EFFECTS OF A THREE-MONTH PROGRAM ON SWIMMING SPEED USING THE BREASTSTROKE TECHNIQUE

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ABSTRACT: The main goal of the research is to determine the effects of the three-month program on breaststroke swimming speed. Swimming offers a variety of physical benefits for most people. For example, it strengthens large muscle groups throughout the body, including the heart. Swimming on a regular basis reduces the risk of cardiovascular diseases, diabetes, and cancer. It is widely known that swimming is a great way to positively improve mood in men and women; it can be used to reduce anxiety and depression as well. Swimming is an activity that requires the body to be in a lying, horizontal position, which relieves the spine of stress. Water provides up to 14% more resistance, which prevents making sudden movements, which ultimately leads to a reduction in injuries, and at the same time encourages strength building. All movements are efficient during swimming, and they evenly place stress on the body to improve strength and muscle building. The sample consisted of males, aged 10-12 years, of the Association of Sports and Health "Sportivo" Sarajevo. The sample of respondents for this research was represented by 44 swimmers, clinically and psychologically healthy and without significant morphological and locomotor impairments. The research was conducted at the regular training sessions of the Sports and Health Association "Sportivo" Sarajevo at the Otoka Olympic Pool, Sarajevo. The choice of variables for this research was made based on their measurement characteristics: validity, reliability, sensitivity, economy and adaptability, and appropriateness to the age of the respondents. To evaluate the speed parameters of breaststroke swimming: Swimming speed at 25m breaststroke technique – BPPT25, Swimming speed at 50m breaststroke technique - BPPT50, and Swimming speed at 100m breaststroke technique – BPPT100. It is worth noting that boys at this age consider the breaststroke technique to be a female technique, and therefore the swimming is much slower as they could not prove their superiority and competitiveness, so they did not give their best performance during the implementation of the program. In this case, the professional should include the psychological preparation of the swimmers in order to get a more efficient result in the program. The results showed that the content of the program had a positive effect on the set variables, but also showed its shortcomings, which should be included in the next project.

Keywords: *Swimming, breaststroke, effects*

INTRODUCION

Not knowing how to swim and not having a swimming pool is not, and must not be an excuse or a "sports" and local problem, instead, it is a global problem, a problem of health, hygiene, safety, education, and culture (Gošnik, J. and Sedar, M. 2010). Swimming is an important factor in the formation of posture and the formation of healthy habits in children. When talking about sports or competitive swimming, it can be said that swimming belongs to the series of cyclical sports in which, according to the form and method of execution, relatively simple movements dominate, which are always the same and are repeated alternately during swimming of a certain technique (Madić, Okičić & Aleksandrović, 2007). Swimming offers a variety of physical benefits for most people. For example, it strengthens large muscle groups throughout the body, including the heart. Swimming on a regular basis reduces the risk of cardiovascular diseases, diabetes, and cancer. It is widely known that swimming is a great way to positively improve mood in men and women; it can be used to reduce anxiety and depression as well. Swimming is an activity that requires the body to be in a lying, horizontal position, which relieves the spine of stress. Water provides up to 14% more resistance, which prevents making sudden movements, which ultimately leads to a reduction in injuries, and at the same time encourages strength building. All movements are efficient during swimming, and they evenly place stress on the body to improve strength and muscle building. As for aerobic and anaerobic respiration, research has shown that middle-aged men and women improve aerobic and anaerobic respiration by swimming, and it increased by 10% in a period of 12 weeks. The amount of blood pumped by the heart also increased, by 18%. Swimming is an optimal sport for children with asthma, which is supported by the fact that children with asthma won five gold medals in Swimming at the Olympics (1956-1972) (Trivun, M., Tošić, J. and Marković, V. 2013). It should be emphasized that swimming burns a large number of calories, from 500 to 650, depending on the intensity of swimming. In addition to strengthening the pectoral muscles, one hour of breaststroke swimming can burn up to 750 calories, 30 minutes of front crawl burns around 350 calories, one hour of butterfly (dolphin) burns around 800 calories, while backstroke burns around 500 calories per hour (Trivun, M., et al. 2013). Swimming has great and irreplaceable importance in the development of a child, which is manifested in the morphological, functional, psychological, biomotor, and intellectual development of young children (Tošić, S. 2010). Wolfrum, M., Rust, C.A., Rosemann, T., Lepers, R., and Knechtle, B. (2014). This research aimed to analyze potential changes in the performance of elite breaststroke swimmers who compete at the national and international levels and to compare it with the performance of freestyle swimming. Swimming speed

in both cases significantly improved (p <0.0001-0.025) over time for both genders, except for the 50m breaststroke for FINA men. Gender differences in swimming speed increased significantly over time for Swiss freestyle swimmers (p <0.0001) but not for FINA freestyle swimmers, while the gender difference remained stable in Swiss and FINA breaststroke swimmers. Gender differences in swimming speed significantly decreased (p <0.0001) with increasing race length. The main goal of the research is to determine the effects of the three-month program on breaststroke swimming speed.

