Journal of Education and Learning; Vol. 9, No. 1; 2020
ISSN 1927-5250 E-ISSN 1927-5269
Published by Canadian Center of Science and Education

The Effects of 6-Week Core Training on Selected Biomotor Abilities in Soccer Players

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Received: October 21, 2019 Accepted: December 2, 2019 Online Published: January 6, 2020

doi:10.5539/jel.v9n1p99 URL: https://doi.org/10.5539/jel.v9n1p99

Abstract

This study aims to analyze the effects of 6-week core training on certain biomotor abilities for footballers in the pubertal period. Accordingly, 30 male footballers who attend football courses regularly participated in the study. Footballers were divided into two groups; 15 of them were assigned to the Core Training Group (CTG) (age: 9.73 years; height: 139 cm; and body weight: 33.66 kg.) while 15 of them were assigned to the Conventional Training Group (CONTG) (age: 10.06 years; height: 139 cm; and body weight: 35.32 kg). While CONTG was applying the traditional training protocol, CTG additionally applied core strength exercises (two days a week for 10-15 min.). The selected biomotor tests were applied to both groups before and after the 6-week application. Between pre- and post-test values in the CTG, a statistically significant difference was found in flamingo balance, core stabilization balance, hand grip strength, 30 sec. abdominal crunch and 30 m sprint tests ($p<0.05$). In the CONTG, a statistically significant difference was found in 30-second push-up test values between pre- and post-tests ($p<0.05$). Comparing the pre-tests between groups, a statistically significant difference was found in flamingo balance and vertical jump tests ($p<0.05$). Also, comparing the post-tests, a statistically significant difference was found in core stabilization balance and vertical jump tests ($p<0.05$).

As a result of this study, it was found that core training to be performed in addition to the traditional football training positively contributed to basic motor development.

Keywords: football, core strength, balance

1. Introduction

The human body is in physical, physiological, biomotoric and psycho-mental forms with a great balance (homeostasis) and adaptation (Aktaş et al., 2019; Çakmakçı et al., 2018). One of the most popular sports branches in Turkey and across the world, football requires high physical performance when it is played at a professional level. As it is a team and struggling sport involving control, it requires high-level sportive performance such as durability, strength, pace, and agility. Today, this requires footballers from all positions to have many motor abilities at a high level (Köklü, Özkan, Alemdaroğlu, & Ersöz, 2009; Akyüz, Uzaldi, Akyüz, & Doğru, 2016; Sevim, 2006; Tatlici & Cakmakci, 2019). In addition, it involves various complex movements within the game such as walking, jogging, dribbling with sprint, shooting, and passing (Eniseler, 1994; Boyle 2004) and these days small times make teams or players winner (Tatlıcı et al., 2018). Athletes with excellent technique and tactics can achieve success if they develop their basic motoric features systematically (Ünlü et al., 2018).

Strength is a biomotor ability determining effectiveness in sports branches. Strength is generally described as the ability to withstand resistance or the ability to endure against resistance at a certain level (Boyle, 2004). Strength and other biomotor abilities are mutually affected development processes. The level of need for strength is different for each sports branch. For children, strength exercises are generally performed by using their own body weight (Muratlı, 2007). Increasing muscular strength provides a significant advantage to athletes in almost all sports branches. Developing groups of the most commonly used muscles in a certain sports branch is the further specialization of strength. Various training methods were developed as a result of scientific research on increasing muscular strength. One of these methods is the core training method (McGill, 2010).

In addition to these physiological features, the athlete has to perfect these features through exercises (Tatlıcı et

al., 2018). Core training is among the most popular methods performed for strength training for footballers. Therefore, recently, core training has become an essential part of training programs (Riewald, 2003). As core muscles are located at the center of the body, they play an active role in most of the body movements (Sato & Mokha, 2009). The core area involves fore body muscles, back body muscles, upper body diaphragm, and lower body pelvic floor muscle, and when this area is strong, it prevents the formation of posture disorders by protecting spine (Handzel, 2003; Schiffer, Schulte, & Sperlich, 2008).

