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EFFECT OF CORE STABILIZATION TRAINING APPLIED TO 10-13 AGE SWIMMERS ON THE SWIMMING TIME AND SOME MOTORIC CHARACTERISTICS

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Abstract:
Purpose: The aim of this study is the effect of core stabilization training (CST) at male swimmers in 10-13 ages on 50 m backstroke swimming time (ST), Biering Sorenson (BS) test, Flexor (FE) and Lateral Endurance test (LE) and Stork (SD) balance test parameters. **Methods:** 14 volunteer male swimmers who swim at the Yeşilvadi Galatasaray Sports School were randomized to Experiment1 (D1) (n = 7) (age 11.57 ± 1.272 years, height 1.53 ± 0.04 m and weight 39.62). ± 3.55 kg) and Experiment2 (D2) (n = 7) (age 11.43 ± 1.272 years, height 1.53 ± 0.04 m and weight 41.43 ± 4.11 kg) after first measurements via the random method and 7 volunteered males were divided into the control group (F) (n = 7) (age 12 ± 1,155 years, height 1.53 ± 0.04 m and weight 41.43 ± 4.11 kg) and included in the study. CSA was applied to the D1 group athletes before swimming training 3 days a week (plank, side plank, reverse arm, reverse leg, reverse crunch, supine bridge, "V" sitting). The D2 group had only club swimming training and the K group had no training. The data were analyzed by Paired-Samples T Test and ANOVA test in SPSS 22.0 package program and the significance level was determined as p> 0.05. **Results:** Statistically significant difference detected in D1 group 50 m (ST) (p=0,012), BS (p=0,001), LE-right (p=0,04) and LE-left (p=0,022), FE values (p=0,004). Significant difference detected in D2 group 50 m ST (p=0,015) and BS test (p=0,000) result (p<0.05). No difference found in K group all parameters (p>0.05). As the result of final measurement results, significant difference detected at LE-right measurement between D1 group and D2 group, and LE-right and LE-left measurements among K group (p<0.05). **Conclusions:** As a result, it can be said that 8-week core and swimming trainings provide improvement in swimming point and endurance parameters and performance improvement can be achieved by applying to swimmers in 10-12 ages.

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Keywords: swimming, core, stabilization, performance

1. Introduction

For children, sport is important both in physical development and social aspects. Through sports, the child recognizes his / her environment, communicates, increases his / her self-confidence and strengthens his / her place in society. In particular, important studies has been made in this branch regarding the contribution of the swimming branch to the physical and mental development of children has been revealed in many scientific studies, self-control, to concentrate on a subject, the use of will, many positive developments such as motivation to success (Sevim, 2002). Swimming provides symmetrical and balanced development of body muscles. It is a horizontal sport in water, and since body weight is not perpendicular to the skeletal system, no complaints such as skeletal disorders are encountered, making joints and ligaments less difficult. Swimming sport maximizes heart, lung capacities, improves endurance and flexibility (Bozdoğan, 2003). In order to achieve sporting efficiency in this branch of sports, the candidate must start at an early age, be run by a coach with good technical knowledge, and receive support from the family and school environment. In order to be successful, an athlete interested in swimming should pay attention to regular training, rest and nutrition with quality training programs (Hannula, 2001). Thera-Band resistance training, which is a functionally practiced model of strength training, has also been reported to be effective in performance degrees in the swimming (Gül et al., 2019). Strength & Condition program can be a valuable tool in helping to decrease likelihood of injury, improve movement skills, and enhance swimming performance in youth swimmers. This is vital to ensuring long-term engagement in physical activity and sport. (Nugent et al., 2018)

2. Literature Review

Core trainings include exercises to train stabilizer muscle groups (muscles in the abdomen, back and hip) that keep the body in balance. It is responsible for supporting the posture, creating movement, coordination of muscle action, building a solid structure, building the force and transferring it to the whole body. If you want to be a strong swimmer, you need to have a strong core to maintain stability and balance and increase coordination (Rosania, 2004). The well-developed core area provides strong and high-quality body rotation. In short, the improved core area greatly improves the performance of swimmers. Especially, it is the type of training that the age group athletes should work to a great extent (Otman, 2012). Core training can be expressed as a set of systematic exercises that focus on and strengthen the muscles in the body center to maintain and increase body balance. It is a training practice that can not only prevent disability but also contribute to improving performance. It is considered that it would be beneficial to include core training practices in almost all sports branches and training programs of individuals exercising (Egesoy et al., 2018). Training for the core of this region It is

thought to increase the strength and stability of the sport performance can affect positively (Gür & Ersöz, 2017). Role of core exercises on the performance is very few, if available. The target performance improvement should not be applied as basic training in strength and condition (Cissik, 2011).

