

# The Impact of Concurrent Training on Some Selected Physical Fitness Components of U-17 Male Handball Trainees in Case of Injibara Town, Ethiopia

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## To cite this article:

Awoke Tibebe, Dessalegn Tilahun. The Impact of Concurrent Training on Some Selected Physical Fitness Components of U-17 Male Handball Trainees in Case of Injibara Town, Ethiopia. *International Journal of Biomedical Science and Engineering*.

Vol. 8, No. 3, 2020, pp. 36-43. doi: 10.11648/j.ijbse.20200803.13

**Received:** January 21, 2020; **Accepted:** September 5, 2020; **Published:** September 23, 2020

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**Abstract:** The aim of this study was to examine the effect of concurrent training on speed, agility and anaerobic power on U-17 Handball trainees. All off twenty six (26) Handball players who was the only Handball training project team at Injibara 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 anaerobic 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 anaerobic training were implemented on the EG twice a week, 35 to 40 min a day. Consequently after six weeks of anaerobic training, DT was taken in each parameter and a little improvement in each test results 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 anaerobic 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 .1262 seconds at  $P = .020$  and .1293 seconds 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 0.1161 m at  $P = 0.000$  respectively. As result the investigator recommended that adding anaerobic training on their Handball training program helps to improve players speed, agility and power.

**Keywords:** Agility, Anaerobic Exercise, Performance Enhancement, Power, Speed

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## 1. Introduction

Handball requires a high level of physical condition in the relevant actions of the game like jumping, diving, blocking, running, sprint, and throwing. Handball is a very strenuous body-contact Olympic sport [1, 2]. Team-handball is a dynamic team sport that played at high speed and incorporates elements physical, mental, technical and tactical. It requires a high-level athletic performance to be successful [3, 4].

Physical performance in Handball depends on various

characteristics. Specifically, endurance, strength, speed, power and agility must all be well developed in order to achieve a high performance level in Handball. Handball match activities cover a range of intensities from low through moderate to high. One of the aims of training is to improve the ability to perform maximal and high-intensity exercise. Handball players must be able to perform anaerobic exercise (exercise at high-intensity, sprint, and develop high levels of power /force/ when kicking and tackling). Good levels of agility and coordination are also necessary and distinguish between elite and average players. Many sports require a

combination of physical fitness components. For instance; Handball players should have the skill of shooting, passing and dribbling. A combination of short-duration strength, speed, and agility training is essential. [2-5]

The fitness requirements for Handball depend on the level of performance. They vary also with age groups, between men and women, and at different stages of the playing season. Coaches, trainers and sports scientists acknowledge that preparation for competitive match-play calls for a systematic approach. This includes consideration of fitness levels of individual players as well as overall throughout the team. Attention to fitness profiles is relevant not just in the build-up towards key matches and tournaments but also throughout the competitive league season. To succeed based on results trainees need being testing selected parameters. These parameters have designed to predict performance capacity, taking in to account the player's current level of fitness and maturity [6, 7] The test items may either be part of a comprehensive physiological assessment or be dedicated to performance in Handball.

## 2. Materials and Methods

### 2.1. Description of the Study Area

The study was conducted in Injibara Town, south western part of the Amhara region and North western part of the county, Ethiopia. It is about 447 km away from the capital city of Ethiopia, Addis Ababa and 118 km from Bahir Dar, the capital city of the Amhara Regional state. Geographically, Injibara is found in 10°59'N and 36°55'E longitude. The highest and lowest altitude of Injibara is recorded to be 2540m.a.s.l and 3000m.a.s.l respectively

### 2.2. Study Design

In this research pre, during and posttest patterned experimental study design on randomly selected (n=13) control group (CG) and (n=13) experimental group (EG) was implemented. And a total of 26 male Handball players, who took a two consecutive years of Handball training in Injibara town which organized and supported by Amhara Handball federation and trained by the investigator himself and one assistant coach, were voluntarily participated in the research. And regular yearly Handball training program was implemented on the control group (CG). While specially designed anaerobic 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.