The core area involves abdomen, lower back, and hips. In addition, the core area is described as the area between the rib CTGe and kneels (Saeterbakken, Tillaar, & Seiler, 2011). According to another description, lumbopelvic hip complex is regarded as the core (Bergmark, 1989; McGill, Grenier, Kavcic, & Cholewicki, 2003; Akyüz, Agar, Akyüz, & Dogru, 2016; Doğru, Akyüz, Akyüz, Murat, Çoban, & Dilber, 2018; Akyüz, Çoban, Dilber, Ergün, Murat, Özkan, & Akyüz, 2016). According to a newer approach, the core concept is described as a training specially designed for muscle activity and integrity of muscle groups forming the body, supporting and wrapping the spine, and playing an active role in upper extremity strength transitions (Parkhouse & Ball, 2011; Stanton, Reaburn, & Humphries, 2004). Core training is a training program enabling strength development of muscles in the lumbopelvic hip area involved in core stability through movements performed with body weight (Akman, Kabadayı, Elioz, Cilhoroz, & Akyol, 2013; Clark, 2001). Core training is usually preferred for developing balance, strength, anatomic function and flexibility (Sun, Gao, Dou, & Tang, 2016). Core training supports neural adaptation while leading to positive structural change in muscles. Furthermore, core training improves core stability and strength by developing proprioceptive senses and providing muscular improvement and body control (Iacono, Martone, Alfieri, Ayalon, & Buono, 2014). Core strength and core stabilization have different meanings. Core stabilization is described as the stabilization of the spinal column through the activation of core muscles while core strength means the strength generated by the contraction of core muscles and the help of internal abdominal pressure (Faries & Greenwood, 2007). A developed core area enables athletes to withstand training load further. It enables athletes to perform technical movements more efficiently. Thus, core area muscles constitute the strength dynamics of the body. Core muscles may not generate strength as high as certain muscles in other parts of the body do, however, during a sportive activity, they play an important role in transferring the power. Core training develops body control and balance. These applications enable the strength development of major and minor muscle groups. Therefore, core training reduces the possibility of injury (Imai, Kaneoka, Okubo, & Shiraki, 2014).

Upper extremity muscles in the core area are an effective factor in struggling during a football play (Handzel, 2003; Schiffer, Schulte, & Sperlich, 2008). The more the core area is developed, the more driving muscle strength of the upper extremity increases (Saeterbakken, Tillaar, & Seiler, 2011; Afyon, 2014). For young footballers, in addition to basic training, the emphasis is placed on core strength training to balance extremity strength (Dello Iacono, Padulo, & Ayalon, 2016). Abdominal crunch and push-up tests are used for muscle strength measurements of the abdominal area as it is the upper extremity and core area for athletes (Biçer, Savucu, Kutlu, Kaldırımcı, & Pala, 2004).

As a result of the literature review, it can be said that core training has various effects on certain biomotor abilities. Therefore, adding core training to footballers' annual training program positively affects performance. The aim of this study was to analyze the effect of a 6-week core training on selected biomotor abilities for male footballers in the pubertal period.

2. Material and Method

2.1 Participants

Thirty athletes who regularly play football at Burdur Fenerbahçe Futbol Okulu and Isparta Altınordu Futbol Okulu participated in this study. The athletes were divided into two groups; 15 of them were assigned to the Conventional Training Group (CONTG) while the other 15 were assigned to the Core Training Group (CTG). Physical characteristics of the athletes are given in Tables 1 and 2.

Table 1. Physical characteristics of the athletes in conventional training group and core training group

	N	Minimum	Maximum	Mean	SD
CTG					
Age (year)	15	9.00	11.00	9.73	.59
Sports Age (year)		1.00	1.00	1.00	.00
Height (cm)		129.00	147.00	139.00	6.17
Body Weight (kg)		26.00	46.00	33.66	5.83
Body Mass Index (kg/m²)		14.50	23.80	17.34	2.77
CONTG					
Age (year)	15	9.00	11.00	10.06	.79
Sports Age (year)		1.00	1.00	1.00	.00
Height (cm)		128.00	148.00	139.40	5.88
Body Weight (kg)		26.50	48.00	35.32	5.80
Body Mass Index (kg/m²)		15.30	24.80	18.24	2.84

2.2 Procedure

Training programs were divided into two as CTG and CONTG. The total duration of the training applied to both groups were equal.

