



Effects of core strength training on selected skill related fitness components of Dessie town U-17 soccer trainees, in south Wollo zone, Amhara regional state, Ethiopia

Menbere Girma Alemayehu¹, Melese Ebabu Mossa², Getasew Gashaw Molla³

¹ Msc in Sport Science, Lecturer at Mekdela Amba University, Tulu Awuliya, Ethiopia

² Msc in Sport Science, Lecturer at Bahirdar University Sport Academy, Bahirdar, Ethiopia

³ Msc in Sport Science, Lecturer at Mekdela Amba University, Mekane Selam, Ethiopia

Abstract

Core training has been widely used by trainers recently in order to improve performance of soccer players. But the researcher doubt that what effect it brings and how much coaches who works at Ethiopian soccer projects/programs aware its effect. The aim of this study is to examine the effect of core strength training on speed, agility and anaerobic power on U-17 soccer trainees. All off twenty six (26) soccer players who was the only soccer training project team at Dessie town with age U-17 were conveniently selected and participated voluntarily in the research. Among those half of them were randomly selected as EG which specially prepared core strength training was applied and the rest were CG. Weight and height averages of U-17 EG and CG were similar which is 56.92 Kg and 57.77 Kg in weight and 1.68m and 1.71m in height respectively. Before training, PT of two groups of thirteen (13) players (IAT and TT of agility tests, VJ and SLJ tests of anaerobic power tests and 10m & 40m dash speed tests) were recorded. The core strength training were implemented on the EG twice a week, 35 to 40 min a day. Consequently after six weeks of core strength training, DT was taken in each parameters and a little improvement in each test results were observed and training was continually given by increasing its intensity. After three months, posttest measurement on the same parameters was taken. The difference between the tests were analyzed statistically, with paired sample “t” test at $P < 0.05$ Consequently it was observed that core strength training implemented on junior level players brought about significant improvements between pre and post test results of agility, in which duration to complete IAT and TT was decreased by a mean difference of 0.381 seconds at $P = 0.001$ and 0.738 seconds at $P = 0.000$. Speed in which duration of 10m and 40m dash speed test result was decreased by a mean difference of .1262seconds at $P = .020$ and .1293seconds at $P = .010$ respectively.. And power, in which height and length of VJ and SLJ test result were increased by a mean difference of .06m at $P = .000$ and .1161 m at $P = .000$ respectively. As result the investigator recommended that adding core strength training on their soccer training program helps to improve players speed, agility and power.

Keywords: strength, football, jump, speed, power, training

Introduction

Background of the Study

Soccer is the most popular sport in the world. From the Andes to Greenland, people just can't seem to resist kicking a leather ball around or watching others doing the same. The figures are staggering approximately 250 million people play the game regularly. In fact, if soccer players made up a nation, it would be the fourth most populous on the planet. You could almost say that soccer is a universal language. If you found yourself in a strange country with no knowledge of the local tongue, you would still be able to strike up a conversation by using a few hand gestures accompanied by the names of some prominent players. Place one hand at chest level while saying “Pele,” then raise it with the word “Maradona” and you'll quickly start making friends (Goldbatt and David, 2011) [11]. And it is obvious that this football legend gets their popularity through hard working since their childhood. As a result now a day's our country, Ethiopia also gives recognition for youth football program as a founding stage for the replacements and developments of elite athletes in the future. But so as to gain the full cumulative effects of youth football training program or to gain an improvement in performance, training shall meet certain criteria. And they should be equipped with the basic

and advanced technical, tactical, physical, and psychological demands of modern football. Within this standing truth developing well-structured youth football development program is primarily mandatory (Asrat, 2014) [6].

Even if different researchers examined that this core strength training helps for improving and strengthening core muscles for better performance, effective motor capabilities, endurance and strength of abdominal muscles and reduce back injuries, its contribution towards skill related fitness components including anaerobic power, speed and agility was investigated merely with scientific researches. And due to lack of investigation of the effects of core strength training on the above listed fitness components especially with local youth soccer trainees, the investigator conducted experiments and identified the effect of core strength training on selected skill related fitness components of U-17 soccer players.

Statement of the Problem

Lots of sport organizations, sport journals and sport science professionals agreed that designing a well-planned grass root and youth football training program is a founding stage of the

replacement and developments of tomorrow's elites. But it's obvious that their agreement can only be true if and only if there is an application of scientific soccer training which is supported by progressive assessments of player's performance, fitness qualities as well as training methodologies.

Even if coaches who work on the grass root level give lots of aerobic, strength and other soccer related skill trainings to their Childs and knows little about the real impacts of their training on health related fitness components, they still lacks of assessing the skill related fitness components in relation to the type of exercise they prescribed.

From this standing point of views and due to lack of investigation related with our countries youth soccer training and players performance assessments, the researcher implemented some soccer and skill related fitness tests and examined the effects of core muscle strength training on U-17 soccer players.

Based on the above reason the researcher tried to test the following hypothesis:

1. **H₀:** Core strength training has no effect on agility of soccer players.
H_A: Core strength training has an effect on agility of soccer players.
2. **H₀:** Core strength training has no effect on Power of soccer players.
H_A: Core strength training has an effect on Power of soccer players.
3. **H₀:** Core strength training has no effect on speed of soccer players.
H_A: Core strength training has an effect on speed of soccer players.

