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The Effect of 8-Week Core Exercises Applied to 10-12 Age Male Swimmers on Swimming Performance

Canan Gülbin Eskiyecek[1], Mine Gül[2]*, Burcu Uludağ[3] and Gazanfer Kemal Gül[4]

[1]Asist. Prof., School of Physical Education and Sports, Mardin Artuklu University, Mardin, Turkey.
[2]Asist. Prof., Faculty of Sports Sciences, Kocaeli University, Kocaeli, Turkey.
[3]Graduate Student, Faculty of Sports Sciences, Kocaeli University, Kocaeli, Turkey.
[4]Asist. Prof., Faculty of Sports Sciences, Kocaeli University, Kocaeli, Turkey.
*Correspondence.

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ABSTRACT
The aim of this study was to investigate the effects of core exercise on 50 meter freestyle, backstroke, butterfly and breaststroke style performances of 10-12 year old males swimmers. In this study, from Kocaeli Swimming Club 24 volunteer male swimmers, 12 experimentals and 12 controls group were participated. 3 days a week for 8 weeks; in addition to club swimming trainings, the experimental group received core exercises and the control group received club swimming trainings only. Before and after the training program, height and body weights of all swimmers, and 50 meter freestyle, backstroke, butterfly and breaststroke techniques were obtained in seconds. Wilcoxon test was used for intra-group comparisons and MannWithney-U test was used for first and post-test measurements of swimmers. At the end of the training, a statistically significant difference was found in the experimental group in 50 m swimming first and last test measurements; difference in freestyle; 0.42 sec, backstroke; 0.30 sec, butterfly stroke; 0.47 sec and breaststroke style 0.49 sec ($p < .05$). A statistically significant difference was found in the control group in 50m swimming first and last test measurements; difference in freestyle; 0.08 sec, backstroke; 0.14 sec, butterfly stroke; 0.18 sec and breaststroke style; 0.13 sec ($p < .05$). When the significance level between the groups was examined; significant difference was found in favor of experimental group in all measurements ($p < .05$). As a result of the research, it can be said that core training has a positive effect on swimming performance of male swimmers.

1. Introduction

Swimming is a sports branch containing many elements such as rhythm, coordination, correct technique, etc. requiring physical power and technical ability coordination [1]. Swimming is the sports performed with continuous movement of arms and legs to cover a certain distance in water. Sportive swimming is defined as the ability of the athlete to cover certain distances in a liquid through free, backstroke, breaststroke, butterfly stroke and mixed techniques in the shortest time possible [2]. Variety of race distances and swimming components make the swimming a complex and difficult sports in terms of physical, technical and tactical aspects [3].

Balancing body position, increasing efficiency by controlling and maintaining with minimum resistance is critical for swimming. However, the support muscle group, which is coordinated with arms and legs in swimming performance, will improve performance. For this, the strength and endurance of the area known as the core throughout the middle part of the body should be controled. A strong core component (stroke pull-push) will provide more energy transfer. For this reason, strong core components should be developed in swimming [4,5]. The concept of core has recently become an essential component of functional athletic performance, becoming an essential part of training plans in the field of sports sciences [6,7,8]. Strength, endurance and high coordination within core studies can be considered as key factors for developing children's motor skills [9].

Core training transfers and controls force and motion in order to provide optimum power production in athletic performance [10,11,12]. The core exercise, performed with the own weight of the body, aiming strengthening of deep muscles and lumbopelvic zone muscles keeping the backbone at a balance [13], core stability training could be beneficial for improving balance by strengthening core muscles most often associated with lumbar spine control to improve dynamic balance [14], can be expressed as a whole of systematic exercises focusing on muscles at the center of the body and aiming to protect and improve the body balance by strengthening these muscles. Since these exercises are not only for avoiding injuries, but also make contribution to improvement of the performance, core exercise applications shall be beneficial in almost all sports and exercise programs of individuals making exercises [15]. Physiological factors are also considered to be effective in performance improvement, and there is a significant positive relationship between swimming training and pulmonary function in healthy young men [16]. In researches performed in the literature, it is believed that the core exercise is required for the sports performance and should be used as a part of exercises. However, this should not be the focus point of any endurance exercise program. Core area is a part of the body, therefore it should not be the focus of any exercise program receding from other body parts that may cause muscle imbalance and possible injuries [17]. Again, in the literature, there are many researches encouraging fundamental training programs and performance improvement exercises without maintaining a strong scientific logic in activities particularly in the sports sector. But, researches indicating whether core power exercises have any benefit in a certain core stability or muscle strengthening are very limited and conflicting due to various data collection methods, exercise techniques and subjects used for the analysis. Despite observing improvements in the core power following a core exercise program in very few researches, it is not observed that exercises do not cause any performance increase in sports activities [18,6]. There is not only one exercise both activating and forcing entire core area muscles; therefore, a combination of exercises is required to create core stability and power improvements for an individual [18].