RESEARCH METHODS

A sample of respondents

The sample consisted of males, aged 10-12 years, of the Association of Sports and Health "Sportivo" Sarajevo. The sample of respondents for this research was represented by 44 swimmers, clinically and psychologically healthy and without significant morphological and locomotor impairments. The research was conducted at the regular training sessions of the Sports and Health Association "Sportivo" Sarajevo at the Otoka Olympic Pool, Sarajevo.

Sample variables

The choice of variables for this research was made based on their measurement characteristics: validity, reliability, sensitivity, economy and adaptability, and appropriateness to the age of the respondents according to Mirvić, E., (2011). To evaluate the speed parameters of breaststroke swimming: Swimming speed at 25m breaststroke technique – BPPT25, Swimming speed at 50m breaststroke technique - BPPT50, and Swimming speed at 100m breaststroke technique – BPPT100.

Process

To ensure the regularity of this research, consents from the following institutions and individuals were used during the planning stages of the process: Assistance from experts in the field of sports and physical education (verified trainers) in the realization of the project; The decision of the Sports and Health Association "Sportivo" Sarajevo that this project can be tested and implemented as part of the regular training of the club of the same name; Approval and confirmation that testing was done at the Otoka Olympic Pool, Sarajevo; All subjects had the same conditions during measurement and testing (the entire research was carried out in the morning hours, between 8 to 9:30 a.m., the temperature was between 24 to 26 degrees Celsius, the place of testing was the Otoka Olympic pool, Sarajevo; equipped with all necessary equipment); Before the measurement and testing process, the swimmers of the Sports and Health Association "Sportivo" were briefed in and the project was explained in an acceptable way of what awaits them during the period of the research implementation, and what is required of them in their work; The measurement was performed in 4 groups of 11 swimmers; A Measurer and Recorder worked at each measuring point; The team of measurers consisted of professors/masters of sports and physical education and coaches of swimming clubs who were familiar with the research project, measurement lists and how to fill them in; The swimmers of the Sports and Health Association "Sportivo" were divided into four groups, each group implemented a program with a different order of sports technique training for a period of 3 months. Initial testing will be done, then a three-month program will be implemented, and lastly, final testing will be done.

Data processing methods

In the process of data processing, based on the characteristics and size of the sample, the subject, the problem, and the goal of the research, statistical methods were determined for obtaining results in the research. Using descriptive statistical methods from the SPSS 12.0 program, we will determine the basic parameters that characterize the sample: Min., minimum value, Max., maximum value, Range, Sum., summary, Median, median, Mean, arithmetic mean, Std. Dev., standard deviation, Error, standard error, Variance, coefficient of variation. The normality of the distribution of variables will be examined based on the coefficient: Skewness, curvature, Kurtosis, and elongation coefficient. Differences will be determined by the T-test for dependent samples.

RESULTS

Central and dispersive parameters of variables for evaluating the speed of breaststroke swimming in the initial state.

Looking at table number 1, descriptive statistical methods were used to process the data, where it can be observed that in all variables there is no significant deviation from the normal distribution. The distributions of the subjects' abilities fit into the standards specified for the speed of breaststroke swimming of boys aged 10 to 12 years, even though this population is in the process of constant transformation, which is the result of the influence of the specific age of the subjects. Therefore, there are no significant deviations in the distribution of results from the normal distribution for certain swimming techniques, which we can see from the table shown, where our current situation can generally be determined. By individual review and analysis of the variables, we can determine the following: Speed of swimming with the breaststroke technique at 25 meters - BPPT25 - the arithmetic mean is (MEAN is 28.0893), the range (MIN. - MAX.) is from 22.22 to 42.30 and the standard deviation (STD. DEV.) 6.62724. The speed of swimming with the breaststroke technique at 50 meters - BPPT50 - the arithmetic mean is (MEAN is 54.3289), the range (MIN. - MAX.) is from 44.66 to 69.80 and the standard deviation (STD. DEV.) is 6.06079. 100-meter breaststroke swimming speed - BPPT100 - arithmetic

mean (MEAN is 109.0423), range (MIN. - MAX.) which is from 99.24 to 132.84 and standard deviation (STD. DEV.) 9.44927. By looking at table no. 1 it can be determined that a normal distribution has occurred.