Objectives of the Study

- To measure the effect of core strength training on agility of U-17 soccer players.
- To test the effect of core strength training on power of U-17 soccer players.
- To evaluate the effect of core strength training on speed of U-17 Soccer trainees.

Materials and methods

Source of Data

Both primary and secondary source of data were used for this study. And the primary data was collected from the pre designed skill related fitness tests. And the secondary data was collected from various documents, journals, books, internet sources and unpublished booklets.

Treatment and study Design

In this research pre, during and posttest patterned experimental method on randomly selected (n=13) control group (CG) and (n=13) experimental group (EG) was implemented. And a total of 26 male soccer players, who took a two consecutive years of soccer training in Dessie town which organized and supported by Amhara football federation and trained by the investigator himself and one assistant coach, were voluntarily participated in the research. And regular yearly soccer training program was implemented on the control group (CG). While specially designed core strength training of 35 to 40 minutes twice a week

for 12 consecutive weeks in addition to the regular training program was implemented on the experimental group (EG).

Description of population and Sampling Methods

The source of population for this study was conveniently selected all available 26 Dessie town U-17 male soccer trainees. And amongst them the researcher randomly selected n=13, CG and n=13, EG which a special treatment was applied. As a result the sampling method in this study was convenience type.

Methods and Procedures of Data Collection

The researcher used quantitative data collection method to collect data from the subjects. by using pre, and post soccer related skill tests including IAT and T tests of agility, VJT and SLJ test of power tests and 10m& 40m dash of speed test results were collected and recorded by the researcher with the help of assistant who took training for two days. Each test was held at a field near to Dessie preparatory school's which was the players training site.

Measurement Tools and Applications

Medical Examination

Even if all the participants are already pre organized and selected based on their and family's interest and consensus as well as medical checkup early, while they join in to the team, the researcher prepared questionnaire for the identification of their current health status and additional consensus format and translated in to local language for ease of understanding and got confirmation to involve actively in this study. And the researcher used following serious of skill related fitness tests and testified the hypothesis.

Vertical jump test

The purpose of this test was to measure the leg muscle power of subjects.



Procedures and analysis

The athlete stands side on to a wall and reaches up with the hand closest to the wall. Keeping the feet flat on the ground, the point of the fingertips is marked or recorded. This is called the standing reach height. The athlete then stands away from the wall, and leaps vertically as high as possible using both arms and legs to assist in projecting the body upwards. And jump height is usually recorded as distance score Getchell (1979).

Standing Long Jump Test (Broad Jump)

The standing long jump, also called the broad jump, is a common and easy to administer test of explosive leg power. The standing long jump was also once an event at the Olympic Games, and the purpose of this test is to measure the explosive power of the legs Getchell (1979).

Procedure and analysis

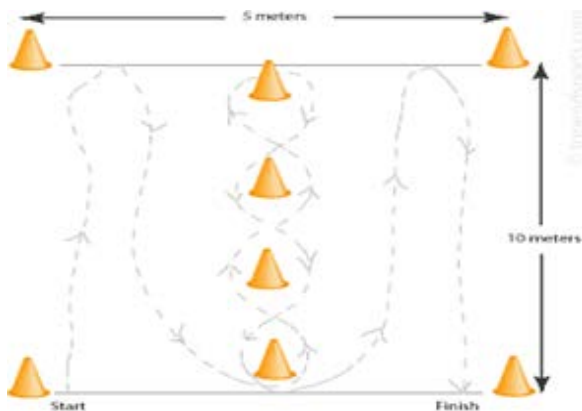


The athlete stands behind a line marked on the ground with feet slightly apart. A two foot take-off and landing is used, with swinging of the arms and bending of the knees to provide forward drive. The subject attempts to jump as far as possible, landing on both feet without falling backwards. Three attempts are allowed. And the measurement is taken from the take-off line to the nearest point of contact on the landing (back of the heels). Record the longest distance jumped, the best of three attempts.

Illinois Agility Test

Agility is an important component of many team sports, though it is not always tested, and is often difficult to interpret results. The Illinois Agility Test (Getchell, 1979) is a commonly used test of agility in sports, and as such there are many norms available. And as the name it indicates the purpose of this test is to measure agility.

Procedure and Analysis



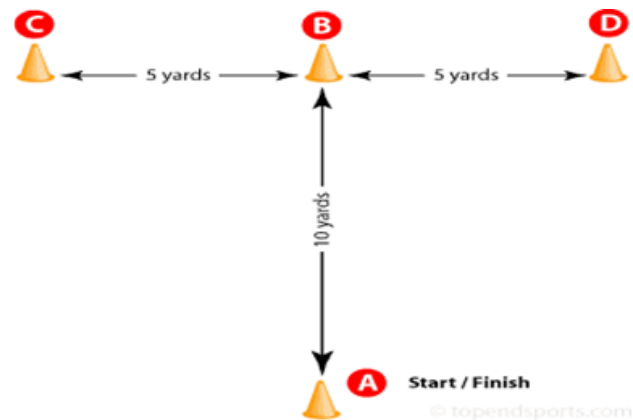
The length of the course is 10 meters and the width (distance between the start and finish points) is 5 meters. Four cones are used to mark the start, finish and the two turning points. Another four cones are placed down the center an equal distance apart. Each cone in the center is spaced 3.3 meters apart. Subjects should lie on their front (head to the start line) and hands by their

shoulders. On the 'Go' command the stopwatch is started, and the athlete gets up as quickly as possible and runs around the course in the direction indicated, without knocking the cones over, to the finish line, at which the timing is stopped (www.topendsport.com).

