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# The Effect of Core Strength Training on 14-Year-Old Soccer Players' Agility, Anaerobic Power, and Speed

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**Abstract:** The football players must be physically fit, technically adept, strategically well-equipped, and mentally prepared to withstand the pressures of the game. Among those essential components, physical fitness is the basis. So, coaches implemented aerobics, strength, and power training for large muscle groups. However, the core muscles, which assist maintain balance, transform stored energy into explosive strength, and enable robust kicking and leaping activities, have received little attention. The goal of this study is to investigate how core strength training improves soccer players' agility, muscular power, and speed. We utilized a true patterned experimental design and randomly selected 13 players as the control group (CG) and 13 players as the experimental group (EG). A pre-test was conducted by both groups' players (agility, anaerobic power and speed tests). In addition to the standard soccer training program, the EG was utilized for core strength training twice a week for three months, for 30 to 35 minutes each day. The coach only implemented regular soccer training on the CG. We repeated the measurements three months later on the same parameter. And agility grew considerably (MD in TT of EG was 0.738) at  $P = 0.000$ , the difference between MD in TT of CG 0.3769 at  $P = 0.005$  and MD in TT of CG 0.3769 at  $P = 0.005$  is reasonably significant. IAT's pre- and post-test mean of EG and CG do not differ significantly, other than their great improvement. However, both groups' IAT results improved significantly (MD and P value of EG in was significantly decreased by a MD of 0.381,  $P = 0.00$ . and 0.3685,  $P = 0.017$  in case of CG). EG's anaerobic power (before and after MD and P value in VJT) was .06 at  $P = 0.000$ , which was larger than CG's MD of .0254 at  $P = .038$ . Furthermore, the pre and post MD and P values in the SLJT of EG and CG are .1161 at  $P = 0.003$  and .0308 at  $P = .052$ , respectively. Furthermore, in the 10m dash test of EG and CG, the MD and P value of the speed test were .1392 at  $P = .020$  and .1206 at  $P = .020$ , respectively. In the 40-meter dash speed test, EG and CG had pre and post MD of .2015 at  $P = .008$  and .1293 at  $P = .010$ , respectively. Generally, three months of core strength training increased the speed, power, and agility of 14-year-old EG much more than CG.

**Keywords:** Agility, Core-strength, Soccer, Speed, Power

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## 1. Introduction

Football performance depends upon physiological, biomechanical, and environmental factors. The game demands diverse qualities from the players, and they need to be physically fit, technically proficient, tactically well-equipped, and well psyched up to resist the pressure of the game. Moreover, these game demands can be met via well-planned and conducted training. Therefore, training should be programmed to make the players fit all these qualities. As a result, soccer training should address physical, technical, tactical, and psychological aspects. Among those essential fitness training components, condition or physical

fitness is the basis for all of the other components of soccer training [1-3].

Coaches nowadays give a variety of aerobics, strength, and power training, which involves large muscle groups and significantly lower and upper extremities, to meet the physical demands of soccer players. However, they later discussed the ideas of improving and conditioning the core muscles, the foundation area that helps maintain balance, convert stored energy into explosive power, and strong kicking and jumping actions of the lower extremities during soccer matches. And its impact has received little attention [4, 5].

Muscle stability and core training provide a foundation for

more excellent force production by the upper and lower extremities in sports performance and have been addressed recently [6]. "A strong core will transfer force from the lower body to the upper body with minimal energy dissipation in the torso [5]."

Furthermore, performance may be negatively affected if power is created but not transferred or there is no strong core muscle. Two soccer as a team sport of intense tackle so substantial central body area decrease injury, improves explosive power, improve the higher rate of anaerobic energy and technical movements with and without the ball [7].

"Twelve weeks of core strength training has a significant effect in standing long jump, shuttle, push up, speed plank, and vertical jump on 16 years old soccer players [9]."

Training the muscles that constitute the anatomical core prevents and treats low back pain. In conjunction with its use for injuries, a surge of excitement in the sports environment where training has focused on the potential connection between core musculature, conditioning, and improved athletic performance [3].

Weight training on players at their developmental age has a negative impact on their development. As a result, youths and children with age 14-years of physical core training and motor capabilities, especially strength development, should be provided with their body weight in more appropriate methods. Moreover, trainers have recently widely used it to improve soccer players' game performances. This training is preferred because we can perform it using easily available tools and it contributes to improving strength quickly [10].