Table 1. Central and dispersive parameters for the swimming program efficiency on the speed of swimming with the breaststroke technique in the initial state

Descriptive Statistics												
Variables	N	Range	Min	Max	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
BPPT25	44	20.08	22.22	42.30	28.089	.99909	6.62724	43.920	1.298	.357	.070	.702
BPPT50	44	25.14	44.66	69.80	54.328	.91370	6.06079	36.733	.365	.357	.085	.702
BPPT100	44	33.60	99.24	132.84	109.042	1.42453	9.44927	89.289	.923	.357	.134	.702
Valid N (listwise)	44											

Central and dispersive parameters of the variables for evaluating the speed of swimming with the breaststroke technique in the final state.

Reviewing table no. 2, it can be seen that in the final measurement used in this research, it can be concluded that there is no significant deviation from the normal ranges. The distributions of the respondents' abilities fit the standards specific to the specified area. So, there are no significant deviations in the distribution of the results from the normal ranges for the individual mentioned variables. We can see this from the presented table, where the current situation can generally be determined. Individual examination and analysis of the variables can determine the following: Speed of swimming with the breaststroke technique at 25 meters - BPPT25 - the arithmetic mean is (MEAN is 25.1575), the range (MIN. - MAX.) is from 79.50 to 30.89 and the standard deviation (STD. DEV .) 2.50345, Swimming speed with breaststroke technique at 50 meters – BPPT50 - the arithmetic mean is (MEAN is 53.4948), the range (MIN. – MAX.) is from 41.88 to 68.10 and the standard deviation (STD. DEV.) 6.52877, Swimming speed breaststroke technique at 100 meters - BPPT100 - the arithmetic mean is (MEAN is 106.5282), the range (MIN. - MAX.) is from 96.03 to 131.11 and the standard deviation (STD. DEV.) is 8.78444

Table 2. Central and dispersive parameters for the swimming program efficiency on the speed of swimming with the breaststroke technique in the final state

Descriptive Statistics												
Variables	N	Range	Min	Max	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
BPPT25	44	11.39	19.50	30.89	25.157	.37741	2.50345	6.267	.960	.357	1.178	.702
BPPT50	44	26.22	41.88	68.10	53.494	.98425	6.52877	42.625	.199	.357	-.309	.702
BPPT100	44	35.08	96.03	131.11	106.528	1.32430	8.78444	77.166	1.478	.357	1.921	.702
Valid N (listwise)	44											

Based on table no. 1 and table no. 2, it can be noted that the results experienced a transformation, and which specific results and how much the transformation took place will be determined in the following methods. It can be stated that the results showed mostly centroid grouping, and the results can be taken into further consideration.

Analysis of the results of the T-test of the initial and final stage of the effectiveness of the program on the speed of the breaststroke swimming technique

T-test analysis (Table 3.) for dependent samples, the effects of the program on the speed of breaststroke swimming were evaluated. The results indicate positive and statistically significant differences in the majority of variables in the transformation of the speed of swimming with the breaststroke technique. Statistically significant differences between the initial and final testing were found in the BPPT25 - BPPT25F tests t(43)= 2.778, p= .008. The average decrease in value in this test was 2.386, while the 95-percent confidence interval extends from .653 to 4.118, eta squared= 0.11. No significant differences were found in the BPPT50 - BPPT50F tests t(43)= 2.375, p= .022. The average decrease in value in this test was .834, while the 95-percent confidence interval extends from .125 to 1.542, eta squared= .10. Statistically significant differences between the initial and final testing were not found in the BPPT100 - BPPT100F

tests t(43) = 2.981, p= .005. The average decrease in value in this test was 2.514, while the 95-percent confidence interval extends from .813 to 4.214, eta squared= 0.12.