T-Test

The main purpose of this test is, testing agility of athletes, and includes forward, lateral, and backward running.

Procedure and Analysis



Set out four cones as illustrated in the diagram above (5 yards = 4.57 m, 10 yards = 9.14 m). The subject starts at cone A. On the command of the timer, the subject sprints to cone B and touches the base of the cone with their right hand. They then turn left and shuffle sideways to cone C, and also touch its base, this time with their left hand. Then shuffling sideways to the right to cone D and touching the base with the right hand. Then shuffle back to cone B touching with the left hand, and run backwards to cone A. The stopwatch is stopped as they pass cone A.

Speed Tests

The purpose of this test was to determine acceleration, maximum running speed of subjects.

Procedure and Analysis



The test involves running a single maximum sprint over a set distance, with time recorded. After a standardized warm up, the test is conducted over a certain distance, such as 10, 20, 40 and/or 50 meters or yards, depending on the sport and what you are trying to measure. The starting position should be standardized, starting from a stationary position with a foot behind the starting

line, with no rocking movements. If you have the equipment (e.g. timing gates), you can measure the time to run each split distances (e.g. 5, 10, 20m) during the same run, and then acceleration and peak velocity can also be determined. It is usual to give the athletes an adequate warm-up and practice first, and some encouragement to continue running hard past the finish line.

Methods of Data Analysis

The data collected through a serious of skill related physical fitness tests was presented as a group mean value and standard deviations. And the effect of core strength training on variables were analyzed in separate two pre coded groups experimental (EG)and control group (CG) twice, pre and posttests. And the difference between each test result was analyzed statically with “t” test at p<0.05through the use of computerized statically package software (SPSS) version 20.

But based on the data analyzed level of significance in all parameters were less than 0.05 (P<0.05). Therefore the investigator rejected the entire null hypothesis.

Results and discussion

This chapter discussed the analysis of data collected from the samples of study and its results. The purpose of this study was to investigate the effect of three months of core strength training on agility, power and speed of Dessie town U-17 soccer trainees. All 26 Dessie town soccer trainees who trained as the only youth soccer project site under the establishment and support of Amhara football federation was selected through convenience sampling method. And a pretest of Agility (Illinois agility and t-test), power (Vertical and standing long jump) and speed test of

10 and 40 meter dash test were given. And continued their soccer training which was given three times per a week, simultaneously half of them were randomly selected and subjected to three months of core strength training. Consequently during test on the same parameters and tests were given after six weeks of training and Then at the end of three months of core strength training (post) similar tests were given for all 26 soccer trainees regardless of their groups so as to evaluate whether core strength training affects agility, power and speed of U-17 soccer trainees or not. Then finding obtained after three months core training program are presented below in tables and analyzed graphically. Table 1 and 2 shows physical features and Table 3 and 4, show the statistics for agility, power and speed test scores. The abbreviations used in the research were as follows: Experimental Group (EG), Control Group (CG), Illinois Agility Test (IAT), T-test (TT), Vertical Jump Test (VJT), Standing Long Jump Test (SLJT), 10 meter dash (ST1) and 40 meter dash for speed test (ST2). Body weight averages of the groups in the research are as follows; U-17 EG=56.92 Kg; CG=57.77 and height averages of the groups in the study are as follows; U-17 EG=1.68 m; CG=1.71m.

Table 1: Body weight and height averages of the groups (Kg)

Groups	N	Weight (Kg)	Height (m)
U-17 EG	13	56.92	1.68
U-17 CG	13	57.77	1.71
Total	26		

X= value mean, SD= standard deviation, N= number of players in a group, EG= Experimental groups, CG= control groups.

Table 2: PT, DT&POT results of IAT and T-test of the Groups.

Groups	N	PT(X,±SD)	DT(X, ±SD)	PoT (X, ±SD)	ΔX(PoT and PT)	P
IAT result of EG	13	17.836±0.5737	17.6869±.5737	17.455±0.5486	-.381	.001
IAT result of CG	13	17.8277±.7579	17.7123±.7015	17.4592±.5701	-.3685	.017
TT result of EG	13	11.372±0.4765	11.2077±.4748	10.634±0.2960	-.738	.000
TT result of CG	13	11.5023±.4797	11.3846± .4116	11.1254±.4650	-.3769	.005

EG= experimental groups, IAT=Illinois agility test, TT= t-test of agility, X=mean value of each tests, ΔX= (MD) mean difference, PT=pretest result, DT= during training PoT= post test results, t-t value, df =degree of freedom, p=significance level.