Core Training group: In addition to the Conventional Training Group program (Table 3), the core strength movements in Table 2 were applied to CTG for approximately 15 minutes per session on an artificial turf football field twice a week for 6 weeks.

Traditional Training Group: The training program shown in Table 3 was applied to CONTG for 60-75 minutes on an artificial turf football field twice a week for 6 weeks.

Core Training Program: In this training program, 10 movements particular to the core area was adopted (One Side Plank, Elbow Plank, V Crunch, Leg Drops/Leg Raise, Mountain Climbers, Scissor Kicks, Squat, Alternate Superman, Glute Bridge, Hip Extension). Before the training, general and special warm-ups appropriate for the movements were performed for 15–20 min. The movements were applied with pyramidal method and intervals appropriate for loads were given. In the core training program, for certain movements, the ever-increasing loads principle is adopted as well as linear increasing in duration and repetition number.

Table 2. 6-week core training program

Movements	1–2 Weeks Duration/Repetition	3–4 Weeks Duration/Repetition	5–6 Weeks Duration/Repetition
One Side Plank	25 sec. *2 Rep.	30 sec. *2 Rep.	35 sec. *3 Rep.
Elbow Plank	25 sec. *2 Rep.	30 sec. *2 Rep.	35 sec. *3 Rep.
V Crunch	25 sec. *2 Rep.	30 sec. *2 Rep.	35 sec. *3 Rep.
Leg Drops/Leg Raise	25 sec. *2 Rep.	30 sec. *2 Rep.	35 sec. *3 Rep.
Mountain Climbers	15 sec. *2 Rep.	20 sec. *2 Rep.	25 sec. *3 Rep.
Scissor Kicks	25 sec. *2 Rep.	30 sec. *2 Rep.	35 sec. *3 Rep.
Squat	20*2 Rep.	25*2 Rep.	30*3 Rep.
Alternate Superman	25 sec. *2 Rep.	30 sec. *2 Rep.	35 sec. *3 Rep.
Glute Bridge	25 sec. *2 Rep.	30 sec. *2 Rep.	35 sec. *3 Rep.
Hip extension	25 sec. *2 Rep.	30 sec. *2 Rep.	35 sec. *3 Rep.

Table 3. 6-Week traditional football training program

Weeks	Drills
1st Week	
Saturday	Warmup+Drill1+Small-sided Game+Stretching
Sunday	Warmup+Drill2+Small-sided Game+Stretching
2nd Week	
Saturday	Warmup+Drill3+Small-sided Game+Stretching
Sunday	Warmup+Drill4+Small-sided Game+Stretching
3rd Week	
Saturday	Warmup+Drill5+Small-sided Game+Stretching
Sunday	Warmup+Drill6+Small-sided Game+Stretching
4th Week	
Saturday	Warmup+Drill1+Small-sided Game+Stretching
Sunday	Warmup+Drill2+Small-sided Game+Stretching
5th Week	
Saturday	Warmup+Drill3+Small-sided Game+Stretching
Sunday	Warmup+Drill4+Small-sided Game+Stretching
6th Week	
Saturday	Warmup+Drill5+Small-sided Game+Stretching
Sunday	Warmup+Drill6+Small-sided Game+Stretching

Drill 1: Footballers are divided into four groups, facing each other in pairs. One of the pairs goes forward and the other pair goes across, they make a controlled pass at first and then they continue to make a one-touch pass.

Drill 2: When the football coach gives a color instruction, the footballer standing on the balls of his feet within the center circle touches the cones and comes back to the center circle and returns his standby position on the balls of his feet until the next color instruction. After 3–5 instructions, the footballer controls the pass he receives from another footballer getting in line with the ball next to the goal post and makes an instep drive and gets back in the line. The footballers passing the ball goes to the center circle.