Even if different researchers examined that core strength training helps with core muscles for better performance, effective motor capabilities, endurance, and strength of abdominal muscles and reduces back injuries in youth football trainees, its contribution towards skill-related fitness components including anaerobic power, speed, and agility was investigated merely with scientific research. Furthermore, due to a lack of investigation and understanding of the effects of strengthening core muscle groups on agility, power, and speed of children under the age of 15, we undertook an experiment on 14-year-old football trainees.

## 2. Methods

### 2.1. Treatment and Study Design

Twenty-six players with age of 14 was conveniently selected in Jara town, Bale zone, Oromia region, Ethiopia. Haramaya University approved the ethical procedure, and all

participant players read and signed a consent form. Moreover, we implemented pre and post-test patterned experiments on 13 randomly selected control groups (CG) and 13 experimental groups (EG). A regular soccer training program was implemented for both groups. A particularly tailored core strength exercise of 30 to 40 minutes was done twice a week on the EG from October to December 2019.2.2. Instruments.

### 2.2. Vertical Jump Test

"To measure the leg muscle power of subjects. The standing long jump, also called the broad jump, is an easy to administer test of explosive leg power [1]."

### 2.3. Illinois Agility Test

"The Illinois Agility Test is a commonly used test of agility in sports, and as such, there are many available. As the name indicates, this test aims to measure agility [1]."

### 2.4. T-Test

This test's primary goal is to assess a player's agility, which includes forward, lateral, and backward running [11, 12].

### 2.5. Speed Tests

"This test aims to determine the acceleration and maximum running speed of subjects [1]."

### 2.6. Methods of Data Analysis

We used standard deviations and group mean values to display the findings of several experiments. Then, utilizing the post and pretest data, we looked at the influence of core strength training on anaerobic power, agility, and speed in the experimental and control groups. Furthermore, using SPSS version 20, the difference between each test result was statistically examined using the "t" test at p 0.05.

## 3. Results and Discussion

Table 1. Anthropometric Characteristics of Participants (n=26).

	Groups	N	X	SD
Weight (kg)	EG	13	56.92	5.50
	CG	13	57.77	4.82
Height (m)	EG	13	1.68	3.62
	CG	13	1.71	4.69

Abbreviations: CG= Control Group, EG= Experimental Group, N= Number of players, SD= Standard Deviation, X= Value Mean.

Table 2. T-test and Illinois Agility Both groups' findings.

Tests	Groups	N	PT (X,±SD)	PoT (X, ±SD)	MD	T	df	P
IAT	EG	13	17.836±0.5737	17.455±0.5486	-.381	4.249	12	0.001
	CG	13	17.8277±.75794	17.4592±.57018	-0.3685	2.776	12	.017
TT	EG	13	11.372±0.4765	10.634±0.2960	-.738	7.774	12	0.000
	CG	13	11.5023±.47974	11.1254±.46506	-0.3769	3.424	12	.005

Abbreviations: CG= control groups, df=degree of freedom, EG= experimental groups, IAT=Illinois agility test, PT=pretest, PoT= posttest, t-t value, P=significance level. TT= t-test, X= value mean, MD = mean difference.

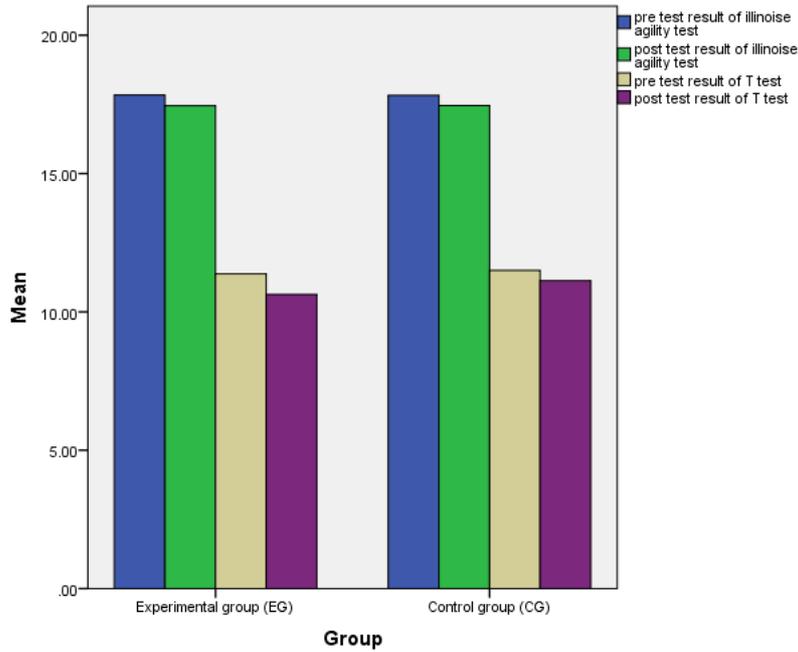


Figure 1. Illinois agility and t-test of both group results.

