalist	1.69	0.50	1.30	2.55	29.5%	0.090	0.768
Dropoff_semifinalist	1.77	0.55	1.23	2.85	31.0%		

Legend: * - statistical significance ($p < 0.05$); Pace1_finalist - time of the first 50 m finalists in the 100 m backstroke discipline; Pace1_semifinalist - time of the first 50 m semi-finalists in the 100 m backstroke discipline; Pace2_finalist - time of the second 50 m finalists in the 100 m backstroke discipline; Pace2_semifinalist - time of the second 50 m semi-finalists in the 100 m backstroke discipline; T100_finalist - total time of the finalists in the 100 m backstroke discipline; T100_semifinalist - total time of the semi-finalists in the 100m backstroke discipline; Dropoff_finalist - the difference between the second and first times of the 50 m finalists in the 100m backstroke discipline; Dropoff_semifinalist - the difference between the second and first times of the 50 m semi-finalists in the 100m backstroke discipline.

Results from Table 1 show that there was a statistically significant difference between finalists and semi-finalists in the first passing time (Pace1_finalist vs. Pace1_semifinalist: t = 5.534; p=0.034), second passing time (Pace2_finalist vs. Pace2_semifinalist: t= 9.978; p= 0.007) as well as in total time (T100_finalist vs. T100_semifinalist: t= 27.098; p=0.000, while there were no statistically significant differences between the finalists and semi-finalists between the second and first times in the 50 m in the 100 m backstroke (Dropoff_finalist vs. Dropoff_semifinalist: t= 0.090; p= 0.768).

Discussion

The aim of this study was to determine the differences in decreasing of swimming pace between finalists and semi-finalists of the World championship 2019 in the 100 m backstroke discipline. According to the results of our study, there was no statistically significant difference in swimming pace between finalists and semifinalists in the 100 m backstroke discipline. However, a statistically significant difference in favor of the finalists in passing times was observed. Consequently, finalists achieved a better time than the semi-finalists in the following variables: the difference between the second and first time in the 50 m in the 100 m backstroke, the time in the first 50 m in the 100 m backstroke and the time in the second 50 m in the 100 m backstroke. Also, it was observed that within the race itself, both finalists and semi-finalists had a better passing time in the first 50 m compared to the second one. Studies with similar objectives are scarce (Kollarz, et al., 2013; Unterweger, et al., 2016).

However, Cuenca-Fernández, et al., (2021) investigated differences in swimming parameters (swimming pace, stroke patterns and muscle power) between swimmers who participated in different races. They established that an ultra-short race-pace training (20x50 m) protocol in swimmers leads to replication of competitive swimming pace, less fatigue and faster recovery. On the other hand, the race-pace training (10x100 m) protocol in swimmers led to deterioration of stroke pattern, muscle power and swimming pace. Moreover, since it was observed in this study that the finalists had a better competative swimming pace than the semi-finalists. Ultra-short race-pace training can be recommended as a method of improving swimming pace for semi-finalists to progress in this integral part of the swim. The analysis of previous studies on the pace of backstroke showed smaller oscillations in the second half of the section in older swimmers compared to younger ones (Šiljeg, Leko, & Mikulić, 2011), and it was suggested that the score in swimming depended mostly on a shorter start and turn time. Veiga & Roig (2017) also achieved similar results.

Furthermore, previous study has found that hand coordination could be one of the key characteristics for increasing swimming speed. The Index of Coordination (IdC) (Chollet, Seifert, & Carter, 2008) quantifies the continuity of arm propulsive action. It was found that this index plays an important role in the analysis of an athlete's adaptation to different swimming distances (Schnitzler, Seifert, & Chollet, 2009), but also that they have a limited range of variation in backstroke (Seifert & Chollet 2009). It was observed that increasing speed and pace in elite swimmers leads to an increase in stroke rate, IdC and relative duration of the arm pull, and to a decrease in stroke distance (Chollet, Seifert, & Carter, 2008). Also, an increase in speed leads to a decrease in the time gaps that defines the beginning and end of the stroke phases, which leads to an increase in the continuity between the propulsive phases and to a decrease in the glide time (Seifert & Chollet 2009). Due to the above, it can be suggested that arm coordination during backstroke has a role in decreasing the swimming pace. Specifically, coordination has been shown to play a smaller role in backstroke than in crawl swimmers due to the limited shoulder flexibility, the alternating body-roll and a lag time with the hand at the thigh at the end of the push phase (Seifert & Chollet 2009).Dias (2022) reported that the duration of the pulling and pushing phases, swimming speed and stroke frequency, and trunk twisting on the undesirable side and elbow angle on the desirable side were significantly higher at the maximum pace of backstroke. Entry and exit phase duration, normalized stroke length, and hip roll were greater at submaximal backstroke pace, with no changes for shoulder rotation or other elbow joint angle variables (Dias, 2022). Faster swimmers had greater shoulder rotation and total shoulder rotation at maximal pace, while slower swimmers had greater maximal elbow angle at submaximal pace (Dias, 2022). Swimmers with higher hand velocity on the non-preferred side showed greater shoulder rotation (Dias, 2022). Therefore, to achieve higher swimming speed, swimmers should prolong the push phase and reduce elbow extension at the end of the push phase. Furthermore, slower swimmers had greater maximal elbow angle at submaximal pace, whereas faster swimmers exhibited greater shoulder roll and total shoulder roll at maximal pace. Therefore, it can be concluded that the appropriate swimming technique plays a role in the decrease of the swimming pace. In our study, it was observed that there was no statistically significant difference in the decreasing of swimming pace between finalists and semi-finalists. It is assumed that these results were obtained because the respondents were elite swimmers. However, it was established that the finalists were faster than the semi-finalists.

Conclusion

Based on the obtained study results, it could be concluded that there were no statistically significant differences in the swimming pace between the finalists and semi-finalists of the 2019 World Championships in the 100 m backstroke discipline. However, there was a statistically significant difference in passing times in favor of the finalists. It was observed that there were statistically significant differences between the semi-finalists and finalists in the variables: the time in the first 50m in the 100m backstroke, the time in the second 50 m in the 100 m backstroke and the difference between the second and first time in the 50 m in the 100 m backstroke. All observed statistically significant differences were in favor of the finalists. Furthermore, the finalists were faster in the first and second passing times than the semi-finalists. The result of the study was to complete the theoretical knowledge of swimmers and swimming coaches about the pace in backstroke swimming and it could be useful in training programs because it indicates that swimmers achieved faster times in the first 50 m of the race. Therefore, swimming coaches are advised to improve the second 50m pace of their swimmers in the 100 m backstroke.

Limitations

It is desirable to have a larger sample of respondents. In this way, future research which will analyze differences in decreasing of swimming pace will provide results that can be generalized.

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Conflict of interest
The authors declare that there is no conflict of interest.

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