Drill 3: The footballers getting in line against the cones run without the ball until the cones as the football coach gives instruction and make a turn from the cone, then control the pass he receives from the footballer behind him and get back in the line. In another drill, with the pass he receives from the footballer behind him, he gets back in the line on his right side.

Drill 4: After divided into two equal groups, between two cones, the footballer from the first group leaves the pass he receives from the second group with a one-touch pass to the footballer behind him from the first group and makes his turn. Then, he shoots the ball in front of him to the goal post.

Drill 5: The footballers dribble randomly in the area within four cones, as the football coach gives an instruction, they dribble until the lines on the right and left side and come back to the area where they start. The group is divided into two teams and they continue dribbling. The team that comes back to the area the latest after the football coach gives an instruction are asked to perform a pre-defined punishment.

Drill 6: As the football coach gives an instruction, the footballers at the stairs start to climb up. When they finish climbing up, they get ahead of the cone and make a turn with the pass from the next footballer and shoot the ball to the goal post.

2.3 Data Collection Tools and Procedure

2.3.1 Vertical Jump Test

Takei jump meter was attached to the abdominal area of the athlete. With arms free and two feet within a determined area, the footballer was asked to jump vertically and land within a determined area. The third round was performed and the highest value in cm was recorded.

2.3.2 Push-Up and Abdominal Crunch Test

The athletes were asked to lie flat with hands at sides, body stretched, feet adjacent, and supported by an assistant at their feet. The athletes were asked to curl up their body and then repeat the movement.

Athletes' repetition numbers were recorded. Measurement of push-up movement was performed in the push-up position. Arms are bent at elbows, the body is lowered and pushed up, and the number of repetitions achieved within 30 sec. was recorded (Biçer, Savucu, Kutlu, Kaldırımcı, & Pala, 2004).

2.3.3 The 30-Meter Sprint Test

Before the run, the athletes were asked to take the running position. When they felt ready, they started to run and kept running at maximal speed for 30 m. The data obtained were recorded in seconds and split seconds.

2.3.4 Core Stabilization Performance Test

The protocol developed by Mackenzie (2005) was used for the measurement. Validity and reliability (95%, 0.94–0.99) analysis of the test (Sport-Specific Core Muscle Strength & Stability Plank Test) were made by Tong et al. (2013). This test is used for observing the core strength and stability development of athletes. The test requires a flat floor, mat, stopwatch and an assistant. Duty of the assistant is to warn the athlete for the next movement. During the test, back and neck position should be flat and parallel to the floor. If the athlete breaks this position, the test is stopped (Mackenzie, 2005). Duration of the test is 180 sec.

2.3.5 Back Strength Test

The athletes placed their feet on Takei dynamometer bench with knees and arms stretched, back flat and body slightly bent further. They were asked to pull the dynamometer bar they grip with their hands by using their back muscles vertically at a maximum level (Boyle, 2004).

2.3.6 Leg Strength Test

After the athletes placed their feet on Takei dynamometer bench with arms stretched, back flat, legs bended at knee, and body slightly bended further, they were asked to pull up the dynamometer bar they grip with their hands by only using their legs and not their back until the knees reach the extension (Muratlı, 2007).

2.3.7 Flamingo Balance Test

Footballers were asked to step up onto a balance board (50 cm. length, 4 cm. height, 3 cm. width) and stand in balance for 1 min. When the balance was broken (drops foot, falls foot from the bench, contacts floor with any part of the body, etc.), the time was stopped. The time was resumed when the athlete got back his balance by stepping up onto the balance bench. The test continued as such for one minute. When the time was up, each balancing attempt (after falling) by the research group was counted and this number was recorded as score when the one-minute time was up after the test was completed (Hazar & Taşmektepligil, 2008).

