

## Investigation of Effects Four-Week Core Training Program on Some Physical Parameters

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DOI: 10.31680/gaunjss.653699

Original Makale / Original Article

Geliş Tarihi / Received: 01.12.2019

Kabul Tarihi / Accepted: 08.02.2020

Yayın Tarihi / Published: 23.03.2020

### Abstract

In this study; It was aimed to determine the effect of the core training program applied for 4 weeks on some physical characteristics in faculty of sport science's students. A total of 23 male athletes, 19-27 age groups, who are studying at Fırat University Sports Sciences Faculty voluntarily, participated in the research group. Participants were divided randomly into two groups: training (n: 12) and control (n: 11). Body weight, Body Mass Index (BMI), dominant hand grip strength, back and leg strengths, vertical jump and 20m sprint measurements were taken before and after the four week core training program. The obtained data were analyzed using the SPSS 22 packet program and Paired Samples t test was used to determine the difference between the pre-post test and the Independent Samples t test was used to determine differences between groups. As a result of the analysis of the obtained data, there was no significant difference between the groups when the control and the training group were compared ( $p>0,05$ ). While no significant differences were found between pre-test and post-test data of control group in intra-group comparisons, it was determined that the training group had significant differences in dominant hand grip strength, back and leg strength and vertical jump values ( $p<0,05$ ), but there was no difference in sprint, body weight and BMI values ( $p>0,05$ ). As a result, it has been shown that core training which is applied for 4 weeks and 3 days a week has significant increases in back and leg strength, vertical jump and hand grip strength values. Consequently, the application of core training programs may be suggested to provide positive effects on performance and physical fitness parameters.

**Keywords:** Strength, Jump, Sprint, Core

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Authors note: This study was presented as an oral presentation in 4. International Sport Sciences, Tourism and Recreation Congress of Students, 2017 Burdur, Turkey.

## Introduction

As can be understood from the definitions of strength, a muscle or group of muscles must be contracted for the strength to occur. Muscle functions can be determined by voluntary contractions and the meaning of this contraction is actually strength (Şahin, 2008). Strength is a complex property. Therefore, in a sporty sense, strength is classified in different ways. According to the contraction of muscle, depending on the type of strength to be developed, the physiological mechanism have been made the different classifications (Bompa, 2011) Resistance exercises are usually done in strength training. In researches, the presence of strong arm, chest, back and leg muscles is considered sufficient to have a strong body. Many athletes notice the pain caused by abdominal muscles that are weakened by the cost of neglecting the abdominal and lumbar region, and injuries caused by muscle spasms. Core movements are expected to be included in training programs so that performance athletes do not encounter this situation (Karacaoglu, 2015). The core word is a word of English origin which means center. In sports sciences, the core is the midpoint of the body, including the center of gravity of the human body (Mc Gill, 2010). The core can be defined as a trunk or a region that provides the connection between legs and arms (Kibler et al., 2006). The exercise program, which is performed with the athlete's own body weight and which aims to strengthen the deep muscles responsible for stabilizing the spine and the muscle groups in the lumbopelvic region, is called core training. Core exercises teach the body muscles to control the spine during dynamic movements (Takanati, 2012). In a study conducted on this subject was investigated the effect of eight-week core training on balance and functional performance of young soccer players. As a result, it was stated that the eight-week core training program applied to the football players could improve their long jump and single triple jump performances (Aslan, 2014). In another study was investigated the effect of core training on some physical and physiological characteristics of adolescent male students. At the end of the study, there were significant differences between the pretest and posttest values of the experimental group in all parameters (back and leg strength, hand grip force, standing long jump, vertical jump) except the aerobic power and the control group had no significant difference between the pre-test and post-test values. When the two groups were compared, there was no significant difference in aerobic power values, but there were significant differences in other physical properties in favor of the experimental

group (Dedecan, 2016). Apart from physical performance, even healthy individuals need to develop a strong and stable core to help prevent injury and improve athletic performance (Riera, 2017). Core exercises have positive effects on core muscles and especially strength development (Taskin, 2016). The lower extremity and core region muscle strength is an important element for success in many competitions and sports branches for optimal performance (Axel et al., 2018).

However, well-organized core stabilization training can improve upper extremity and balance function. It may also improve the upper extremity motor function and quality of life of injury individuals (Ming, 2018). In the light of this information; the aim of this study is to determine the effect of short term core training program on some physical characteristics.

## **Method**

### ***Subjects***

The research group was formed inactive 23 male students who studying at Firat University Faculty of Sport Sciences. Students participated in the training group (mean age 22.92, height 180.33, body weight 73.41) and control group (mean age 22.82, height 179.64, body weight 73.00). Before the research, the necessary information was explained to all participants. Participants signed voluntary consent forms. The participants were randomly divided into two groups as training (n: 12) and control (n: 11). Necessary measurements were taken from the participants before and after the four-week core training program.