Better understanding of roles owned by certain muscles during core power exercises shall enable implementation of more functional training programs, and that shall be able to enable more effective transformation of the core exercise into improvements in the sportive performance [6]. Starting from this point of view; this study aims to research whether core exercises applied on 10-12 age male swimmers have any effect on 50 m four different styles of swimming (freestyle, backstroke, butterfly and breaststroke stroke) points.

2. Method

2.1. Research Group

The research is realized with volunteered attendance of 24 male swimmers in 19-12 ages among Kocaeli Swimming Club athletes. The research group is divided into 2 groups as 12 persons of test groups with the random method (Mean age = 11.25±0.75 years, mean height = 1.55±0.03 cm, mean body weight= 46.13±2.11 kg; mean sports age = 28±2.52 month) and 12 persons of control group (mean age= 10.42±0.51 years; mean height = 1.54±0.03 cm; mean body weight = 45.56±1.83 kg; man sports age = 28.50±3.03 month) (Table2).

2.2. Research Method

The core trainings applied to the athletes participating in the research focused on the movements towards the abdomen and back to support the arm and leg movements used in swimming training. With the hypothesis that the use of synergic muscles in the force transfer may have an impact on swimming performance, the training program specified in table1 has been made. In training sessions, core training was applied to the Experimental group with club swimming training, which 8 weeks long, 3 days a week, 15 repetitions and 3 sets. The number of repetitions, sets and rests were increased after the first two weeks of training (Table 1). The control group only continued club swimming training.

Table–1. Weekly Core Exercise Program Table.

Days	1st Week – 2nd Week	3rd Week	4th Week – 8th Week
Tuesday **Thursday** **Saturday**	*Warm-Up:* 10 min *Stretch:* 5 min *Number of Repeats*: 15 *Number of Sets*: 3 *Rest Period:*1 min *Cooling:* 10 min *Core Exercises Applied:* 1. Crunches 2. Pull the knees in the straight bridge position 3. Lower and lift the hip in the side bridge position 4. Pocket Knife 5. Side pocket knife (right) 6. Side pocket knife (left) 7. Kneel in supine position and forward extension 8. Reverse shuttle 9. Lowering and lifting legs in supine position 10. Turn the hip to the right and the left in the straight bridge position	*Warm-Up:* 10 min *Stretch:* 5 min *Number of Repeats:* 20 *Number of Sets:* 3 *Rest Period:*1-2 min *Cooling:* 10 min *Core Exercises Applied*: 1. Crunches 2. Pull the knees in the straight bridge position 3. Lower and lift the hip in the side bridge position 4. Pocket Knife 5. Side pocket knife (right) 6. Side pocket knife (left) 7. Kneel in supine position and forward extension 8. Reverse shuttle 9. Lowering and lifting legs in supine position 10. Turn the hip to the right and the left in the straight bridge position	*Warm-Up:* 10 min *Stretch:* 5 min *Number of Repeats:* 20 *Number of Sets:* 4 *Rest Period:*1-3 min *Cooling:* 10 min *Core Exercises Applied:* 1. Crunches 2. Pull the knees in the straight bridge position 3. Lower and lift the hip in the side bridge position 4. Pocket Knife 5. Side pocket knife (right) 6. Side pocket knife (left) 7. Kneel in supine position and forward extension 8. Reverse shuttle 9. Lowering and lifting legs in supine position 10. Turn the hip to the right and the left in the straight bridge position

2.3. Performance Measurement Tools Applied on Athletes

Length and body weights of all swimmers participating in the study were measured before the test and their descriptive statistics were recorded. In swimming performance measurements, athletes swimming in the pool at 50m distance from the starting point, swimming with the back, butterfly and breaststroke style and their degrees were taken in seconds. To measure swimming performances of athletes participating in the test, FINISH 3X-300M branded stopwatch was used.