### 2.3. Measurement Tools and Procedures

First medical examination was taken from all participants of the study. Players were familiar with the tests and had performed the test prior to the present study at least once. Testing was conducted at the same time of day and on the same field for both pre- and post-testing sessions. Anthropometric data such as age, height, weight, assessment were recorded first. Performance testing consisted of the

Vertical jump test and Standing Long Jump Test (Broad Jump) for power, the Illinois Agility and T-Test for agility, 10m and 40m dash for speed. All testing sessions were carried out with a 48 h recovery period. Each participant performed two trials with minimum three minutes recovery between the tests, times were recorded to the nearest 0.01 second, and the better of the two trials was recorded. Familiarization test for power, agility and sprint track were conducted during both the pre- and post-tests, with two sub-maximal trials prior to the start of the test. Prior to the testing, the participants followed the same supervised warm-up procedure with 10 minutes jogging and sprint drills. Consequently the experimental group performed on separate days of concurrent training in addition to the handball training and continued with their regular training. After the experimental period of 3 months, both testing sessions were repeated

### 2.4. Methods of Data Analysis

The data collected through a series of skill related physical fitness tests was presented as a group mean value and standard deviations. And the effects of anaerobic 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  $p < 0.05$  through the use of computerized statically package software (SPSS) version 20.

### 2.5. Results

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 anaerobic training on agility, power and speed of Injibara town U-17 Handball trainees. 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. The trainees continued their Handball training which was given three times per a week; simultaneously half of them were randomly selected and subjected to three months of anaerobic 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 anaerobic training (post) similar tests were given for all 26 Handball trainees regardless of their groups so as to evaluate whether anaerobic training affects agility, power and speed of U-17 Handball trainees or not. Then finding obtained after three months core training program are presented below in tables and analyzed graphically. Tables 1 and 2 shows physical features and Tables 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.

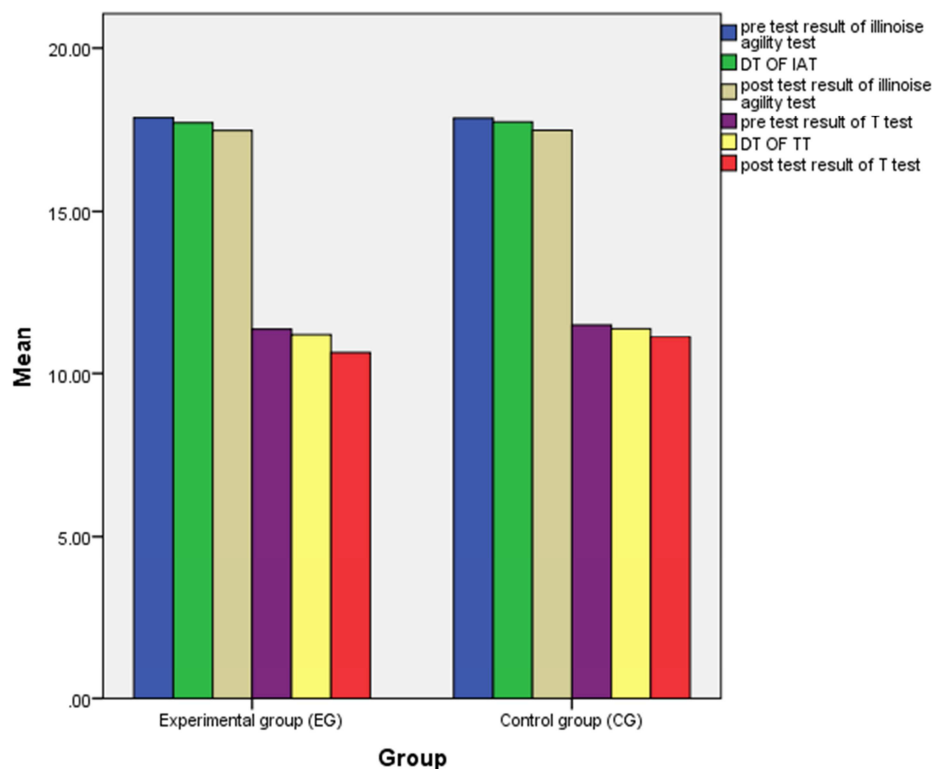
Groups	N	PT (X,±SD)	DT (X, ±SD)	PoT (X, ±SD)	ΔX (PoT)	P & PT
IAT result of EG	13	17.836±0.5737	17.6869±.5737	17.455±0.5486	-.381	.001
IAT result of CG	13	17.8277±.7579	17.7123±.7015	17.4592±.5701	-.3685	.017
TT result of EG	13	11.372±0.4765	11.2077±.4748	10.634±0.2960	-.738	.000
TT result of CG	13	11.5023±.4797	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 Table 2 shows that Pre, DT and post IAT test mean of EG was 17.836, 17.6869 and post IAT test mean was 17.455 respectively. 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 was 11.372, 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 anaerobic 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, [4] 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.