### ***Height, Body Weight and Body Mass Index***

*Measurement of Body Weight:* The subjects were measured with Tanita device in bare feet and in swimsuit clothes, in an upright position, motionless and without support.

*Measurement of Height:* The subjects were measured with a stadiometer with a sensitivity of 0.001 m with the head upright, eyes facing upwards and the heels adjacent.

*Body Mass Index (BMI):* Body mass index was calculated according to the formula.  $BMI = [Body\ weight\ (kg)] / [Height^2\ (m^2)]$  (Şenel and Baykal, 2017).

### *Sprint Test*

Athletes ran the specified distance (20 m) with their maximal forces. The athletes participated twice to test with a resting time of 2 minutes. Degrees were recorded in seconds with a chronometer and the best grade was evaluated (Akyüz, 2017).

### *Hand Grip Test*

The measurement was carried out with Takei brand hand grip dynamometer. The dynamometer was required to be held in a comfortable position with 90 degrees of flexion on the index finger. It is asked from the participants to squeeze the handle with all their strength for 3 seconds. The grip strength measurements of the participants were taken three times and the highest value was recorded in kilograms (kg) (Kim et al., 2018).

### *Back and Leg Strength*

Holtain dynamometer was used for back strength measurement. After placing the legs on the dynamometer stand, the volunteers performed the measurement by stretching the dynamometer bar with their hands vertically at the maximum rate, with the knees and arms stretched, the back straight and the trunk slightly tilted forward (Harbili et al., 2005). Leg strength measurement: Holtain dynamometer was used for leg strength measurement. After placing the legs on the dynamometer table with the knees (130-140°), the arms were stretched, the back straight and the trunk slightly tilted forward, with the hands grasping the dynamometer bar vertically at the maximum rate, using the legs only until the knee was come the extension. (Harbili et al., 2005).

### *Vertical Jump Test*

When the athlete was ready to use the Takei brand Jump meter with a sensitivity of 0.1 cm to distribute the weight equally with his bare foot, the degree of jumping was taken (Selçuk et al., 2018).

### *Core Training Program*

Core training program was applied to the participants in the training group for 3 days a week for 4 weeks. Participants were not taken a diet program along with the exercises. While the participants in the control group continued their sports activities for health, the athletes in the training group did additional core training program. The study included 10 different exercise patterns. Core exercise program;

15 minutes of warming, 10-14 repetitions with moderate tempo, 3 sets for each exercise and 15 minutes of cooling was done regularly.

### Statistical analysis

The data obtained were analyzed using SPSS 22 software. Mean and standard deviation were used for descriptive statistics. Paired Samples t test was used to determine the difference between pre-test and post-test, Independent Samples t test was used to reveal differences between groups. Significance was evaluated as  $p < 0.05$ .

### Results

**Table 1.** Comparison of Pre-test Values Between Groups

Variables	Groups	n	Mean	Sd	t	p
Height (cm)	Training	12	180,33	8,76	0,19	0,84
	Control	11	179,64	8,04		
Hand Grip Strength (kg)	Training	12	49,39	6,76	0,15	0,87
	Control	11	48,94	6,90		
Vertical Jump (cm)	Training	12	30,75	4,93	-0,39	0,69
	Control	11	31,55	4,63		
Back Strength (kg)	Training	12	115,12	19,56	-0,41	0,68
	Control	11	118,31	16,92		
Leg Strength (kg)	Training	12	126,62	24,26	-0,23	0,81
	Control	11	129,00	23,92		
Age (Year)	Training	12	22,92	2,23	0,11	0,91
	Control	11	22,82	1,94		
Sprint (sn)	Training	12	3,42	0,22	-0,81	0,42
	Control	11	3,50	0,27		
Body Weight (kg)	Training	12	73,41	14,62	0,06	0,94
	Control	11	73,00	14,41		
BMI	Training	12	20,24	3,13	0,01	0,98
	Control	11	20,22	3,27		

When Table 1 was examined, it was found that there was no difference between the pre-test comparisons between the groups ( $p > 0.05$ ) and that the groups were distributed normally.