Core strength is needed to maintain proper posture, balance, and alignment in the water. If these elements are not maintained, then resistive forces will increase and stroke technique will break down, leading to an inefficient stroke. Increasing the core strength of a swimmer will improve his or her ability to maintain efficient technique throughout the entire race (Fig, 2005). For young swimmers, an age-appropriate and well-structured strength training program can be a valuable tool to reduce the likelihood of injury, improve mobility and improve swimming and very important for long-term participation in physical activity and sport. Coaches working with young athletes should strive to provide fun, interactive and challenging strength training programs development and sport-specific needs (Nugent, et al., 2018). It improves the basic skills performance of children with little knowledge of core stability. Strength, endurance and high coordination within core studies can be considered as key factors for developing children's motor skills (Rostami & Ghaedi, 2017).

The aim of this study, the effect of CSA applied to swimmers aged 10-13 years on 50m supine swimming degree and some motoric properties was aimed. Accordingly, before and after the 8-weeks training, 50 meters Backstroke Test, Sorenson Test, Flexor Endurance Test, Lateral Endurance Test, Stork Balance Test were applied.

3. Material and Methods

3.1. Subjects

14 volunteer male swimmers who swim at the Yeşilvadi Galatasaray Sports School were randomized to Experiment1 (D1) (n = 7) (age 11.57 ± 1.272 years, height 1.53 ± 0.04 m and weight 39.62). ± 3.55 kg) and Experiment2 (D2) (n = 7) (age 11.43 ± 1.272 years, height 1.53 ± 0.04 m and weight 41.43 ± 4.11 kg) after first measurements via the random method and 7 volunteered males were divided into the control group (F) (n = 7) (age 12 ± 1,155 years, height 1.53 ± 0.04 m and weight 41.43 ± 4.11 kg) and included in the study.

3.2. Experiment Design

This study was carried out with the participation of 21 volunteer athletes from swimming athletes in Yeşilvadi Galatasaray Sports School. In this study, 21 volunteer athletes including 7 athletes D1 group, 7 athletes D2 group and 7 athletes K group were included. Before the trainings, the content of the work program to be applied to the athletes was explained to the club managers and coaches and necessary permissions were obtained from the club and family. Within the framework of training programs, swimming training and CSA were applied to group D1, swimming training was applied only to group D2 and no studies were applied to group K.

CSA movement names applied to the subjects in the 8-week trainings were planned as plank, side plank, reverse arm, reverse leg, reverse crunch, supine bridge, "V" sitting. These movements and swimming activities were performed 3 days a week on Fridays, Saturdays and Sundays. The duration of the movements applied in the training was planned on average seconds by recording the maximum time of the movements of all athletes before the first measurement was taken. Increased durations, decreased repetitions and set-up exercises were performed as the movement times progressed for weeks (Table 1).

Table 1: Training Group Core Area Weekly (Time-Repeat-Set) Work Table

Days		**Friday-Saturday-Sunday**					
Core Area Movements Weeks		**Weeks 1- 2**	**Weeks 3-4**	**Week 5**	**Week 6**	**Week 7**	**Week 8**
Plank	Time (s) * Repeats	25*4*3	30*4*3	35*3*3	40*3*3	45*3*3	50*3*2
Side Plank (right/left)		30*4*3	40*4*3	50*3*3	60*3*3	70*3*3	80*3*2
Reverse Arm Reverse Leg (right/left)		50*4*3	60*4*3	70*3*3	80*3*3	90*3*3	100*3*2
Reverse Crunch		25*4*3	30*4*3	35*3*3	40*3*3	45*3*3	50*3*2
Back Bridge		25*4*3	30*4*3	35*3*3	40*3*3	45*3*3	50*3*2
"V" Sitting		15*4*3	20*4*3	20*3*3	30*3*3	35*3*3	40*3*2

3.3. Measures

A. Stork Balance Test

In Stork balance test measurements, the athlete takes his bare feet and hands on his waist, body upright, position facing upwards and the leg to be measured is on the knee cap of the other leg. With the command, the heel of the foot on the ground is raised and the time is started. The test is carried out in both legs.