Table 3. Results of the T-test of the initial and final stages of swimming speed with the breaststroke technique

Variables		Paired Differences					t	Df	Sig. (2-tailed)	η2
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
					Lower	Upper				
Pair 1	BPPT25 - BPPT25F	2.386	5.698	.85911	.65380	4.118	2.778	43	.008	0,11
Pair 2	BPPT50 - BPPT50F	.834	2.329	.35114	.12595	1.542	2.375	43	.022	0,10
Pair 3	BPPT100 - BPPT100F	2.514	5.593	.84329	.81343	4.214	2.981	43	.005	0,12

DISCUSSION

The main objective of this study was to determine the effects of the three-month program on breaststroke swimming speed. According to the research conducted by (Okičić, Jorgić, Madić, Thanopoulos and Jovanović, 2012), the entire set of specifically applied motor variables has a statistically significant relationship with the result of swimming in the 100 m breaststroke. The obtained results indicate the need to learn and improve the breaststroke technique and develop all parameters of specific motor skills in young swimmers. It also indicates that in the training process with younger categories, optimal conditions should be created for the development of all motor skills that can have an impact on swimming efficiency in breaststroke technique. Marinho, A.D., Amorimi, R.A., Costa, A.M., Marquesi, M.C., Perez-Turpin, J.A. and Neiva, H.P. (2011). This research aimed to analyze AnCV in young swimmers, comparing the anaerobic indicator with the best swimming performances in short sections (50, 100, and 200 m). The results showed a strong relationship between AnCV and swimming performance in 50 and 100 m backstroke, breaststroke, and front crawl; and between AnCV and swimming performance in 200 m breaststroke and front crawl. In addition, no differences were found between 200 m speed and AnCV in all swimming techniques. Abe, D., Tokumaru, H., Niihata, S., Muraki, S., Fukuoka, Y., Usui, S. and Yoshida, T. (2006). They investigated high swimming speeds, the relationship between speed (v) and sustainable pace (T) can be described by a hyperbolic relationship: (v - Vcrit) · t = D', where Vcrit is called the critical speed and D' is defined as the curvature constant hyperbolic curves. This study aimed to examine whether Vcrit can be applied to evaluate short-distance breaststroke performance and to assess the relative contribution of D' in short-distance swimming performance. Cluster analysis showed that most subjects were classified as Vcrit dependent when swimming 50 m. These results significantly influenced how it could be applied to evaluate short-term and long-distance swimming performance, and it determines about 80% of short-distance breaststroke swimming performance. Knowing the changes in the relationships of breaststroke parameters, when swimming different sections, is useful data for coaches and their swimmers (Sidney, Alberty, Leblanc & Chollet, 2011). According to Takagi, Sugimoto, Nishijima & Wilson (2004), better swimmers have a longer gliding phase and tend to lose as little speed as possible during the retro pulse phase in breaststroke, which was determined by analyzing different breaststroke disciplines in the 2001 World Swimming Championships. Šiljeg, Leko and Mikulić (2011).

Pešić, M., et al. (2013). in their research determined the effects of a one-year training process on changes in the parameters of specific motor skills in the discipline of 100 meters breaststroke in young swimmers. They concluded that the applied training program lasting one year can be concluded to have achieved positive results in terms of improving the results of swimming in the 100-meter breaststroke, as well as improving all parameters of specific motor skills that affect that result. Given that the start time (VS), turn time (VO) and absolute swimming speed (V10) takes place in the anaerobic work mode, we can say that the applied training program had a positive impact on the energy system, that is, on the anaerobic endurance of young swimmers, as well as on the strength of the leg muscles, which play a significant role in the reflection phase at the start and each turn. The following training process should be modified in terms of rationality, in order to achieve even greater training effects for the same or a shorter period. Dimitrić, G., et al. (2013). This paper aims to determine the individual influence of swimming techniques on the result in the 200-meter medley, using the times of the first 30 male and female swimmers who participated in the European championship in small pools (25 m) in Poland in 2011. The conclusion was made that in the male and female competition, swimming with the breaststroke technique has the greatest influence on the final result, i.e. the swimmer's rank. However, it must be taken into account that this research is about children aged 10-12 who are in biological development and are not professional competitors. In this period, the children have not perfected the complete breaststroke technique, where certain details must be pointed out and corrected when performing the technique. The training itself should lead to better results, which can be proven in subsequent research. The results are good indicators for coaches and experts in breaststroke technique to modify and adapt the new training regimen for breaststroke technique. It can be concluded that the program had a positive impact, but it is evident that better results can be achieved with certain program changes.

