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Effect of Core Training Program on Physical Functional Performance in Female Soccer Players

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Abstract

The purpose of this study was to determine the effect of core training program on speed, acceleration, vertical jump, and standing long jump in female soccer players. A total of 40 female soccer players volunteered to participate in this study. They were divided randomly into 1 of 2 groups: core training group (CTG; n = 20) and control group (CG; n = 20). The mean (SD) age was 19.05 ± 1.15 years, height was 160.60 ± 4.22 cm, weight was 56.45 ± 3.33 kg, and sport age was 4.50 ± 1.24 for the core training group; the mean (SD) age was 18.55 ± 0.76 years, height was 159.10 ± 3.86 cm, weight was 52.20 ± 3.60 kg, and sport age was 3.35 ± 0.75 years for the control group. Following randomization, the 2 groups did not differ significantly ($p>0.05$) in any of the dependent variables. The subjects in the control group did not participate in the training and participated only in the pre- and posttest measurements. To evaluate the effect of core training over the functional performance, we applied a testing procedure that included measurements of speed, acceleration, vertical jump, and standing long jump. The core training group showed a 3.4%, 5.9%, 13.3%, 4.2% improvement in speed, acceleration, vertical jump, and standing long jump (respectively) ($P<0.05$), whereas the control group did not change ($P>0.05$). In conclusion, Core exercises were improved speed, acceleration, vertical jump, and standing long jump in 18-19 years-old female soccer players. Therefore, it is believed core training is necessary for optimal sport performance and should not be dismissed for all sport branches.

Keywords: core, speed, acceleration, vertical jump, standing long jump

1. Introduction

Soccer has had a significant place in Turkish Society as in many societies, and become an indispensable part of our daily life. Its extreme popularity and its appealing to many lead people to be interested in soccer more than other branches of sport. However, the high interest of people on this sport accompanies competition element. Pursuant to the competition element, the thought that soccer players come to one step ahead of their rivals reveals the importance of various training exercises improving sport performance and accordingly their different applications. The main factor affecting soccer players' performance is physical features because physical characteristics have an important place on demonstrating physiological capacity. As physical characteristics become an integral part of demonstrating performance elements such as strength, speed, endurance, and quickness, they are also significant components in practicing high sport performance (Açıkada, 1990). During a match in soccer, constantly changing sprints such as 10m-20m-30m, continuous high jumps in high-balls, and tackles based on muscles strength have been faced. This reveals the need of general aerobic endurance. In term of aerobic endurance improvement and exercises improving performance, arm, leg, and core exercises are significantly required (Çimen & Günay, 1996). Core exercises are training exercise programs which soccer players practice through their own body weight or assistive tools and which aim the development of central muscles' strength that balance posture (Atan et al., 2013). Core practices include buttocks, back, and abdominal muscles. These muscles play important roles on transferring power between lower and upper extremities. Additionally, they help in making the aimed move easier and strongly (Handzel, 2003). Because of its effectiveness, core exercise is an indispensable training exercise in soccer as well as in other sport branches. However, there is a need for prospective researches investigating when core exercises should be applied and its effectiveness on soccer players. The purpose of this study done, to examine the impact of the functional performance of the 8-week core training program, which will be applied to young woman.

2. Methods

The participant profile of this study has consisted of 40 volunteer female soccer player, who have played as amateur in school indoor soccer team at least for three years. As the half of them was studied as training group, the other half was the control group of the research. Before the measurement, the subjects were informed about the measurement protocols and they were asked not to consume energizing drinks, alcohol, and etc.

2.1 Height and Weight Measurement

Height measurement was taken according to the measurement technique through stadiometre (SECA, Germany) which has 0.01 m degree of precision. The body weight of the subjects was measured through an electronic scale that has 0.1 kg degree of precision (Gordon et al., 1988).

2.2 Standing Long Jump Test

Without speeding, the subject was asked to practice long jump in the stop-standing position by interconnecting double legs. After the long jump, the distance between the jump-off point and the latest track point were measured in cm. The subjects were tested twice and the best result was recorded (Gordon et al., 1988).

2.3 10 and 30 Metre Speed Test

The measurement was taken in a 45 m indoor running track. The running time of the subjects was measured through a new test, Finland-brand stopwatch with photocell, which was established between 0-10 m and 0-30 m. The best result from three experiments was recorded. Between experiments, the subjects were given two minutes for the rest time (Açıkada, 2008).