B. Biering Sorenson Test

For this test, bench in the pool area was used, the athlete's prone body was laid on the bench in such a way that it would hang from the bed to the spina iliac from anterior superior. The athlete was asked to fix the legs at the level of the gastrocnemius muscle and hold the trunk parallel to the ground against gravity with the hands clamped on the chest. Partial trunk extension is allowed. When the posture deteriorated and / or the athlete quit because of fatigue and pain, the time was stopped and the score in seconds was recorded (Yıldız, 2012).

C. Flexor Endurance Test

To perform the measurement, the knees are bent, the soles of the feet fixed on the floor by the trainer, hands crossed on the shoulder. Once the position is achieved, the back support is withdrawn and the test is started to record the retention time (Yıldız, 2012).

D. Lateral Endurance Test

The athletes are asked to stand on the front arms of the dominant side, at least 3 minutes after resting and after resting the non-dominant side on one side, with one foot in front of the other, with the body on a straight line. The time to be maintained in this position is recorded (Yıldız, 2012).

E. 50 Meter Backstroke Swimming Test

Before the test, the athletes warmed up on land and swam 200 m freestyle warming in water. The test was started from the moment the athlete pushed the wall of the pool with his feet with the command of the whistle. The test was completed when the athlete completed the 50 m distance and touched the wall with his hands.

3.4. Data Analysis

The data obtained at the end of the trainings, descriptive statistics, in-group and inter-group analyzes were performed in SPSS 22.0 analysis program. As a result of the first measurement analysis of the athletes, it was found that the data were in accordance with the normal distribution. Paired-Samples T Test and ANOVA test were used to determine the origin of the difference as a result of the first and last measurements and intra-group analysis and the significance level was determined as $p > 0.05$.

4. Results

Table 2: D1, D2 And K Groups First And Last Measurement Analysis Table

Groups	Variables (sec)	Mean±SS	Mean Difference	t	p
D1	50 m ST First	59,86±18,59	1,064	3,552	0,012*
	50 m ST Last	58,431±17,9			
	BS First	120,07±48,47	0,604	-5,597	0,001*
	BS Last	121,35±48,8			
	S Right First	42,65±16,95	0,157	-1,058	0,331
	S Right Last	42,71±17,02			
	S Left First	44,14±22,84	0,258	-1,641	0,152
	S Left Last	44,30±22,99			
	LE Right First	42,37±10,84	0,229	-2,606	0,040*
	LE Right Last	42,59±10,78			
	LE Left First	37,77±3,16	0,173	-3,067	0,022*
	LE Left Last	37,97±3,22			
	FE First	120,27±48,88	0,164	-4,52	0,004*
	FE Last	120,55±48,79			
D2	50 m ST First	62,85±22,75	0,258	3,358	0,015*
	50 m ST Last	62,58±22,52			
	BS First	120,25±48,86	0,086	-10,282	0,000*
	BS Last	120,58±48,87			
	S Right First	44,87±10,51	0,316	-0,048	0,963
	S Right Last	44,87±10,47			
	S Left First	34,960±16,63	0,267	-0,792	0,458
	S Left Last	35,04±16,70			
	LE Right First	39,15±17,82	0,152	-1,466	0,193
	LE Right Last	39,23±17,74			
	LE Left First	29,51±7,65	0,17	-2,151	0,075
	LE Left Last	29,650±7,62			
	FE First	120,59±48,66	0,302	-1,115	0,308
	FE Last	120,71±48,80			
K	50 m ST First	80,87±23,52	1,127	-1	0,356
	50 m ST Last	81,29±23,35			
	BS First	82,64±35,74	0,013	1,686	0,143
	BS Last	82,63±35,74			
	S Right First	37,34±15,42	0,02	-0,383	0,715
	S Right Last	37,350±15,42			
	S Left First	35,830±16,16	0,754	0,988	0,361

S Left Last	35,55±15,98			
LE Right First	27,51±7,71	0,029	-0,394	0,707
LE Right Last	27,51±7,7			
LE Left First	26,74±11,29	0,023	-0,826	0,441
LE Left Last	26,750±11,30			
FE First	84,85±33,34	0,036	-1,037	0,34
FE Last	84,86±33,34			

