European Journal of Physical Education and Sport Science
ISSN: 2501 - 1235
ISSN-L: 2501 - 1235
Available on-line at: www.oapub.org/edu

DOI: 10.46827/ejpe.v11i7.5719 Volume 11 | Issue 7 | 2024

THE EFFECT OF DIFFERENT STRENGTH TRAINING ON ANAEROBIC POWER, SPEED AND FUNCTIONAL MOVEMENT SCREEN TEST SCORES IN YOUNG FOOTBALL PLAYERS

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Abstract:
The aim of this study is to investigate the effects of different strength training on anaerobic power, speed and functional movement screen test scores in young football players. A total of 22 male football players between the ages of 18-22 who were doing regular football training participated in the study voluntarily. Participants were divided into two different groups as experimental (n:11 age: 20.15±1.77) and control group (n:11 age: 21.47±1.96) by random method. Different strength training sessions were applied to the experimental group 3 days a week for 6 weeks. Both groups continued their regular season football training. Core training and plyometric training programs were applied to the experimental group as strength training methods. Anaerobic power, speed and functional movement screen test scores were measured before and after training. A vertical jump test was applied to measure the anaerobic power of the subjects. A 30-meter test was applied for speed. Functional Movement Screen test kit was used to measure functional movement screen test scores. The SPSS 22.0 package program was used to obtain statistical results. Shapiro-Wilk test was applied for the normality test. A Paired Samples T-test was used to compare intragroups. Independent Samples T Test was applied for statistical evaluation between groups. The significance level was determined as $p<0.05$. A positive improvement was found in the anaerobic power, speed and functional movement screen test scores of the experimental group after different strength training programs. As a result, it can be said that a 6-week different strength training program applied to young football players has a positive effect on anaerobic power, speed and functional movement screen test scores.

Keywords: football, strength training, anaerobic power, speed, functional movement screen

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1. Introduction

Football is a sport in which physical characteristics such as sprinting, changing direction, and dribbling will be repeated throughout the match (1). The important elements of successful performance for football players include strength, endurance, aerobic capacity, continuity, mobility, speed, agility, and quickness. Speed, technical-tactical and explosive power abilities are effective factors in success in football (2).

Strength is a concept that expresses the body's ability to resist internal and external resistance. This ability occurs through the interaction of the nervous and muscular systems. The peak force that an athlete can produce depends on the biomechanical characteristics of the movements and the volume of the muscles they interact with (3). Physical activity exercises that aim to keep the explosive power, speed and strength of the applied movement together are called plyometric exercises (4). Plyometric training can generally be expressed as exercises performed with body weight and using the force of gravity (5). Core training is added to the latest training planning programs and attracts great attention. Core strength exercises are known as exercises that are performed using body weight and target the strengthening of the muscles that keep the body in balance and the lumbo-pelvic muscle groups (6).

The Functional Movement Screen (FMS) test can be used to determine the potential injury risk of athletes and to increase the athletic performance of athletes (7). The purpose of the test is to determine the range and angle of motion in the joints, trunk strength, coordination, balance, flexibility, asymmetry of movement and stabilization status (8). Functional Movement Screen tests can be used as an important tool in determining potential injury risks of athletes and improving their athletic performance. This test can help optimize training programs and rehabilitation processes by providing important information about athletes' balance, flexibility and stability.

The aim of this study is to investigate the effects of different strength training on anaerobic power, speed and functional movement screen test scores in young football players and to make recommendations to athletes and coaches for training periodization in football.

2. Methods

2.1. Subjects

A total of 22 male football players between the ages of 18-22 who regularly train in football participated in our study as volunteers. The participants were randomly divided into two different groups as experimental (n:11 age: 20.15±1.77) and control group (n:11 age: 21.47±1.96). Different strength trainings were applied to the experimental group 3 days a week for 6 weeks. Both groups continued their regular in-season football training. Core training and plyometric training programs were applied to the experimental group as different strength training methods in unit training. Anaerobic power, speed and FMS

test scores were measured before and after training. Approval for our study was received from Gaziantep University, Health and Sports Sciences Ethics Committee.

2.2. Different Strength Training Programs

In our study, core and plyometric training programs for the lower and upper extremities were applied to the experimental group in addition to football training 3 days a week for 6 weeks. The control group continued their normal football training. The experimental group applied full sit-ups, cross sit-ups, crunches, drop jumps, box jumps, squat jumps, split squat jumps and overhead slam exercises as core and plyometric training. Core and plyometric training were applied as 2*12 (sets*repeats) for the first two weeks, 2*15 for the second two weeks and 3*20 for the last two weeks (9). A 60-second rest period was given between sets and 15 seconds between repetitions. The subjects were given a 10-minute warm-up period before starting their training. The subjects were informed about how to perform core and plyometric exercise movements and were motivated.