CONCLUSION

The goal of the research was to determine the effects of a three-month program on the speed of breaststroke swimming. Three tests were applied that evaluated the speed of swimming with the breaststroke technique. By looking at the descriptive statistics, it can be concluded that the values of the arithmetic means of the initial and final tests are in a normal distribution, and can go even further. By analyzing the results of the T-test for dependent samples, it can be concluded: the obtained results indicate to water polo experts that continuous work on technique improvement is of great importance for the speed of breaststroke swimming. By bringing together all biomechanical principles, the resistance in the water is reduced and thus the speed of swimming with the breaststroke technique is increased. It is worth noting that boys at this age consider the breaststroke technique to be a female technique, and therefore the swimming is much slower as they could not prove their superiority and competitiveness, so they did not give their best performance during the implementation of the program. In this case, the professional should include the psychological preparation of the swimmers in order to get a more efficient result in the program. The results showed that the content of the program had a positive effect on the set variables, but also showed its shortcomings, which should be included in the next project.

REFERENCES

1. Abe, D., Tokumaru, H., Niihata, S., Muraki, S., Fukuoka, Y., Usui, S. and Yoshida, T. (2006). *Evaluation of breaststroke performance in short sections at critical speeds.* Journal of Sports Science and Medicine, no. 5(2), 340-348.
2. Dimitrić, G., Batez, M., Bogdanovski, M., Petrović, M. and Glaviči, I. (2013). *The influence of swimming techniques on the result in the 200-meter medley.* Sport Mont, no. 37, 38, 39, 281-296. Podgorica: Montenegrin Sports Academy.
3. *Gošnik, J. and Sedar, M. (2010). Assessment of swimming safety of students from 2002 to 2009 consecutively and checking of swimming knowledge at the Faculty of Philosophy in Zagreb in 2010.* Zagreb: Faculty of Philosophy.
4. *Madić, D., Okičić, T. and Aleksandrović, M. (2007).* Swimming (swimming). Nis: Fakultet sporta i fizičkog vaspitanja.
5. *Marinho, A.D., Amorimi, R.A., Costa, A.M., Marquesi, M.C., Perez-Turpin, J.A. and Neiva, H.P. (2011). "Anaerobic" critical speed and swimming performance of young swimmers.* Journal of Human Sport and Exercise, 6 (1), 81-86.
6. *Mirvić, E. (2011). The level of transformational changes in functional, motor abilities, and swimming efficiency under the influence of the swimming program.* Doctoral thesis. Faculty of Sports and Physical Education, Sarajevo.
7. *Okićić, T., Jorgić, B., Madić, D,. Thanopoulos, V., and Jovanović, P. (2012). Relationships of basic and specific motor abilities with the results of breaststroke swimming in young swimmers.* Sports Sciences and Health, 2 (1), 16-21.
8. *Sidney, M., Alberty, M., Leblanc, H., & Chollet, D. (2011). Stroking parameters during competition. In S. Ludovic, C. Didier, & M. Inigo, World book of swimming: From science to performance (pp.443-458).* New York: Nova Science Publishers, Inc.
9. *Pešić, M., Jorgić, B., Madić, D. and Okičić, T. (2013). The effects of the training process on the specific motor skills of young swimmers in the discipline of 100 meters breaststroke. Third International Conference "Sports Sciences and Health".* Proceedings, 419-423. Banja Luka: Pan-European University.
10. *Šiljeg, K., Leko, G., and Mikulić, P. (2011). Situational success in the 100-m backstroke event at the 2004 and 2008 European swimming championships.* Sport Science 4 (2), 28-31.
11. *Takagy, H., Sugimoto, S., Nishijima, N., & Wilson, B. (2004). Differences in stroke phases, arm-leg coordination, and velocity fluctuation due to an event, gender, and performance level in breaststroke.* Sports Biomechanics, 3(1), 15-27.
12. *Tošić, S. (2010). The influence of flexibility on swimming results.* Unpublished master's thesis, Niš, Faculty of Sports and Physical Education.
13. Trivun, M., Tošić, J. and Marković, V. (2013). *Therapeutic swimming.* High School of Sports and Health, Belgrade, Serbia.
14. Wolfrum, M., Rust, C.A., Rosemann, T., Lepers, R., and Knechtle, B. (2014). *Changes in breaststroke performance of national and international athletes competing between 1994 and 2011 compared to freestyle performance.* Sports Science, Medicine, and Rehabilitation, 6-18.

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