2.4 Vertical Leap

In this test, Takai-brand jump metre was used. In the test aiming to determine explosive force, the subjects practiced a full jump upward by positioning their knees in 90^0 flexion squat and placing their hands on their waist. Test was repeated three times and the best value was recorded (Açıkada, 2008). Between each experiment, the subjects were given two minutes for the rest time.

2.5 Overview of Core Training

The core training program in this study was prepared in the light of the researches by Sato and Mokha (2009) and Brungardt et al. (2006). In the training program that lasted eight weeks as three days in a week, exercises were planned from easy to hard. Details about the core training program are shown in Chart 1 (Harman & Garhammer, 2008).

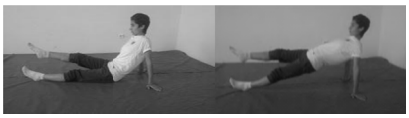
Table 1. The exercises were labeled as weekly with numbers and names through the core training

Weeks	Monday		Wednesday		Friday	
	Exercise 1	2x25 sn	Exercise 1	2x25 sn	Exercise 1	2x25 sn
1	Exercise 2,3,4,5	2x10 repeat	Exercise 2,3,4,5	2x10 repeat	Exercise 2,3,4,5	2x10 repeat
	Exercise 9,10	10 m	Exercise 9,10	10 m	Exercise 9,10	10 m
	Exercise 1	2x25 sn	Exercise 1	2x25 sn	Exercise 1	2x25 sn
2	Exercise 2,3,4,5.6	2x10 repeat	Exercise 2,3,4,5.6	2x10 repeat	Exercise 2,3,4,5.6	2x10 repeat
	Exercise 9,10 ,11	12 m	Exercise 9,10 ,11	12 m	Exercise 9,10 ,11	12 m
	Exercise 1	2x25 sn	Exercise 1	2x25 sn	Exercise 1	2x25 sn
3	Exercise 2,3,4,5.6,7	2x10 repeat	Exercise 2,3,4,5.6,7	2x10 repeat	Exercise 2,3,4,5.6,7	2x10 repeat
	Exercise 9,10 ,11	15 m	Exercise 9,10 ,11	15 m	Exercise 9,10 ,11	15 m
	Exercise 1	2x30 sn	Exercise 1	2x30 sn	Exercise 1	2x30 sn
4	Exercise 2,3,4,5.6,7.8	2x12 repeat	Exercise 2,3,4,5.6,7.8	2x12 repeat	Exercise 2,3,4,5.6,7.8	2x12 repeat
	Exercise 9,10 ,11	20 m	Exercise 9,10 ,11	20 m	Exercise 9,10 ,11	20 m
	Exercise 1	2x30 sn	Exercise 1	2x30 sn	Exercise 1	2x30 sn
5	Exercise 2,3,4,5.6,7.8	2x12 repeat	Exercise 2,3,4,5.6,7.8	2x12 repeat	Exercise 2,3,4,5.6,7.8	2x12 repeat
	Exercise 9,10 ,11,12	20 m	Exercise 9,10 ,11,12	20 m	Exercise 9,10 ,11,12	20 m
	Exercise 1	2x35 sn	Exercise 1	2x35 sn	Exercise 1	2x35 sn
6	Exercise 2,3,4,5.6,7.8	2x15 repeat	Exercise 2,3,4,5.6,7.8	2x15 repeat	Exercise 2,3,4,5.6,7.8	2x15 repeat
	Exercise 9,10 ,11,12	25 m	Exercise 9,10 ,11,12	25 m	Exercise 9,10 ,11,12	25 m
	Exercise 1	2x35 sn	Exercise 1	2x35 sn	Exercise 1	2x35 sn
7	Exercise 2,3,4,5.6,7.8	2x15 repeat	Exercise 2,3,4,5.6,7.8	2x15 repeat	Exercise 2,3,4,5.6,7.8	2x15 repeat
	Exercise 9,10 ,11,12	25 m	Exercise 9,10 ,11,12	25 m	Exercise 9,10 ,11,12	25 m
	Exercise 1	2x40 sn	Exercise 1	2x40 sn	Exercise 1	2x40 sn
8	Exercise 2,3,4,5.6,7.8	2x15 repeat	Exercise 2,3,4,5.6,7.8	2x15 repeat	Exercise 2,3,4,5.6,7.8	2x15 repeat
	Exercise 9,10 ,11,12	30 m	Exercise 9,10 ,11,12	30 m	Exercise 9,10 ,11,12	30 m