Table 2 and Figure 1 indicated that, at p 0.05, both EG and CG showed a substantial change. However, there is a difference in their pre-and post-mean values of both agility tests, with the MD in the TT of EG being 0.738 at P = 0.000, which is a

statistically significant difference from the MD in the TT of CG being 0.3769 at P = 0.005. And there is also a relative significant change at the EG in which the MD of IAT was 0.381 at P = 0.001. And 0.3685 at P=0. 017 in the case of CG.

Table 3. Vertical and standing long jump test result of both Groups (n=26).

Tests		N	PT (X,±SD)	PoT (X, ±SD)	MD	T	df	P
VJT	EG	13	0.82±0.03	0.88±0.035	.06	-5.299	12	0.000
	CG	13	.8154±.04977	.8408±.05693	.0254	-2.330	12	.038
SLJT	EG	13	2.1354±.1367	2.2515±0.8315	.1161	-3.798	12	0.003
	CG	13	2.0877±.13498	2.1185±.14736	.0308	-2.159	12	.052

Abbreviations: CG= control groups, df=degree of freedom, EG= experimental groups, PT=pretest, PoT= posttest, t-t value, P=significance level, SLJT= standing long jump test, VJT=vertical jump test, X=mean value of each test, MD= mean difference.

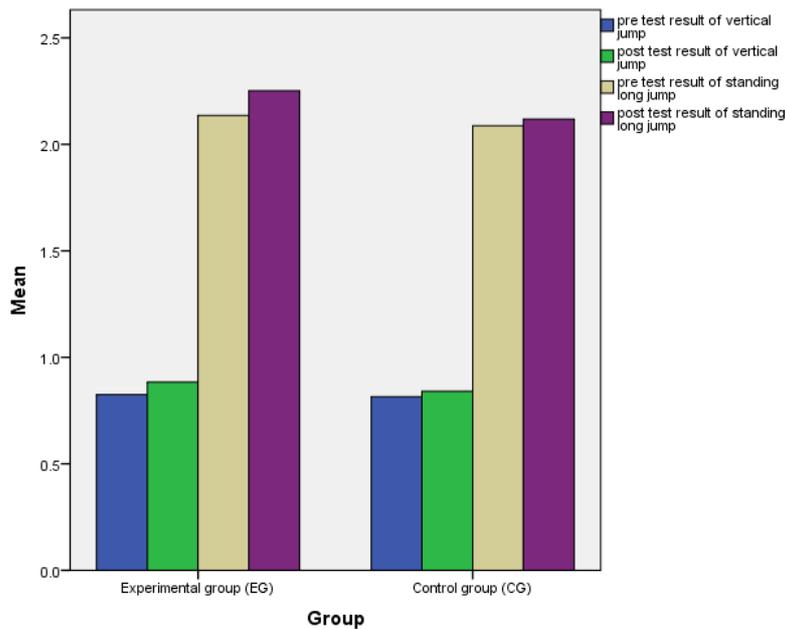


Figure 2. Vertical and standing long jump (power) test of both groups.

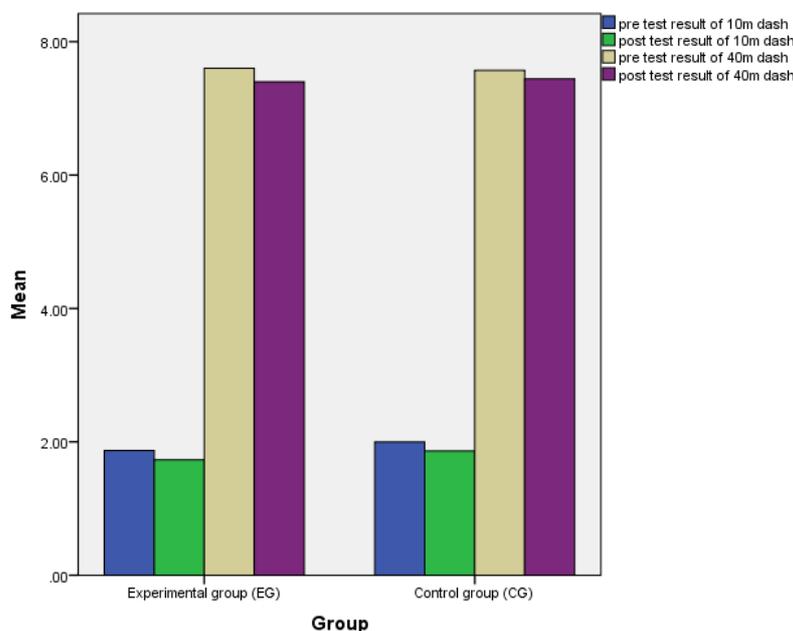
As table 3 and figure 2 indicated, in the vertical jump test, both EG and CG showed a significant difference at  $p < 0.05$ . However, there is a difference between the pre and post mean values of vertical jump tests, with the MD in EG being .06 at  $P = 0.000$ , which is much better than the MD in the CG