As Table2: shows that Pre, DT and post IAT test mean of EG was 17.836, 17.6869 and post IAT test mean was 17.455 resrespectively. And of the CGPT, DT and PoT result of IAT mean was 17.8277, 17.7123 and 17.4592 respectively. And also PT, DT and PoT test results of the EG was11.372, 11.2077 and 10.634 respectively. And also the CG was 11.5023, 11.3846 and 11.1254 respectively. So these data indicated that there is a significant difference and gradual improvement between PT, DT and PoT test results of both the EG and CG. In which incase of the EG, duration of Illinois agility run test was significantly less by a mean difference of 0.381 at P=0.001 and duration of T-test was significantly decreased by a PT and PoT mean difference of

.738. At P=0.000 after three months of core strength training. And also in case of the CG, in which duration of Illinois agility run test was significantly less by a mean difference of .3685 at P=.017 and duration of T-test was significantly decreased by a mean difference of .3769 at P=0.005.As a result the investigator accepted alternative hypothesis 1 and rejected the null hypothesis. And is confirmed with this finding, Pankaj bhai and Shantilal (2015) found in their research conducted on effect of core stability training on speed of running in female cricket players that, two weeks of core stability training improves speed of running and agility in selected female cricket players as measured by 4x10 m shuttle run test and T test for agility.

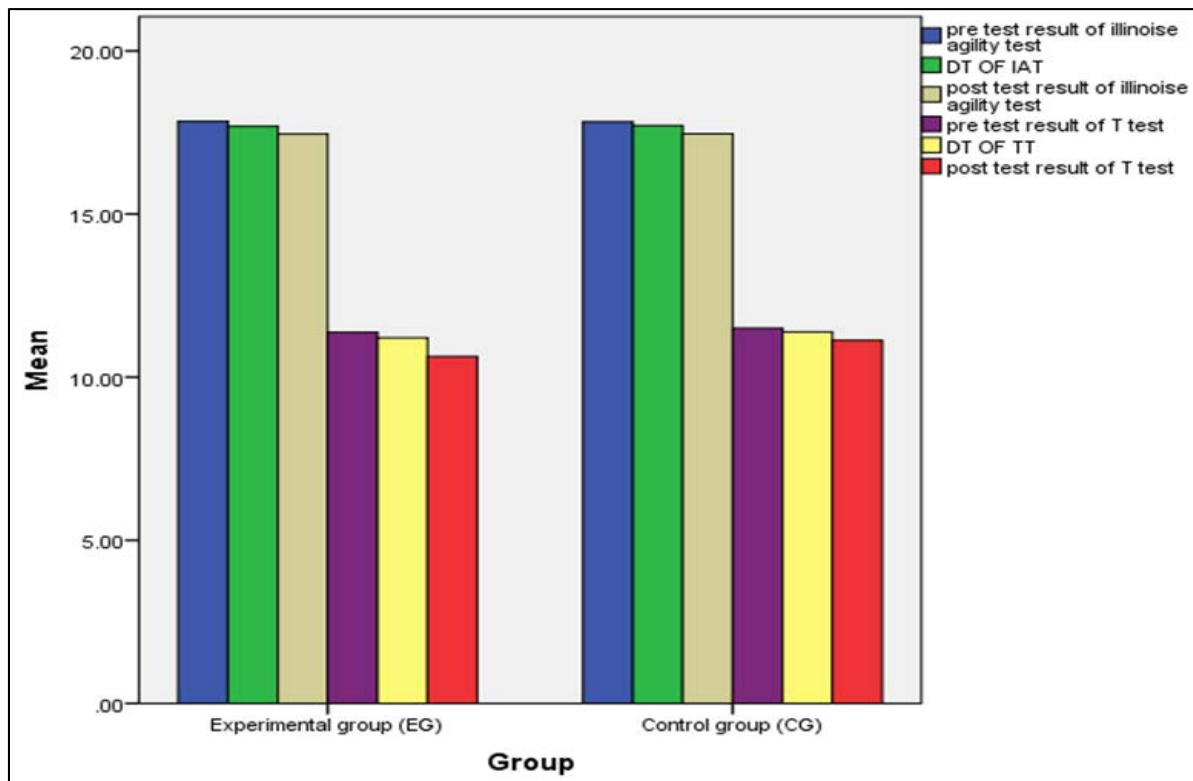


Fig 1: Graphical presentation of IAT and T Test result of both groups

As the collected data and graph indicated; even if both EG and CG had a significant change at $p < 0.05$, there is a difference in their pre and post mean values of both agility tests, in which mean difference in t- test of EG was 0 .738. At $P = 0.000$ which is

relatively high change than mean difference in t- test of CG 0.3769 at $P = 0.005$. But in case of Illinois agility test there is no much difference among pre and posttest mean of both EG and CG beyond to their significant change listed above.

Table 3: PT, DT&POT results of VJT and SLJT of the Groups.