2.4. Data Analysis

In order to determine whether there is a statistically significant difference between the results of the first and post-test measurements of the groups, Wilcoxon test was applied to non-parametric tests for intra-group comparisons between the descriptive statistics and non-parametric tests. SPSS 22.0 statistical package program was used to analyze the data and the level of significance was determined as p< .05.

3. Results

Table–2. Comparison Of Descriptive Statistics Of Test And Control Groups With First Test And Final Test Values.

	Experimental Group					Control Group				
Variables	**N**	**Mean**	**Std. D.**	**Mean Difference (S)**	**p**	**Mean**	**Std. D.**	**Mean Difference (S)**	**p**
Age (year)	12	11,25	0,75			10,42	0,51		
High (cm)	12	1,55	0,03			1,54	0,03		
Weight (kg)	12	46,13	2,11			45,56	1,83		
Training Age (month)	12	28,00	2,52			28,50	3,03		
Freestyle First	12	32,42	1,89	0,42	**0.002***	38,45	4,98	0.08	**0.005***
Freestyle Last	12	31,99	1,79			38,37	4,99		
Backstroke First	12	35,72	1,99	0,30	**0.010***	42,16	5,20	0.14	**0.010***
Backstroke Last	12	35,43	2,14			42,03	5,26		
Butterfly First	12	34,96	2,69	0,47	**0.003***	43,08	5,95	0.18	**0.004***
Butterfly Last	12	34,50	2,62			42,90	5,99		
Breaststroke First	12	39,74	2,88	0,49	**0.003***	50,98	4,15	0.13	**0.008***
Breaststroke Last	12	39,25	2,85			50,84	4,14		

*p< .05

According to Table 2, in 50 m first and last test swimming points of the test group; freestyle p=0.002 (difference; 0.42 sec), backstroke p=0.01 (difference; 0.30 sec), butterfly p=0.003 (difference; 0.47 sec) and breaststroke styles p=0.003 (difference; 0.49 sec) measurement results have statistically significant differences (p< .05). In 50 m first and last test swimming points of the control group; freestyle p=0.005 (difference; 0.08 sec), backstroke p=0.010 (difference; 0.14 sec), butterfly p=0.004 (difference; 0.18 sec) and breaststroke styles p=0.008 (difference; 0.13 sec) measurement results have statistically significant differences (p< .05).

Table–3. Statistical analysis of final test measured values in 50m swimming styles between groups.

Swimming Styles (sec)	Groups	N	Mean	Std. D	Mean Dif. (sec)	Z	p
50 m Freestyle	Experimental	12	31.99	1.79	-6.38	-3,523	**0.000***
	Control	12	38.37	4.99			
50 m Backstroke	Experimental	12	35.43	2.14	-6.60	-3,406	**0.001***
	Control	12	42.03	5.26			
50 m Butterfly	Experimental	12	34.50	2.62	-8.40	-3,465	**0.001***
	Control	12	42.90	5.99			
50 m Breaststroke	Experimental	12	39.25	2.85	-11.59	-4,099	**0.000***
	Control	12	50.84	4.14			

*p< .05

According to Table 3, in the comparison of the last test swimming degrees of the swimmers between the groups, it was found that there were statistically significant differences in favor of the experimental group in all measurements (p< .05).

4. Discussion

In this study, the effect of 8 weeks swimming + core exercise on 50 m freestyle, back, butterfly and breaststroke style performances of male swimmers in the 10-12 age group was investigated and the results were compared with the other studies in the literature. As a result of the core training that was added to the experimental group swimming training, 50m free (difference; 0.42sec; p = 0.002), back (difference; 0.30sec; p = 0.01), butterfly (difference; 0.47sec; p = 0.003) and breaststroke styles swimming degrees (difference; 0.49 sec; p = 0.003) mean differences and were found improvement in analysis results (p <0.05). In the research, only the control group which is performing club swimming training, 50m freestyle (difference; 0.08s; p = 0.005), back (difference; 0.14s; p = 0.010), butterfly (difference; 0.18s; p = 0.004) and breaststroke styles swimming degrees (difference; 0.13s; p = 0.008) mean differences and were found improvement in analysis results (p <0.05).