2.3.8 Long Jump with Pause Test

At the back of the start line, with toes out front the line, arms free, the athletes were asked to jump to the farthest point they can, and the measurement was made from the point the sole of their feet touched the ground. Each athlete performed the test twice and the best performance achieved was recorded in sec. (Baechle & Earle, 2008).

2.3.9 Right- and Left-Hand Grip Strength Test

In the study, Takei hand dynamometer grip was used for the measurement. The measurement was recorded with the athlete standing in anatomical position. The athlete took the dynamometer in the hand he preferred. Later, the same procedure was repeated for the other hand. The procedure was repeated three times and the best value was recorded in kg (Muratlı, 2007).

2.4 Data Analysis

Descriptive statistical values including arithmetic mean and standard deviation ($x \pm SD$) were calculated for all variables. Shapiro-Wilk normality test was used to determine whether the data showed normal distribution. The Paired t-Test was used to determine whether the changes over time in the variables recorded during the different measurement periods (pre-test, post-test) in the CTG and CONTG were different.

In addition, differences between CTG and CONTG for each measurement period were evaluated by the independent-samples t-test. Statistical procedures were performed in SPSS package software and α=0.05 error level were applied to all statistical procedures

3. Result

Table 4. Comparison of pre-test and post-test for conventional training group and core

	Protocol	Test Order	Mean	SS	T	P
Flamingo Balance Test (Error hit)	CTG	Pre-Test	14.463	4.202	5.652	.000*
		Final Test	7.264	5.061		
	CONTG	Pre-Test	5.931	4.182	.871	.391
		Final Test	5.332	5.102		
Core Stabilization Balanca Test (sec.)	CTG	Pre-Test t	80.401	26.421	-6.562	.000*
		Final Test	132.661	37.903		
	CONTG	Pre-Test	95.603	48.792	-.053	.953
		Final Test	96.001	43.473		
Back Strength Testi (kg)	CTG	Pre-Test	52.001	10.431	-.612	.552
		Final Test	52.701	10.801		
	CONTG	Pre-Test	95.602	12.502	-.443	.661
		Final Test	90.112	11.951		
Leg Strength Test (kg)	CTG	Pre-Test	46.961	11.413	-.322	.752
		Final Test	48.083	18.611		
	CONTG	Pre-Test	52.001	15.151	-1.431	.173
		Final Test	53.602	15.952		
Long Jump with Pause Test (cm)	CTG	Pre-Test	149.401	15.041	.353	.722
		Final Test	148.732	12.713		
	CONTG	Pre-Test	145.261	12.391	-.152	.873
		Final Test	145.463	13.261		
Vertical Jump Test (cm)	CTG	Pre-Test	26.662	5.811	-1.673	.112
		Final Test	28.801	6.381		
	CONTG	Pre-Test	35.932	6.461	.442	.663
		Final Test	35.603	5.573		
Right-Hand Grip Test (kg.)	CTG	Pre-Test	12.122	3.392	-2.263	.044*
		Final Test	12.312	2.942		
	CONTG	Pre-Test	12.641	3.573	.402	.692
		Final Test	12.513	3.882		
Left-Hand Grip Test (kg.)	CTG	Pre-Test	11.924	2.951	-2.673	.012*
		Final Test	12.592	3.291		
	CONTG	Pre-Test	11.352	3.101	-1.291	.214
		Final Test	11.763	3.792		
30 sn. Crunch Test (Repetitions)	CTG	Pre-Test	12.802	2.881	-7.753	.000*
		Final Test	18.533	3.522		
	CONTG	Pre-Test	14.662	5.991	-1.731	.103
		Final Test	17.132	6.581		
30 sn. Push-up Test (Repetitions)	CTG	Pre-Test	11.601	4.462	-1.112	.282
		Final Test	13.402	6.042		
	CONTG	Pre-Test	11.803	4.373	-3.821	.000*
		Final Test	16.462	3.312		
30 m. Sprint Test (sec.)	CTG	Pre-Test	5.531	.351	-2.353	.033*
		Final Test	5.562	.362		
	CONTG	Pre-Test	5.281	.413	-1.872	.082
		Final Test	5.372	.461		

Note. P<0.05.