2.3. Anaerobic Power Test

The subjects' anaerobic power test measurements were made with the vertical jump test. The test was performed on a flat surface in front of a predetermined wall in cm, in a side position, and the distance the subject touched was recorded by raising his arm as high as possible. The highest level at which the subjects jumped with the help of their arms and touched the wall was measured. The distance between the subjects' first reach and jump was measured in cm. After 3 trials, the best degree was recorded. Lewis protocol was used to calculate anaerobic power (10).

2.4. 30 Meters Speed Test

The 30-meter running test, which measures speed, is a test that must be run at maximum speed. Subjects were given a 10-minute warm-up period before the 30-m sprint test. During the test, the subjects were asked to start from 1 m behind the start line and when the subject felt ready. A 3-minute rest period was given, and 2 repetitions were performed. At the end of the measurement, the best degree was recorded (10, 11).

2.5. Functional Movement Screen (FMS) Test

The FMS test consists of seven basic movement patterns: Deep squat, Hurdle step, In-line lunge, Shoulder mobility, Active straight leg raises, Trunk stability push-up and Rotary stability. The functional movement screen test was performed using a score model ranging from 0 to 3. Subjects were informed about how the test would be performed before the test. Subjects who felt pain during the tests were given zero points. Subjects who could not perform the test by following the instructions were given one point. Subjects who completed the movement incompletely were given 2 points. Subjects who performed the movement completely were given 3 points. Five of the seven basic test movements (Hurdle step, In-line lunge, Shoulder mobility, Active straight leg raises, and Rotary stability) were tested bilaterally on the right and left body. In bilateral test

measurements, if the subject received a lower score for one side of the body, this score was accepted as the result of the relevant test. The highest total FMS score that can be obtained from the test is 21 points (8, 12).

2.6. Statistical Analysis

The analysis of the statistical data of our study was performed using the SPSS program. The Shapiro-Wilk Test was applied for the normality test of the data. The Paired Samples T Test was applied for intra-group comparisons. The Independent Samples T Test was applied for statistical evaluation between groups. Statistical results were evaluated at $p<0.05$ significance levels. G Power 3.1 program was used to determine the number of subjects.

3. Results

Table 1: Anthropometric information of the experimental and control groups

Variable	Experimental Group	Control Group
	Mean±SD	Mean±SD
Age (years)	20.15±1.77	21.47±1.96
Height (cm)	174.21±2.78	175.36±2.11
Weight (kg)	69.78±2.57	70.17±2.51

Anthropometric information of the experimental and control groups is given in Table 1.

Table 2: Statistical analysis results of the experimental group (n:11)

Variable	Pre-test	Post-test	t	p
	Mean ±SD	Mean ±SD		
Anaerobic Power (kgm/sn	113.16±3.52	120.41±4.78	-5.326	**0.001***
Speed 30 m (sec)	4.77±0.23	4.28±0.19	3.543	**0.001***
Total FMS (Points/21)	16.21±2.41	19.07±1.74	-4.355	**0.001***

*p<0.05 FMS: Functional movement screen

In Table 2, after the core strength and plyometric training program was applied to the experimental group, a statistically positive significance was found in anaerobic power, speed and total FMS test scores ($p<0.05$).

Table 3: Statistical analysis results of the control group (n:11)

Variable	Pre-test	Post-test	t	p
	Mean ±SD	Mean ±SD		
Anaerobic Power (kgm/sn	114.81±3.71	115.63±2.48	-1.265	0.256
Speed 30 m (sec)	4.76±0.79	4.66±0.52	2.672	0.132
Total FMS (Points/21)	16.74±1.41	17.09±1.12	-1.245	0.252

FMS: Functional movement screen

A comparison of the pre-test and post-test measurement values of the control group is given in Table 3. No significance was found in the data of the control group (p>0.05).

Table 4: Comparison of statistical data of groups (n:22)

Variable	Experimental Group Difference	Control Group Difference	t	p
	Mean ±SD	Mean ±SD		
Anaerobic Power (kgm/sn	-7.25±4.14	-0.82±1.86	-4.175	**0.001***
Speed 30 m (sec)	0.49±0.52	0.10±0.41	2.121	**0.001***
Total FMS (Points/21)	-2.86±1.59	-0.35±0.74	-1.879	**0.001***

*p<0.05 FMS: Functional movement screen

The comparison of the data of the experimental and control groups is shown in Table 4. Significance was found in the anaerobic power, speed and total FMS test scores in favor of the experimental group among the groups (p<0.05).