vertical jump test, which was .0254 at  $P = .038$ . and in the standing long jump test findings, there is a significant difference between the pre- and post-test MDs of both EG and CG, which are .1161 at  $P = 0.003$  and .0308 at  $P = .052$ , respectively.

**Table 4.** 10-meter and 40-meter dash tests of the groups.

Speed Tests	Groups	N	PT (X,±SD)	PoT (X, ±SD)	MD	T	Df	P
ST-1	EG	13	1.8700±.1403	1.7308±0.1219	-.1392	3.354	12	0.006
	CG	13	1.9900±.17574	1.8638±.18728	-.1262	2.694	12	.020
ST-2	EG	13	7.6000±.2707	7.3985±.2982	-.2015	3.165	12	0.008
	CG	13	7.5708±.36716	7.4415±.4011	-.1293	3.049	12	.010

Abbreviations: CG= control groups, Df=degree of freedom, EG= experimental groups, PT=pretest, PoT= posttest, t-t value, P=significance level, ST-1=speed test-1 (10-meter dash), ST-2= speed test 2 (40-meter dash), PT=pretest X=mean value, MD= mean difference.



**Figure 3.** 10m and 40m dash speed test results of both groups.

As shown in table 4 and graph 3, both groups showed a significant change at  $p < 0.05$ , but the difference in pre and post mean values of both speed tests was only marginally different, with MD in the 10-meter dash speed test of EG and CG being .1262 at  $P = .020$  and 0.006 at  $P = .020$ , respectively. Also, in a 40-meter dash speed test, EG and CG had pre and post MD speeds of 2015 at  $P = .008$  and 1293 at  $P = .010$ .

In general, statistically significant differences and a faster rate of change were observed in the agility, power, and speed of children aged 14 soccer players after three months of core strength training. Moreover, most of the previous research confirmed the present study's findings.

Twelve weeks of core strength training had a significant impact on the motor skills of 16-year-old soccer players, including the horizontal broad jump, shuttle run, speed, and vertical jump, which are all important characteristics in soccer speed, power, and agility [8]. And also, 40-m sprint speed improved after the core training of a female volleyball team [13].

"Two weeks of core stability training improves the speed and agility of female cricket players [1]." Three months of core stability and functional exercises had a significant effect on an expert female footballer's 30-meter sprint test at  $p < 0.05$  [14]. Core strength training is used to improve the balance and jumping abilities of soccer players [15, 16]. Six-week core stability exercises on the performance of male athletes, 11–14 years old, have brought a significant increment in standing broad jump, vertical jump, 9.1 m sprint, and shuttle run, and we recommend the core stability exercises to improve the general performance of athletes [1].

## 4. Conclusions

This study adds new information about regular measurements of soccer trainees and the training program and its effect on skill-related physical fitness qualities in Ethiopia, where its status in soccer is not good globally. We came to the following conclusions since the primary goal of this study was to see how three months of core strength

training affected football trainees' agility, power, and speed. Core strength training has a relatively positive effect on the agility of 14-year-old soccer trainees.

- 1) Core strength training improves the power of 14-year-old soccer players by a significant amount.
- 2) Core strength training improved the speed of 14-year-old soccer trainees significantly.
- 3) Three months of core strength training significantly increased speed, power, and agility in 14-year-old experimental groups compared to control groups.

## 5. Recommendation

Finally, we recommend the following points.

- 1) since core strength it has an effects on agility, power and speed, coaches shall add it in their regular soccer training program.
- 2) Coaches who train children shall measure and evaluate each training sessions and progressive performance of their players too.
- 3) And further study shall be done on other specific fitness components through increasing number of players, adding players of other teams and classifying by their positional play.

## Competing Interest

The authors declare that they have no competing interests.

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