As shown in table 2, when D1 group first and last measurement analysis results are examined, 50m backstroke ST (M.D.=1,06; t=3,55; p=0,012), BS test (M.D.=0,60; t=-5,60; p=0,001), LE-right (M.D.=0,23; t=-2,61; p=0,04), LE-left (M.D.=0,17; t=-3,07; p=0,022) and FE test (M.D.=0,16; t=-4,52; p=0,004) the results have been determined (p<0.05). The data obtained before and after the trainings between Stork Left tests (M.D.=0,157; t=-1,058; p=0,331) and Stork left tests (M.D.=0,258; t=-1,641; p=0,152) no significant difference (p>0.05). When D2 group first and last measurement analysis results are examined, first and last measurement 50m backstroke ST (M.D.=0,26; t=3,358; p=0,015) ve BS test (M.D.=0,09; t=-10,28; p=0,00) results are determine (p<0.05). But Stork Right (M.D.=0,316; t=-0,048; p=0,963) and Stork Left (M.D.=0,267; t=-0,792; p=0,458), LE Right (M.D.=0,152; t=-1,466; p=0,193), LE Left (M.D.=0,170; t=-2,151; p=0,075) and FE (M.D.=0,302; t=-1,115; p=0,308) no significant difference (p>0.05). When K group first and last measurement analysis results are examined; all parameters of group K were analyzed, however, no statistically significant difference was found in any data (p>0.05). When the table is examined, no improvement has been achieved in the mean values and therefore the average differences have not improved.

Table 3: Final Measurement Analysis Table of Groups D1 and D2

Variables (sec)		Mean	S. D.	Mean Difference	t	p
50 m ST	D1	58,431	17,900	-4,096	-,377	0,713
	D2	62,527	22,519			
BS	D1	121,347	48,800	0,763	0,029	0,977
	D2	120,584	48,868			
S Right	D1	42,709	17,015	-2,163	-0,286	0,779
	D2	44,871	10,473			
S Left	D1	44,296	22,999	9,257	0,862	0,406
	D2	35,039	16,695			
LE Right	D1	42,593	10,778	3,359	0,428	0,676
	D2	39,234	17,739			
LE Left	D1	37,974	3,222	8,326	2,663	0,021*
	D2	29,649	7,617			
FE	D1	120,550	48,790	-0,164	-0,006	0,995
	D2	120,714	48,790			

As shown in Table 3, when at the end of the 8-week core training, the final measurement data were analyzed, only LE-left values between D1 and D2 groups (MD=8,326; t=2,663; p=0,021) significant difference was found in favor of D1 group (p<0.05). 50m backstroke ST (MD=-4,096; t=-3,377; p=0,713) although the mean value of D1 group was better than D2 group, no statistically significant difference was found (p>0.05). BS tests (MD=0,763, t=0,029, p=0,977), Stork-left and LE-right value the average difference in favor of the D1

group has been improved. However, no statistically significant difference was found (p>0.05).

Table 4: Final Measurement Analysis Table of Groups D2 and K

Variables (sec)		Mean	S.D.	Mean Difference	t	p
50 m ST	D2	62,527	22,519	-18,767	-1,531	0,152
	K	81,294	23,351			
BS	D2	120,584	48,868	37,950	1,658	0,123
	K	82,634	35,737			
S Right	D2	44,871	10,473	7,526	1,068	0,306
	K	37,346	15,422			
S Left	D2	35,039	16,695	-0,507	-0,058	0,955
	K	35,546	15,977			
LE Right	D2	39,234	17,739	11,724	1,604	0,135
	K	27,510	7,700			
LE Left	D2	29,649	7,617	2,900	0,563	0,584
	K	26,749	11,298			
FE	D2	120,714	48,790	35,854	1,605	0,134
	K	84,860	33,341			

As shown in Table 4; when the last measurements between group D2 and K are analyzed, 50m backstroke ST (MD=-18,767; t=-1,531; p=0,152), BS test (MD=37,950; t=1,658; p=0,123), Stork right (MD=7,526; t=1,068; p=0,306) and Stork left tests (MD=-0,507; t=-0,058; p=0,955), LE-right (MD=0,11,724; t=1,604; p=0,135) and LE-left (MD=2,90; t=0,563; p=0,584), FE tests (MD=35,854; t=1,605; p=0,134) development in favor of D2 group was determined. No statistically significant difference was found as a result of analyzes and differences (p>0.05).