In this study, as a result of pre-test and final test comparisons, a statistically significant difference was found in flamingo balance, core stabilization balance, right and left-hand grip, 30-second abdominal crunch and pace test for CTG ($p<0.05$) while a statistically significant difference was found in 30-second push-up test for CONTG ($p<0.05$).

Table 5. Intergroup comparison in different measurement periods (pre-test – post-test)

	Test Order	Protocol	Mean	SS	T	P
Flamingo Balance Test (Error hit)	Pre-Test	CTG	14.462	4.201	5.572	.000*
		CONTG	7.261	5.062		
	Final Test	CTG	5.932	4.181	1.041	.301
		CONTG	5.331	5.103		
Core Stabilization Balanca Test (sec.)	Pre-Test	CTG	80.402	26.422	-1.063	.292
		CONTG	132.661	37.903		
	Final Test	CTG	95.602	48.792	2.462	0.21
		CONTG	961	43.473		
Back Strength Testi (kg)	Pre-Test	CTG	52.002	10.432	1.443	.152
		CONTG	52.701	10.801		
	Final Test	CTG	95.602	12.504	1.494	.453
		CONTG	90.001	11.953		
Leg Strength Test (kg)	Pre-Test	CTG	46.962	11.412	-1.022	.312
		CONTG	48.081	18.613		
	Final Test	CTG	52.002	15.154	-.872	.381
		CONTG	53.601	15.953		
Long Jump with Pause Test (cm)	Pre-Test	CTG	149.403	15.042	.823	.413
		CONTG	148.731	12.714		
	Final Test	CTG	145.263	12.393	.692	.492
		CONTG	145.262	13.262		
Vertical Jump Test (cm)	Pre-Test	CTG	26.661	5.814	-4.123	.000*
		CONTG	28.803	6.382		
	Final Test	CTG	35.931	6.463	-3.102	.043*
		CONTG	35.602	5.572		
Right-Hand Grip Test (kg.)	Pre-Test	CTG	12.123	3.393	-.403	.682
		CONTG	12.312	2.942		
	Final Test	CTG t	12.641	3.571	.632	.533
		CONTG	12.513	3.881		
Left-Hand Grip Test (kg.)	Pre-Test	CTG	11.921	2.953	.513	.612
		CONTG	12.593	3.292		
	Final Test	CTG	12.641	3.571	.632	.521
		CONTG	11.763	3.792		
30 sn. Crunch Test (Repetitions)	Pre-Test	CTG	12.802	2.881	-1.083	.281
		CONTG	18.533	3.522		
	Final Test	CTG	14.661	5.991	.723	.473
		CONTG	17.133	6.583		
30 sn. Push-up Test (Repetitions)	Pre-Test	CTG	11.601	4.461	-.112	.902
		CONTG	13.403	6.042		
	Final Test	CTG	11.801	4.371	-1.723	.091
		CONTG	16.462	3.312		
30 m. Sprint Test (sec.)	Pre-Test	CTG	5.533	.351	1.732	.093
		CONTG	5.562	.362		
	Final Test	CTG	5.283	.411	-1.201	.212
		CONTG	5.372	.463		

Note. P<0.05.

When the pre-test results of CTG and CONTG were compared, a statistically significant difference was found in flamingo balance and vertical jump tests ($p<0.05$). When the final tests were compared, a statistically significant difference was found in core stabilization and vertical jump tests ($p<0.05$).

4. Discussion and Conclusion

This study aimed to analyze the effect of a 6-week core training on certain biomotor abilities for footballers in the pubertal period. Many research on developing core strength for achieving sportive success was found in the literature. Findings obtained in this research was in line with the relevant literature.