4. Discussion

In our study, after the 6-week core strength and plyometric training program was applied to the experimental group, statistical significance was found in anaerobic power, speed and total FMS test scores (p<0.05). No significance was found in the data of the control group (p>0.05). In the comparison between the groups, significance was found in the anaerobic power, speed and total FMS test scores in favor of the experimental group (p<0.05).

Strength is an important factor in sports performance, and biomotor abilities are effective in sports branches. It is stated that plyometric training is important for the development of vertical jump performance, which plays an important role in the sports performance of athletes (13, 14). Football players need studies that include plyometric exercises in training planning for strength, rapid strength and explosive power during competitions and training. In recent years, plyometric training programs have been included in strength training methods (15, 16). Core strength training is an effective method for the development of diaphragm muscles and core muscles of the trunk. Core training is known to be an effective method for athletes to develop sports performance parameters such as speed, anaerobic power and balance. Core training provides an increase in muscle strength together with nerve-muscle interaction (17, 18). Anaerobic power, leg strength, speed, endurance and acceleration are important performance parameters for football players. Football is a sport that includes movements such as acceleration, speed, agility and jumping (19).

Adams *et al.* (2001) found an increase in vertical jump values as a result of plyometric exercises (20). Studies have determined that athletes' vertical jump performances have improved. (21, 22, 23). In a study conducted on athletes by Myer *et al.*, an increase in vertical jump values was found after core strength training (24). In another study, an increase in vertical jump values was found after a core strength training

program was applied to volleyball players (25). Durham *et al.* (2001) found that plyometric strength training improved vertical jump values (26). The results we found in our study are similar to the studies given in the literature. It can be said that the increase in anaerobic power values of the experimental group in our study is due to the development of muscle strength as a result of the different strength training they did.

Speed is a skill that is generally dependent on the genetic factors of the individual and can be improved (27). In a study conducted on volleyball players, a significant increase in the speed values of the experimental group was detected after a 6-week core strength training program. (28). In their study on young football players, Brull and Beltran (2021) found that 8 weeks of core training contributed significantly to the development of speed and change of direction skills (29). Slimani *et al.* (2016) found that plyometric training improved speed and agility values (30). There are studies showing that exercise programs applied to athletes have a positive effect on speed parameters (31, 32). These studies show that strength training can increase performance measures such as speed and agility.

The findings in the literature are similar to those of our study. It can be said that the significant difference in the speed values of the athletes is due to the different strength training and nerve-muscle interaction done together with the football training. It is thought that different strength training contributes to the development of the speed abilities of the athletes.

FMS is a tool used to assess functional movement capacity deficiencies and injury risk based on mobility and stability (33). The total FMS score that individuals can receive in the total FMS scoring criteria is 21 points. While a total FMS score below 14 points increases the risk of injury, the risk of injury decreases as the total FMS scores increase (34).

Kiesel *et al.* (2011) study shows that corrective exercises in addition to a normal season training program can significantly increase FMS scores. This finding suggests that it is possible to improve the functional movement abilities of athletes and increase their performance (35). Baron *et al.* (2020) study examined the functional status of young football players using selected tests of the FSM protocol and evaluated the effect of 12 weeks of functional training on speed parameters. The results of the study show that the functional status of the participants improved significantly, and there were significant increases in speed parameters (36). Goss *et al.* found improvements in FMS test scores after 6 weeks of exercise (37). Bagherian *et al.* (2018) found that the core training they applied in their research was significant in the athletes' total FMS scores and high stepping movement values (38). Linek *et al.* found that 8 weeks of stabilization exercises applied to volleyball players positively affected the total FMS scores (39). These results support the idea that regular corrective exercises performed during the season can improve FMS scores in young elite football players.

Our study is similar to the literature. It can be said that the increase in total FMS test scores in the experimental group in our study is the result of a 6-week different strength training program applied together with regular football training. It is thought

that different strength trainings in addition to in-season training in football, can increase functional mobility, improve athletic performance and provide precautions against injuries.

As a result, it can be said that 6 weeks of different strength training applied to young football players positively affected anaerobic power, speed and functional movement screen test scores. In addition to football training plans, it can be recommended that regular and planned strength training exercises be included, and different strength training programs be organized.

Conflict of Interest Statement

There are no potential conflicts of interest between the authors of this article.

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