Groups	N	PT (X,±SD)	DT(X, ±SD)	PoT(X, ±SD)	ΔX(MD)	P
VJT result of EG	13	0.82±0.03	.8369±.02983	0.88±0.035	.06	.000
VJT result of CG	13	.8154±.04977	.8215±.04432	.8408±.05693	.0254	.038
SLJT result of EG	13	2.1354±.1367	2.1562±.1238	2.2515±0.8315	.1161	.003
SLJT result of CG	13	2.0877±.13498	2.0923±.1357	2.1185±.14736	.0308	.052

EG= experimental groups, N= number of players in a group, VJT=vertical jump test, SLJT= standing long jump test, PT=test before training, DT=during training PoT=test after three months of training, t=value, df= degree of freedom, p= level of significance, ΔX=(MD) mean difference.

As Table 2: shows that EG Pre, during and post VJT test mean was .82, .8369 and .88 respectively. And of the CG, PT, DT and PoT result of VJT mean was .8154, .8215 and .8408 respectively. So these data indicated that there is a significant difference and gradual improvement between PT, DT and post test results of both groups. In which incase of the EG, height of VJT test result was significantly increased by a PT and PoT mean difference of .06 at $P = .000$, after three months of core strength training. And in case of the CG, height of VJT result was significantly increased by a mean difference of .0254 At $P = .038$. But in case of the second power test which is SLJT, a significant difference and gradual improvements was obtained only at the EG in which there PT, DT and post test result was 2.1354, 2.1562 and 2.2515 respectively. In which length of SLJT result of this groups is increased by a PT and PoT mean difference of .1161 at $P = .003$.

But based on the pre given significance value in which the mean difference of pre and post SLJT result of the CG was .0308 at $P > .05$. Since the only improvement was shown by the EG, the researcher accepted alternative hypothesis 2 and rejected the null one. And it is confirmed with the following findings.

Tarik. O, (2016) found in their research conducted on Relationship between core stability, dynamic balance and jumping performance in soccer players that core stability is associated with jump height in soccer players.

Heydar S *et al* (2013) [19] showed in their research conducted on The effect of six- week core stability exercises on performance of male athlete, 11-14 years old that significant increment was observed in Performance tests of (Standing Broad Jump, Vertical Jump, 9.1 m Sprint, Shuttle Run) and recommend the core stability exercises to improve general performance of athletes. Thus it is in conformity with the finding of this study.

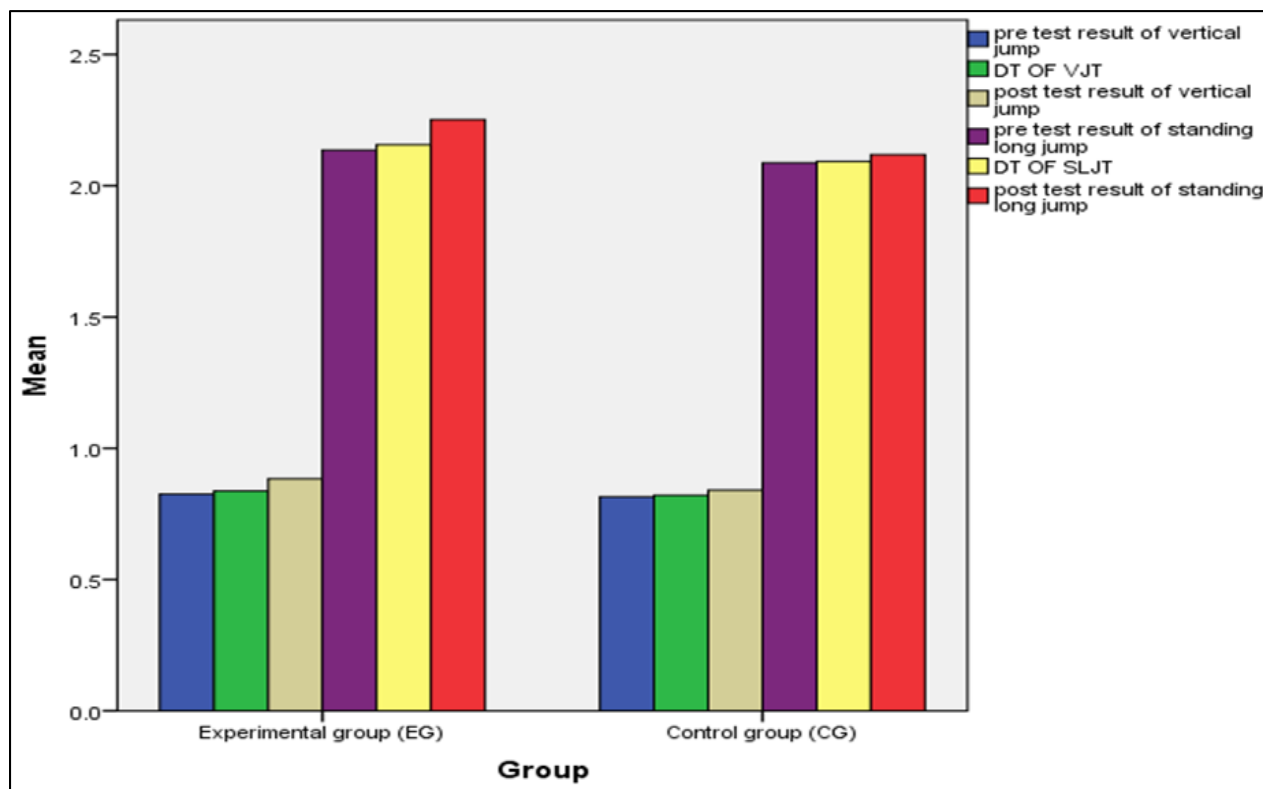


Fig 2: Graphical presentation of VJT and SLJT (power) test of both groups.