**Table 2.** Comparison Pre-post Test of Control Group

Variables	Tests	Mean	Sd	t	p
Body Weight (kg)	Pre test	73,00	14,41	1,83	0,09
	Post Test	72,54	14,16		
Hand Grip (kg)	Pre test	48,94	6,90	-1,91	0,08
	Post Test	49,38	6,98		
Vertical Jump (cm)	Pre test	31,55	4,634	-1,93	0,08
	Post Test	31,82	4,687		
Back Strength (kg)	Pre test	118,31	16,92	-1,49	0,16
	Post Test	118,86	16,31		
Leg Strength (kg)	Pre test	129,00	23,92	-2,20	0,05
	Post Test	129,54	23,97		
Sprint	Pre test	3,50	0,27	-1,36	0,20
	Post Test	3,60	0,29		
BMI	Pre test	20,22	3,27	1,82	0,09
	Post Test	20,10	3,21		

When Table 2 was examined, it was found that there was no statistically significant difference between the pre-test and post-test values of the control group ( $p > 0.05$ )

**Table 3.** Comparison Pre-post Test of Training Group

Variables	Tests	Mean	Sd	t	p
Body Weight (kg)	Pre test	73,41	14,62	0,08	0,93
	Post Test	73,37	15,28		
Hand Grip (kg)	Pre test	49,39	6,76	-2,66	0,02*
	Post Test	51,80	7,64		
Vertical Jump (cm)	Pre test	30,75	4,93	-2,57	0,02*
	Post Test	35,08	6,85		
Back Strength (kg)	Pre test	115,12	19,56	-2,43	0,03*
	Post Test	120,03	18,32		
Leg Strength (kg)	Pre test	126,62	24,26	-2,86	0,01*
	Post Test	135,45	27,29		
Sprint	Pre test	3,42	0,22	-2,19	0,05
	Post Test	3,55	0,33		
BMI	Pre test	20,24	3,13	0,08	0,93
	Post Test	20,23	3,33		

\* $p < 0,05$

According to Table 3, there was a statistically significant difference in hand grip strength, vertical jump, back strength and leg strength values of the training group ( $p < 0.05$ ). There was no difference in sprint, body weight and BMI values ( $p > 0.05$ ).

## Discussion

As a result of the analysis of the data obtained in the study, no significant difference was found between the groups when the control and training groups were compared. Intra group comparisons, no significant differences were found between the pre-test and post-test data of the control group. There were significant

differences in dominant hand grip strength, back and leg strength and vertical jump values of the training group, but there was no difference in 20m sprint, body weight and body mass index values. When similar studies are examined; Atıcı (2013) has reported that there were significant differences in the hand grip, back strength and vertical jump levels of the core training program applied to women swimmers between 18-24 years of age. Similar to current research results, Karacaoglu (2015) have showed that there were significant differences in 20m sprint, vertical jump, back and leg strength values within the core training program applied on male volleyball players. Sekendiz et al. (2010) found significant increases in strength parameters as a result of core training with swiss-ball. Kim (2010) has showed that as a result of the 12-week core strength training program, significant increases in squat and back strength were determined in golf players and this increase had a positive effect on golf kicking performance. In another study, Drinkwater et al. (2007) have reported that there was an increase in leg strength after applying a core based training program on an unstable surface provided by Bosu. Marshall and Murphy (2005), swiss ball exercises applied to the core area after the leg strength test during the activation of the abdominal muscles and increased their contribution to the test results are higher. Bilici and Selçuk (2018) conducted a research on volleyball players for 10 weeks and 3 days a week. As a result, they found that vertical jump, lower and upper extremity strength improvements were achieved and body fat percentage decreased in the research group. In present study, there was no difference in body mass index. This is thought to be due to the duration of core training. In another study, Afyon et al. (2017) stated that the core training program they performed 2 days a week for 8 weeks had positive effects on strength development as in previous studies. They also stated that the core training program applied in addition to football training made significant contributions to agility and sprint performance. Similarly, Taskin (2016) has showed that sprint, acceleration and vertical jump performances were improved in core exercises performed for 8 weeks, 3 days a week. For this reason, a similar study, which states that core training is required for optimal performance in all sports branches, emphasized that it has positive results in 10 and 20 meter sprint performances (Prieska et al., 2015). In another study Sharma et al. (2012) have reported that the nine-week core exercise program positively affected the volleyball players' static balance and vertical jump performance. Doğan et al. (2016) conducted a study on football players for 8 weeks

and 2 days a week. When the pre-test and post-test values of the research group were compared, they observed a significant improvement in all parameters (leg strength, back strength, flexibility, vertical jump, VO<sub>2</sub>max with 20 m speed). As a result, they stated that core strength training had positive effects on some physical and physiological parameters. Balaji and Murugavel (2013) have stated that sprint, agility and leg strength values of handball players increased significantly with core trainings.

As a result, long-term core training program had positive results. It was found that the short-term (four weeks) core training program applied in the current study supports the results of the previous research and it creates significant increases in back and leg strength, vertical jump and hand grip strength values. Consequently, it can be suggested that core training programs, which can have positive effects on performance, health and physical fitness parameters, can be applied both for health and for optimal performance.

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