Exercise 1

Exercise 2

Exercise 3



Exercise 4

Exercise 5

Exercise 6

Exercise 7

Exercise 8

Exercise 9

Exercise 10

Exercise 11

Exercise 12

2.6 Statistical Analysis

The SPSS statistical program (version 15.0) was used for data analysis. Standard statistical methods were used for the calculation of means and SD. The Kolmogorov-Smirnov test was used to determine if dependent variables were normally distributed. The Levene test was used to determine if there was homogeneity of variance. Paired t-tests were used to determine significant differences over time for each dependent variable. Unpaired t-tests were used to compare the core training and control groups. For all analyses, the criterion for significance was set at an alpha level of $p = 0.05$.

3. Findings

Table 2. Data summary for the physical characteristics in core training group and control group

Variables	Core training group (N=20)	Control group (N=20)
	Mean ± SD	Mean ± SD
Age (year)	19.05±1.15	18.55±0.76
Height (cm)	160.60±4.22	159.10±3.86
Body weight (kg)	56.45±3.33	52.20±3.60
Sport age (year)	4.50±1.24	3.35±0.75

As shown in Table 2, the mean (SD) age is 19.05±1.15 (years), height is 160.60±4.22 (cm), body weight is 56.45±3.33 (kg), and sport age is 4.50±1.24 (years) for the core training group; the mean (SD) age is 18.55±0.76 (years), height is 159.10±3.86 (cm), body weight is 52.20±3.60 (kg), and sport age is 3.35±0.75 (years) for the control group.

Table 3. Data summary for the dependent variables core training group and control group

Variables		Core training group	Control group
		Mean ± SD	Mean ± SD
Speed (sn)	Pretraining	5.26±0.19	5.25±0.18
	Posttraining	5.08±0.13	5.28±0.18
Acceleration (sn)	Pretraining	2.17±0.12	2.17±0.14
	Posttraining	2.04±0.07	2.17±0.13
Vertical jump (cm)	Pretraining	38,20±3.85	38.90±4.75
	Posttraining	43.30±2.49	38.85±3.95
Standing long jump (cm)	Pretraining	180.40±6.44	176.20±6.48
	Posttraining	187.95±7.96	175.90±5.17

In the pretraining in shown in Table 2, the mean (SD) speed is 5.26±0.19 (seconds), acceleration is 2.17±0.12 (seconds), vertical jump is 38.20±3.85 (cm), and standing long jump is 180.40±6.44 (cm) for the core training group; the mean (SD) speed is 5.25±0.18 (seconds), acceleration is 2.17±0.14 (seconds), vertical jump is 38.90±4.75 (cm), and standing long jump is 176.20±6.48 (cm) for the control group. İn the posttraining, the mean (SD) speed is 5.08±0.13 (seconds), acceleration is 2.04±0.07 (seconds), vertical jump is 43.30±2.49 (cm), and standing long jump is 187.95±7.96 (cm) for the core training group; the mean (SD) speed is 5.28±0.18 (seconds), acceleration is 2.17±0.13 (seconds), vertical jump is 38.85±3.95 (cm), and standing long jump is 175.90±5.17 (cm) for the control group.

Table 4. Comparison of the pretraining–posttraining relative dependent variables with respect to core training group and control groups

Variables		Core training group			Control group		
		Different Mean ± SD	T	P	Different Mean ± SD	T	P
Speed (sn)	Pretraining–posttraining	0.18±0.13	6.346	0.000*	-0.03±0.08	1.555	0.137
Acceleration (sn)	Pretraining–posttraining	0.13±0.10	5.952	0.000*	-0.01±0.06	0.400	0.694
Vertical jump (cm)	Pretraining–posttraining	-5.10±1.83	12.447	0.000*	0.05±1.82	0.123	0.904
Standing long jump (cm)	Pretraining–posttraining	-7.55±5.36	6.293	0.000*	0.30±3.57	0.376	0.711

*P<0.05.

As shown in Table 4, paired t-tests detected significant differences in pre- and posttests for speed, acceleration, vertical jump, and standing long jump in core training group ($p < 0.05$). On the other hand, there is no significant differences in pre- and posttests for speed, acceleration, vertical jump, and standing long jump in control group ($p > 0.05$).