As the above data and graph indicated; even if both EG and CG had a significant change in VJT at $p < 0.05$, there is a difference in their pre and post mean values of SLJT in which mean difference in EG was .06 at $P = 0.000$ which is relatively high change than

mean difference in vertical jump test of CG .0254 at $P = .038$. And in case of SLJT; there is also difference between a pre and posttest mean difference values of both EG and CG which is .1161 at $P = 0.003$ and .0308 at $P = .052$ respectively.

Table 4: PT, DT & PoT results of 10m and 40m dash tests of both groups

Groups	N	PT (X,±SD)	DT(X,SD)	PoT (X, ±SD)	ΔX(MD)	P
ST1 of EG	13	1.8700±.1403	1.8415±.1197	1.7308±0.1219	-.1392	.006
ST1 of CG	13	1.9900±.17574	1.9654±.1579	1.8638±.18728	-.1262	.020
ST2 of EG	13	7.6000±.2707	7.5085±.2616	7.3985±.2982	-.2015	.008
ST2 of CG	13	7.5708±.36716	7.5292±.4011	7.4415±.4011	-.1293	.010

EG= experimental groups, N= number of players in a group, ST1=speed test 1(10 meter dash), ST2= speed test 2(40 meter dash), PT=test before training, DT= test during training, PoT=test after three months of training, t=value, df= degree of freedom, p= level of significance, ΔX= (MD) mean difference.

As Table 4: shows that Pre, during and posttest result of ST1 (10mdash) test mean of EG was 1.8700, 1.8415 and 1.7308 respectively. And of the CG, Pre DT and PoT test mean was 1.9900, 1.9654 and 1.8638 respectively. And also pre, during and post ST2 test results of the EG was 7.6000, 7.5085 and 7.3985 respectively. And also the CG was 7.5708, 7.5292 and 7.4415 respectively. Therefore these data indicated that there is a significant difference and gradual improvement of players speed between three consecutive tests of both the EG and CG. In which in case of the EG, duration of 10m dash speed test (ST1) was significantly less by a PT and PoT mean difference of .1392 at $P = .006$ and duration of 40m dash speed test (ST2) was significantly decreased by a mean difference of .2015. At $P = .008$ after three months of core strength training. And also in case of the CG, in which duration of 10m dash speed test (ST1) was

significantly less by a mean difference of .1262 at $P = .020$ and duration of 40m dash speed test (ST2) was significantly decreased by a mean difference of .1293 at $P = .010$. As a result the investigator accepted alternative hypothesis 3 and rejected the null hypothesis. And the following researchers supported this study. Thomas and William (2009) [30] found in their research conducted on a female volleyball team that 40m sprint speed improved after core training: thus, it is in conformity with the finding of this study. Natalia Niewolna and Teresa ZwierkoA (2015) [31] found in their research conducted on The Effect of three months Core Stability and Functional Exercises on Selected Speed and Strength Parameters in Expert Female Footballers, There was also a significant reduction in the time of 30 meter sprint at $p < 0.05$, Thus it is also in conformity with the finding of this study.