Table 5: Final Measurement Analysis Table of Groups D1 and K

Variables (sec)		Mean	S.D.	Mean Difference	t	p
50 m ST	D1	58,431	17,900	-22,863	-2,056	0,062
	K	81,294	23,351			
BS	D1	121,347	48,800	38,713	1,693	0,116
	K	82,634	35,737			
S Right	D1	42,709	17,015	5,363	0,618	0,548
	K	37,346	15,422			
S Left	D1	44,296	22,999	8,750	0,827	0,425
	K	35,546	15,977			
LE Right	D1	42,593	10,778	15,083	3,013	0,011*
	K	27,510	7,700			
LE Left	D1	37,974	3,222	11,226	2,528	0,027*
	K	26,749	11,298			
FE	D1	120,550	48,790	35,690	1,598	0,136
	K	84,860	33,341			

As shown in Table 5; at the end of the 8-week core training, the final measurement data were analyzed, analysis between D1 and K groups LE-right (MD=15,083; t=3,013; p=0,011) and LE-left (MD=11,226; t=2,528; p=0,027) significant difference was found in favor of D1 group (p<0.05). 50m backstroke ST (MD=-22,863; t=-2,056; p=0,062), BS test (MD=38,713;

t=1,693; p=0,116), Stork right (MD=5,363; t=0,618; p=0,548), Stork left (MD=8,750; t=0,827; p=0,425) and FE test (MD=35,690; t=1,598; p=0,136) the average difference in favor of D1 group was determined. No difference was found in terms of analysis (p>0.05).

5. Discussion

The aim of this study was to investigate the effect of 8 weeks CSA on the results of 50 m backstroke swimming time, Biering Sorenson, Stork balance, Lateral Endurance right-left and Flexor Endurance test in 10-13 years old athletes. As a result of the training, in the group analysis, D1 group athletes doing CSA and swimming training showed improvement and a significant difference was found as a result of the first and last measurements of 50m backstroke ST, BS, LE-right and left and FE tests (p<0.05). Significant differences were found in the first and last measurements of the 50m backstroke ST and BS test among the D2 group athletes who only performed club swimming training (p<0.05). There was no improvement in any parameters of K group who did not participate in training and study (p> 0.05). As a result of the last measurement analysis, when the source of the difference is examined, results in favor of D1 group were determined. It was found that the D1 group had better results than the D2 group in the LE-left test and that the LE-right and LE-left test had better results than the K group. In line with these results, comparisons were made with literature researches.

Amaro et al. (2016), in the group of 12.7 ± 0.7 years of 21 male swimmers on the number of repetitions they applied for 10 weeks and the duration of the planned strength training experiment1 (p = 0.003) and experimental2 (p = 0.018) group jump in the vertical analysis values were significantly different (p <0.05); 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.

Axel et al. (2018), 15.9 ± 1.0 age average of 19 male professional surf athletes applied to the lower extremity of the core strength training, the study examined the effect of field test performance, 8-week training did not provide a significant improvement in core strength, but field tests showed that there was a difference (p <0.05). He supported the research in terms of training and results.

Grant and Kavaliauskas (2017) examined changes in swimming performance and some physiological tests as a result of 7 weeks of land resistance training with 9 swimmers of 13 ± 1.1 years. When the research data were examined, they concluded that resistance training had no effect on 100 m swimming point (p> 0.05), it was effective in vertical jump, back and leg strength measurement and 60 push-ups (p <0.05). It is thought that an adaptation process is needed for swimmers to demonstrate their power development in water. It supports the research.

Lizuka et al. (2016), the average age of 20.2 ± 1.0 age elite male swimmers applied to the effect of deep body muscle training on the acute performance of swimming in the study before and after deep body training data obtained as a result of flight distance and duration (p > 0.05). Significant improvement was found in 5 m distance time values (p

<0.05). As a result of this, it can be said that deep muscle work improves the swimming phase and therefore swimming performance. It supports the research in terms of improving swimming performance values.