Table 5. Comparison of the dependent variables in core training group and control groups

Variables	Core training group-Control group			Core training group-Control group		
	Pre training			Post training		
	Different Mean ± SE	T	P	Different Mean ± SE	T	P
Speed (sn)	0.00±0.06	0.034	0.973	-0.20±0.05	4.006	0.000*
Acceleration (sn)	0.00±0.04	0.036	0.972	-0.14±0.03	4.155	0.000*
Vertical jump (cm)	-0.70±1.37	0.512	0.611	4.45±1.04	4.259	0.000*
Standing long jump (cm)	4.20±2.04	2.036	0.052	12.05±2.12	5.676	0.000*

*P<0.05.

As shown in Table 5, there are no significant differences between core training group and control group in any of the dependent variables in pretraining (p>0.05). However, the 2 groups did differ significantly (p<0.05) in posttraining of all dependent variables.

4. Discussion and Conclusion

As happened in other sport branches, players make a great effort to outmaneuver their rivals by exhibiting an optimum performance during race in soccer. However achieving an optimum performance and to become one step further from rivals can be possible by maximizing physical features such as speed, strength, and endurance with planned training (Gençay, 2000). Recently, core training programs that drawing considerable interest, become irreplaceable part of such training programs which aim to improve the mentioned above characteristics (Riewald, 2003). The purpose of this study was to determine the effect of core training program on speed, acceleration, vertical jump, and standing long jump in female soccer players. The main result of this study supports our hypotheses. Core exercises were improved speed, acceleration, vertical jump, and standing long jump in 18-19 years-old female soccer players. The core training group showed improvement 3.4%, 5.9%, 13.3%, 4.2% in speed, acceleration, vertical jump, and standing long jump (respectively) (P<0.05), whereas the control group did not change (P>0.05).

In the research studied by Nuzzo et al. (2008), weight exercises and core training practices are compared. There is a decision like that core training programs need to be integrated with weight exercises to receive a higher level of efficiency from the target muscles of 15 aged and over people. This studied article show us that our participants has appropriate age range to measure the effects of core training programs. As examined the researches related to core training, a study by Nesser et al. (2008), which investigates the relations among core stability, strength, and power of the 1. League American soccer players, shows that there is some significant correlations among vertical jump leap, 10 yard shuttle running test, agility (pro-agility), power clean test values, and core stability values. This working group with a similar group of this study done, the players' motor performance level has been observed as a result of studying in high school core exercises done by rugby players that in positively changes (Pienaa & Coetzee, 2013). In a similar study conducted on young players, besides of regular training program the implementation of core exercises has been reported to cause positive changes to the players' performance levels of 10 and 20 m (Prieska et al., 2015). Another study which is consisted of male volleyball players demonstrates that there is a signficant difference for the benefit of training group in terms of the values from 20-30 m speed, vertical leap, right-left leg jump, 30 sn. shuttle and balance error numbers (Karacaoğlu, 2015). Mendeş (2016)'s in a study done, 6 weeks of core training program was investigated the effect on anaerobic power, speed and agility in soccer and the end of the study, the players was observed to 10 m and 20 m sprint performance value significant changes as compared to the week however ıt wasn't observe to anaerobic power and agility performance a significant changes. In a different study on core training, athletes of Muay Thai was done isometric and dynamic core exercises for 6 weeks and the comparison of the two types of exercise have been found to be more effective than isometric core exercises (Benjamin & Stuart, 2015). Core training has an important place in terms of maximizing physical characteristics of soccer players. According to Willardson (2007), the level of power generation in arms and legs of soccer players is directly proportional to the power in the core part as the result of core training exercises. Sharma et al. (2012) examined the effect of core strengthening training program on body imbalance by means of vertical jump performance and stable balance variables of volleyball players. They determined that there was a positive effect of 9-week core training program on static balance and vertical jump values. Additionally, a study on young soccer players by Aslan (2014) showed that 8-week core training program show increase in long jump performance by nondominant leg

standing and triple jump distance. Another research with swimmers revealed that there is a positive effect of core training on MaxVO2, vertical jump, right-left hand grip, leg and back strength, flexibility, balance performance (Atıcı, 2013). The results that found at the literature and the values that found in our study in accordance with each other. Because core region muscles has very important role on transferring power to extremist (Shinkle et al., 2012). Weak core muscles affect the performance negatively (Nourbakhsh & Arab, 2002). Additionally, it is observed that core exercises are effective in the recovery process after supramaximal training exercises because these exercises help that heart beat rate easily falls to the resting heart beat level (Atan et al., 2013). Consequently, there are positive impacts of the training programs on the sportive performance for core muscles and strength improvement.

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