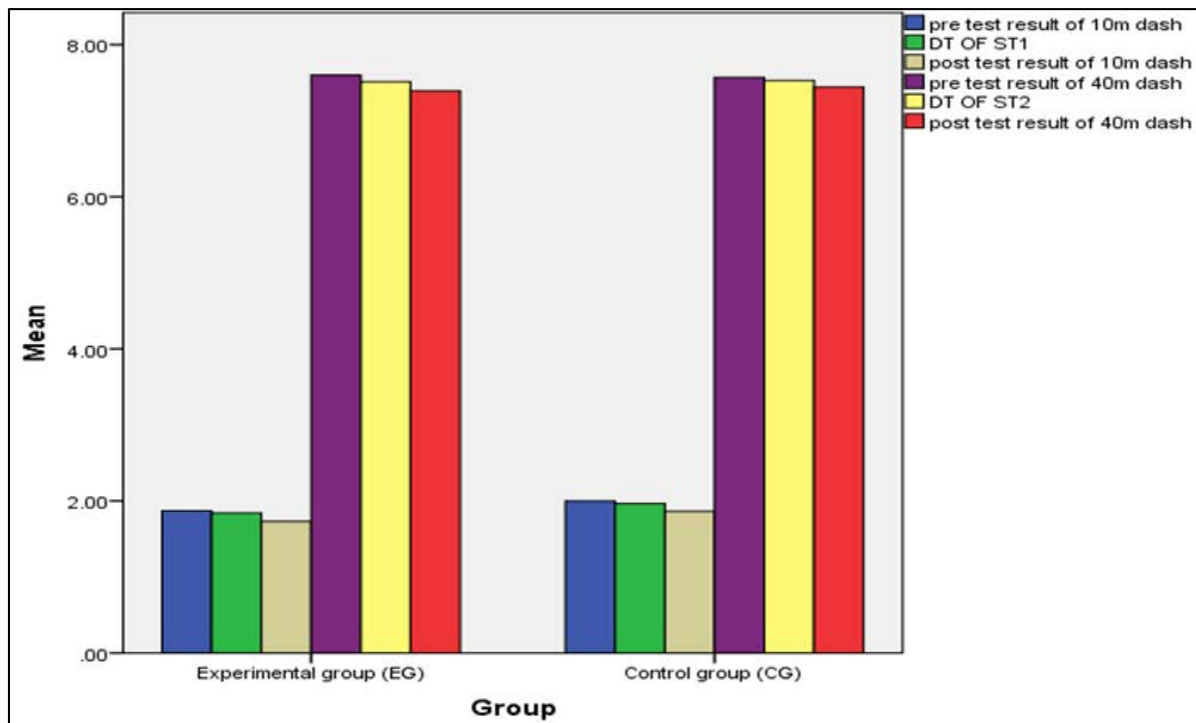


Fig 3: Graphical presentation of ST1 (10m) and ST2 (40m dash) speed test the group

As the collected data and graph indicated; even if both EG and CG had a significant change and gradual improvements in each tests. There is only a little difference in change of pre and post mean values of both 10m and 40m dash speed test, in which mean difference in 10m dash speed test of EG and CG was .1392. At $P=.006$ and .1262 at $P=.020$ respectively. And also pre and post mean differences in ST2 (40 meter dash speed test) of EG and CG was .2015 at $P=.008$ and .1293 at $P=.010$ which was a little or no change between both groups were observed here. Generally Three months of core strength training has a significant change of improvement in speed, power and agility of U-17 Experimental groups than control groups though three months of regular soccer training has its own positive effect on such skills too.

Summary, Conclusions and recommendations

Conclusions

Based on the major findings of the study the following points were stated as a conclusion.

- The result of the study showed that 3months of core strength training has relative positive effect on agility of U-17 soccer trainees as measured by Illinois agility and T-test.
- The output of the study showed that 3 months of core strength training has a significant improvement on power of U-17 soccer trainees.
- The finding of this study yields a significant benefit on improvement of soccer trainee's speed.
- In general after three months of core strength training, statistically significant improvement and change were observed in U-17 soccer player's agility, power and speed. And is supported by this finding conducted by Afiyon. A, stated in his research done on 16 years old soccer players that 12 weeks core strength training has an explosive effect on player's motoric capabilities such as; standing long jump,

shuttle run, speed, plank, and vertical jump which are some of an important parameters of soccer speed power and agility. Therefore this finding complies with this study.

Recommendations

Based on the above results, discussions and findings of the research done on the effect of three months of core strength training on selected skill related fitness components of Dessie town U-17 soccer trainees. And since it has a great importance in addressing and evaluating the effects of core strength training on soccer related skills and performance for players, coaches, clubs as well as coaching staffs in broad. The following recommendations are forwarded.

- U-17 soccer trainees of Dessie town shall give emphasis and practice core strength training so as to improve their speed, power and agility.
- Coaches, physical education teachers and other football trainers who support this project shall consider and aware of the impact of core strength training on skill related fitness components and add it on their regular soccer training.
- sport offices and professionals who support and sponsored this youth soccer projects shall aware and prepare trainings for soccer trainers/coaches about progressive assessment and evaluation of each training sessions they give and their players performance too.
- And further study shall be done on other specific fitness components through increasing subjects, adding players of other teams and classifying by their positional play.

References

1. Abdul Latif N, Abdul Majd N. Randomized Controlled Trial of Core Strength Training in Older Adults: Effects on Functional Mobility. Academic Journal of Bioscience. 2015; 3(1A):19-25.