It is thought that the reason for the development of the control group swimming degrees may be due to the formation of a competitive environment in the training with teammates and the desire to perform better. In addition, it has been found in the literature research that the athletes who only practice swimming practice can improve their performance and motoric features [19, 20, 4].

Amaro et al. in their study, 12.7 ± 0.7 years of 21 male swimmers which applied for 10 weeks and the duration of the planned strength training, there was a significant difference (p <0.05) in 50m swimming degree (p = 0.003). It was found supportive in terms of the training method applied in the study [21]. Öner et al. stated in their study that the core exercise program applied to swimmers has positive effect in terms of the sportive success [22].

Patil et al. in their study on the effect of core training on swimming performance applied for 6 weeks to male and female of 12-18 age group and 14-18 age group, concluded that the training group had a significant effect on 50m swimming performance (p< .05). Although the method used in the literature shows similarity, the results obtained support this research [23]. In his study, Bıyıklı stated that core training, which was arranged in accordance with the age group before or during puberty, positively contributed to the physical performance of female swimmers in the 11-13 age group [20].

Karpinski et al. in their study, after a 6-weeks core training on swimming performance of national level swimmers with mean 20.2 ± 1.17 age, it was found that it can be said that this core training affects the efficiency on a short distance of swimming performance ($p<0.05$) [24].

Aktuğ et al. reported that there was a significant difference in some performance values and 50m free swimming of Thera-Band endurance training for swimmers aged 12 years ($p< .05$). Although a different training program was applied to the swimmers of the same age group in the literature, it was revealed that the strength training applied in a similar way had positive effects on the swimming degrees of the swimmers [19].

Atasoy in his study, examined the effect of swimming training program applied to male and female swimmers in the beginner level of the 8-10 age group for 14 weeks on 25 m freestyle points and determined basic motoric characteristics, and as a result of these changes with positive and negative changes at a statistically significant level [25].

Besides studies examining sportive performances through swimming points with core exercises applied to swimmers, there are also studies researching performances of swimmers through various motor characteristics. Accordingly; in his study, Özdoğru reported that 8-week core training applied to male swimmers in the age group 10-12 has improved balance, vertical jump, speed, flexibility, crunch and right-left hand grip performances among motor parameters ($p< .05$) [4] .

In his study, Gencer investigated the effect of core training on swimmers and swimming performance of 9-12 year-old swimmers and concluded that the training group had a significant effect on 25 m and 50 m swimming performance of the test group ($p< .05$) [26].

In the study conducted by Kıstak et al., in order to determine the relationship between the basic motoric characteristics of female and male swimmers in the 8-10 age group and 25 m freestyle, backstroke, butterfly and breaststroke swimming, a number of tests were applied to the swimmers and accordingly some basic motoric characteristics and swimming degrees were compared and statistically significant relationships were reported ($p< .05$) [27].

As a result of the studies carried out in the literature, it has been found out that in parallel with this study, the core exercise of children especially during their developmental stages provides positive improvements on both swimming performance and some basic motoric characteristics of swimmers.

5. Conclusion

In the research, which examines the effect of core training on performance development, it can be said that some selected core movements have an effect on swimming performance by transferring the force between muscles in order to support their technical skills in swimming. The improvement of the 50m free, back, butterfly and breaststroke style technical swimming performance of the research group showed better development than the control group which only performed swimming training, on the other hand, all data compared, it has been revealed that conducting both swimming and core training has a positive effect on performance. It can be said that the performance development of the control group was shown in line with the increasing intensity with the repetition principle of swimming training, as a result of the development of force as a result of both technical development and movements against water resistance. Performance improvements can be achieved by increasing the number of repetitions of athletes by increasing the core area movements in training. As a result, it is thought that core training applied to male swimmers can provide improvements on swimmers' swimming performances and can be used as aviable method in training.

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