Balaji and Murugavel (2013) have reported that the sprint performance essential for footballers developed positively with core training. Boyacı and Afyon (2017) found that 12-week core training developed footballers' 20 m. sprint, vertical jump, and long jump with pause performances, and abdominal crunch and push-up values

of footballers showed progress after core training. Furthermore, this can trigger a performance increase for 12–14 year-old footballers as they are in puberty period. In the study carried out by Afyon and Boyacı (2014) on sedentary groups and footballers, it was found that core training improves push-up and abdominal crunch performances, contributes to muscle durability considerably, and balance parameters can be improved with core training. Suna and Alp (2019) reported that the difference in push-up values in their study. Researchers emphasized that values found were higher may be due to the fact those participants apply the trainings more. In the study analyzing the effect of eight-week core training on certain physical and physiological parameters for footballers, Doğan et al. (2016) applied core training program in addition to the 8-week training for core training group while the control group was asked to continue conventional training only. When pre-test and final test values were compared for the control group, a significant improvement was found in body weight index, body weight, vertical jump, leg and back strength values. However, when the differences between the groups were evaluated, it was found that flexibility, leg and back strength, 20-meter-pace and VO2max parameters of the core training group showed progress further. Parkhouse et al. (2011) have reported that 6-week static core training for footballers improved their 20-meter sprint performance.

Boyacı and Tutar (2018) have reported that the Quad-Core training program procedure they applied on child athletes improved core muscle strength and durability. In the study where a core training program was applied, Carpes et al. (2008) found that core training improved the back and leg strength when performed regularly. In the study where the effect of core training applied regularly on male high school students was analyzed, Tokgöz (2017) have reported that the back and leg strength of the children performing core training regularly showed progress positively. Cosio-Lima et al. (2003) found that back strength showed progress as a result of 5-week-core training program they applied to the research group. Casio-Lima et al. (2003) applied core stability strength training and achieved a higher change and significant result in knee flexion and extension strengths when compared to the control group which performed no training. Reed et al. (2012) evaluated 24 different experimental studies in their compilation study discussing the effects of core stability training on athlete performance. The study revealed that there was a significant relationship between core stability and athlete performance. Sekendiz et al. (2010) found that core training applied with swiss-ball improved the back strength. Tamer et al. (2018) have reported that the athletes' aerobic power (MaxVO2) and 10–30 m. sprint abilities showed progress as a result of an 8-week exercise program. Kibler et al. (2006) have reported that core muscles provide stability to the abdomen, back, spine and hip. Furthermore, scientific studies have shown that core muscles played an effective role in generating the strength needed to perform the rotational movement between the hips and back. Schiffer et al. (2008) found that core training has a positive effect on vertical jump performance. Also, Sato and Mohka (2009) have reported that core exercises have a positive effect on balance performances. Baydemir and Alp (2018) found significant differences in balance tests in soccer players. Kean et al. (2006) found that core training enables abdominal muscle activation. İmai et al. (2014) have reported that core training developed the control and balance the ability of the body and played an effective role for muscles to gain strength. Prieske et al. (2015) have stated that a 9-week core training applied additionally in their study positively contributed to 10–20 m. sprint performances.

Axel (2013) applied an 8-week core training to 19 surfers with an average age of was 15 years. It was found that the surfers developed their strength, balance, and agility abilities. In the study on baseball players, Lust et al. (2009) analyzed the difference between the core training group and the group that did not perform core training and revealed that the core training group made progress in the Sorensen and side bridge test. Samson (2005) applied core training to 13 tennis players (average age: 20) three days a week for 30 minutes and discussed the relationship between training and dynamic balance. As a result of the study, a significant difference was found in certain physical parameters. Weston et al. (2013) carried out an experimental study on 32 golf players (club players) to analyze core training. The experimental group carried out an 8-week training program consisting of basic level core exercises in addition to their routine training and the measurements were made for Backspine, Sidespine, pace, and core durability. As a result of the study, it has been reported that there was a significant difference in the measured abilities and the training program was successful.

Aiming to reveal the effects of core training program applied with body weight in addition to the annual training program of the footballers in puberty period, this study showed that the core training applied was an effective method for developing basic biomotor abilities. Football managers and athletic performance coaches working with youth teams in football clubs are advised to add core training exercises to their annual training program.

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