2. Afyon Y. The Effect of Core and Polymeric Exercises on Soccer Players: Effect of Core Training on 16 Year-old Soccer Player. *Academic journal*. 2014; 9(23):1275-1279.
3. Akuthota V, Ferreiro A, Fredericson M. Core Stability Exercise Principles. Article in *Current Sports Medicine Reports*, 2008. Doi: 10.1097/01.CSMR.0000308663.13278.69.
4. Amil G. Effect of Core Stability Training on Speed of Running in Female Cricket Player. Msc Thesis, RK, University, Rajkot, India, 2015.
5. Anderson L, Drust B, Morgan R, Orme P. Principles and Practices of Training for Soccer. *Journal of Sport and Health Science*. 2014; 3:251-157.
6. Asrat Abate. An assessment of the practice of youth Football projects of Addis Ababa city administration. Msc Thesis, Addis Ababa University, Addis Ababa, Ethiopia, 2014.
7. Avey D. *Journal of strength and conditioning research*. 2014; 60:579.
8. Aydogmus M, Ozmen T. Effects of Core Strength Training on Dynamic Balance and Agility in Adolescent Badminton players: *journal of Body work and Movement Therapies*. 2015, 1-6.
9. Behm G, Borde R, Bruhn S, Gube M, Granacher U, Prieske O *et al*. Neuromuscular and Athletic Performance Following Core Strength Training in elite youth Soccer: *Scandinavian Journal of Sport Medicine and Exercises*. 2016; 26:48-56.
10. Cresser J. Total Soccer Conditioning. A ball oriented Approach. 2012; 1:5-24.
11. Goldbatt A, David G. *Essential Soccer Skills*, 1st edition. DK Publishing, New York, USA, 2011.
12. Demchak T, Mcmannus D, Nesser T. Effect of Core Strength on the Measure of Power in the Extremities. *The Journal of Strength and Conditioning Research*, 2012. Doi: 10.1519/JSC.0b013e31822600e5.
13. Dolan K. Reactive Agility, Core Strength, Balance and Soccer Performance. Msc Thesis, Ithaca College, 2013.
14. Drinkwater J, Willardson M, Cowley M. Review on The Use of Instability to Train The Core, 2010. Doi: 10.1139/H09-127.
15. Durandt J. Fitness Testing and the Physical Profiling of Players, 2009, 7-47.
16. FIFA (Federation of International Football Association). *Coaching Manual*. Zurich, Switzerland, 2005.
17. Fredericson M, Moore T. Muscular Balance, Core Stability and Injury Prevention for Middle and Long distance runners. *Physical Medicine and Rehabilitation*. 2005; 16:669-689.
18. Hartmann U, Martinez V, Niessen M. Women's Football: Players Characteristics and Demands of the Game: *Journal of Sport and Health Science*. 2014; 3:258-272.
19. Heydar S, Hossein N, Mohsen A, Rasoul M. The effect of six- week plyometric and core stability exercises on performance of male athlete, 11-14 years old. *Advances in Environmental Biology*. 2013; 7(6):1195-1201.
20. Hlinku A. The relationship between speed factors and agility in sport games. *Journal of human sport and exercise*, 2014. doi:10.4100/jhse.2014.91.06.
21. Jacob L, Jeff Jim FC, John R. Effect of core strength and endurance training on performance in college students: Randomized pilot study. *Journal of Bodywork and Movement Therapies*. 2012; 17:278-290.
22. Kimitake S, Monique M. Does Core Strength Training Influence Running Kinetics, Lower-Extremity Stability, and 5000-m Performance in Runners? In *The Journal of Strength and Conditioning Research*. 2009; doi: 10.1519/JSC.0b013e31818eb0c5.
23. Lederman E. *The Myth of Core Stability*, 2009. www.cpdo.net.
24. Mirandaa H, Antunesa JR, Pauli EF, Pugginab ASR. Effects of 10-week soccer training program on anthropometric, psychological, technical skills and specific performance parameters in youth soccer players. *Science and Sports*. 2013; 28:81-87.
25. Morgans R, Patrick O, Liam A, Barry D. Principles and practices of training for soccer. *Journal of Sport and Health Science* 3 251e257, 2014.
26. Myer J, Ford K, Palumb J, Hewett T. Neuromuscular Training Improves Performance and Lower-Extremity Biomechanics in Female Athletes. *Journal of Strength and Conditioning Research*. 2005; 19(1):51-60.
27. Nesser T, Huxel K, Tincher J, Okada T. The relationship between core Stability and performance in Division I football players. *Journal of Strength and Conditioning Research*. 2008; 22(6):1750-1754.
28. NSCA (National Strength and Conditioning Association).. *Conditioning fundamentals*. *Performance Training Journal*. 2011; 10(5):2-27.
29. Niessen M, Hartmann U, Vanessa. Women's football: Player characteristics and demands of the game. *Journal of Sport and Health Science*, 2014. 3 258e272.
30. Williams C. Core Training: Partner Based Medicine Ball Training. 10(5):1-8.
31. Niewolna N, Zwierko T. The Effect of Core Stability and Functional Exercises on Selected Speed and strength Parameters in expert female footballers. *Central European Journal of Sport Sciences and medicine*. 2015; 12(4):91-97.
32. Nikolaidis N. Core Stability of Male and Female football players. Article in *Biomedical Human Kinetics*, 2010. Doi: 10.2478/v10101-010-0007.
33. Ozmen T. Relationship between Core Stability, Dynamic Balance and Jumping Performance in Soccer Players. *Turkish Journal of Sport and Exercise*. 2016; 18(1):110-113.
34. Shinkle S. Effect of Core Strength on the Measure of Power in the Extremities. Master of Science, Indiana State University, 2010.
35. Taskin C. Effect of Core Training Program on Physical Functional Performance in Female Soccer Players. School of Physical Education and Sports, Batman University, Batman, Turkey from, 2016. doi:10.5539/ies.v9n5p115.
36. Wasely J. The Relationship between Power, Strength and Speed Measure and Playing Ability in Premier Level Competition Rugby forwards. Msc Thesis, Queensland University, 2006.
37. Williams I. General Characteristics of U-17 Soccer Trainees. Pp105-107. In *US-Youth Soccer Player Development Model*, 2012, 105-107.
38. www.bodybuilding.com (assed on March 13/ 2017) www.topendsports.com/testing/tests/home assessed on September 2016.