Sharrock et al. (2011), 18-22 age range of athletes engaged in different branches of the core stability, T Test, 40 yard line test, vertical jump and health ball throwing tests were examined by applying the relationship between the core stability test and health ball throwing test strong ($p = 0.023$; $r = -0.389$), and there was a moderate and weak relationship between athletic performance tests, and males ($r = -0,322$) were better at core stabilization than females ($r = -0.268$). However, they concluded that further research is needed to find answers to questions about the degree of impact of the relationship on performance.

Stanton et al. (2004), in their study on the effect of Swiss Ball training on core stability and running performance for 6 weeks, it was found that core stability tests in young athletes with a mean age of 15.5 ± 1.4 years made a significant difference in the experimental group at the end of 6 weeks compared to the control group (p. <0.05). It was also concluded that 6-week Swiss Ball training improved core stability but did not improve running performance and submaximal speed.

Bıyıklı (2017), a significant difference was found in the speed, standing, long jump, vertical jump, balance, crunch, right-left hand grip and flexibility parameters in the 10-week core training research group in female swimmers aged 11-13 ($p <0.05$). There was a statistically significant difference between the study and control groups in speed ($p = 0.042$), vertical jump, balance and crunch values ($p = 0.00$). He believes that core training can contribute to the physical performance of child athletes.

Patil et al. (2014), in their study on the effect of 6-week core training on swimming degrees and performance on swimmers with a mean age of 14.2 ± 1.49, it was found that the two-week measurement values improved significantly in the training group ($p> 0.05$). When compared with the control group, a significant increase was found in favor of the research group. As a result, it was determined that core strength training applied with traditional swimming training had an effect on 50 m swimming performance.

Karpinski et al. (2019), in their study on the effects of a 6-week core exercises 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 of swimming on a short distance ($p<0.05$).

Dedecan (2016) examined the effects of core training on 8 weeks and 4 days a week on some physical and physiological characteristics of male athletes in the school team aged 14-16 years. As a result of the training, significant differences were found in all parameters (leg-back force, right-left hand grip strength, standing long jump, skinfold measurements, vertical jump and 1 min crunch and push-up tests) except for the 20 m crunch run ($p <0.05$).

Kamiş (2017), in the study where the relationship between core stability and athletic performance was investigated in elite male athletes and basketball players aged 14-16, no statistically significant difference was found between core stability and athletic

performance in short distance runners ($p > 0.05$). In basketball players, only a weak negative correlation was found between core stability and 30m speed running ($r = -0.477$, $p = 0.039$). When the groups were evaluated together, core stability was positively between long jump test ($r = 0.463$, $p = 0.005$), 60-second crunch test ($r = 0.360$, $p = 0.034$) and sit-and-lie test ($r = 0.544$, $p = 0.001$) weak and medium correlation was determined. As a result, core stability ($p = 0.008$), pro-agility agility test ($p = 0.011$), standing long jump ($p = 0.024$), sit-ups ($p = 0.014$) and sit-and-lie ($p = 0.000$) tests were stronger in short-distance athletes than basketball players.

6. Conclusion

In this study, the effects of CSA applied for 8 weeks on 50m swimming time, Biering Sorenson test, Stork Balance test, Lateral Endurance Right and Left test and Flexor Endurance test were examined. The results of the first and the last measurement data of 50m ST ($p = 0.012$), BS test ($p = 0.001$), LE Right test ($p = 0.040$), LE Left test ($p = 0.022$) and FE test in CSA and D1 athletes performing swimming training ($p = 0.004$) were found statistically significant ($p < 0.05$). Only 50m ST ($p = 0.015$) and BS test results of the traditional swimming trainers were found as ($p = 0.000$) and significant difference was detected ($P < 0.05$). No significant difference was found in the measurement values of the group K group who did not participate in any training ($p > 0.05$).

As a result of intergroup analysis, D1 group showed more significant results in terms of mean differences than D2 and K groups. However, when compared with D2 group, only LE Left value ($p = 0.021$) was statistically significant ($p < 0.05$). Although they did not train when compared with the K group, they did not meet the expectation of a significant increase and significant difference of D1 group. However, there is an improvement in the analysis of average difference values. In addition, there was a significant difference in LE Right ($p = 0.011$) and LE Left ($p = 0.027$) values according to K group ($p < 0.05$).

As a result, it can be said that 8-week core and swimming trainings provide improvement in swimming time and endurance parameters, and coaches can apply them to swimmers 10-12 years of 10-12 age to improve land and water performance.

Conflict of interest

The authors have no conflicts of interest to declare.

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