**Figure 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.

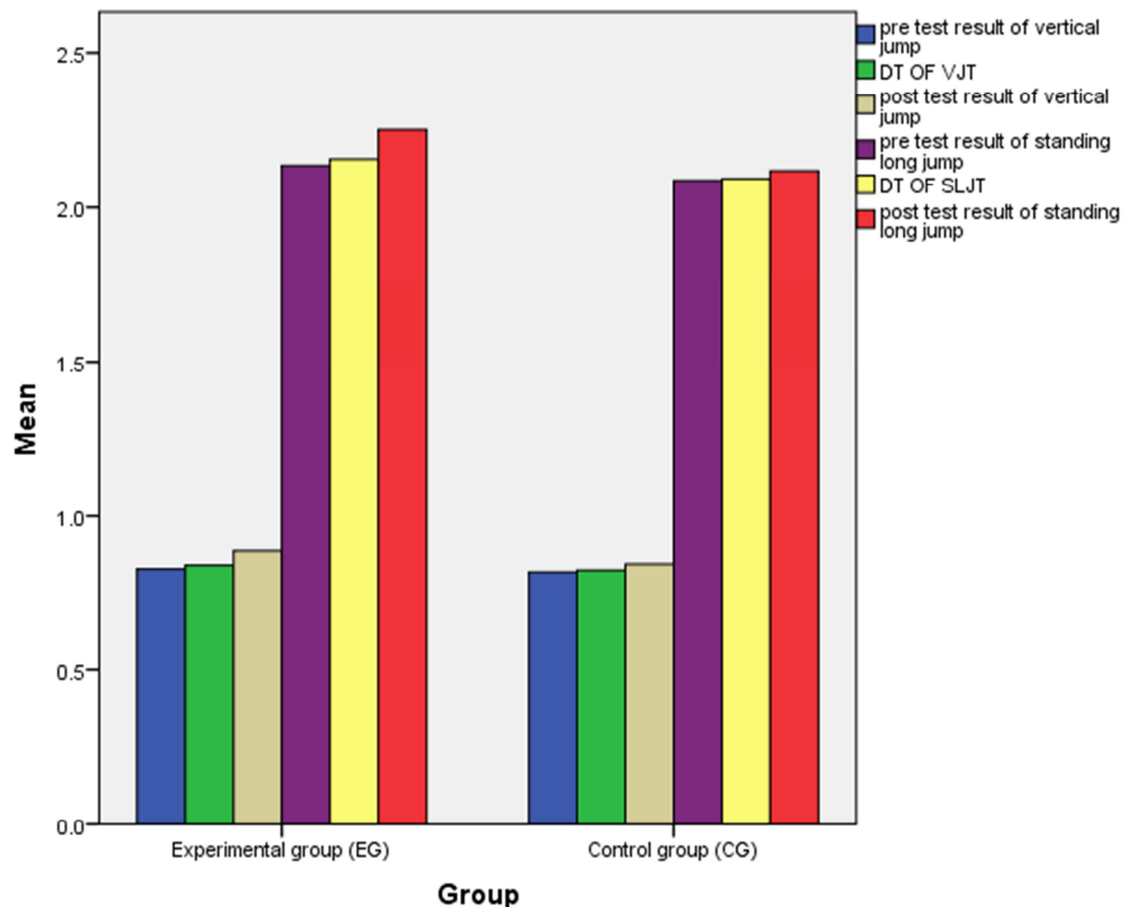
*Table 3. PT, DT& POT results of VJT and SLJT of the Groups.*

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 0.82, 0.8369 and 0.88 respectively. The CG, PT, DT and PoT result of VJT mean was 0.8154, .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 0.06 at  $P=.000$ , after three months of anaerobic training. In case of the CG, height of VJT result was significantly increased by a mean difference of 0.0254 At  $P=0.038$  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 0.1161 at  $P=0.003$ . But based on the pre given significance value in which the mean difference of pre and post SLJT result of the CG was 0.0308 at  $P > 0.05$ . Since the only improvement was shown by the EG, the researcher accepted alternative hypothesis 2 and rejected the null one.



*Figure 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.

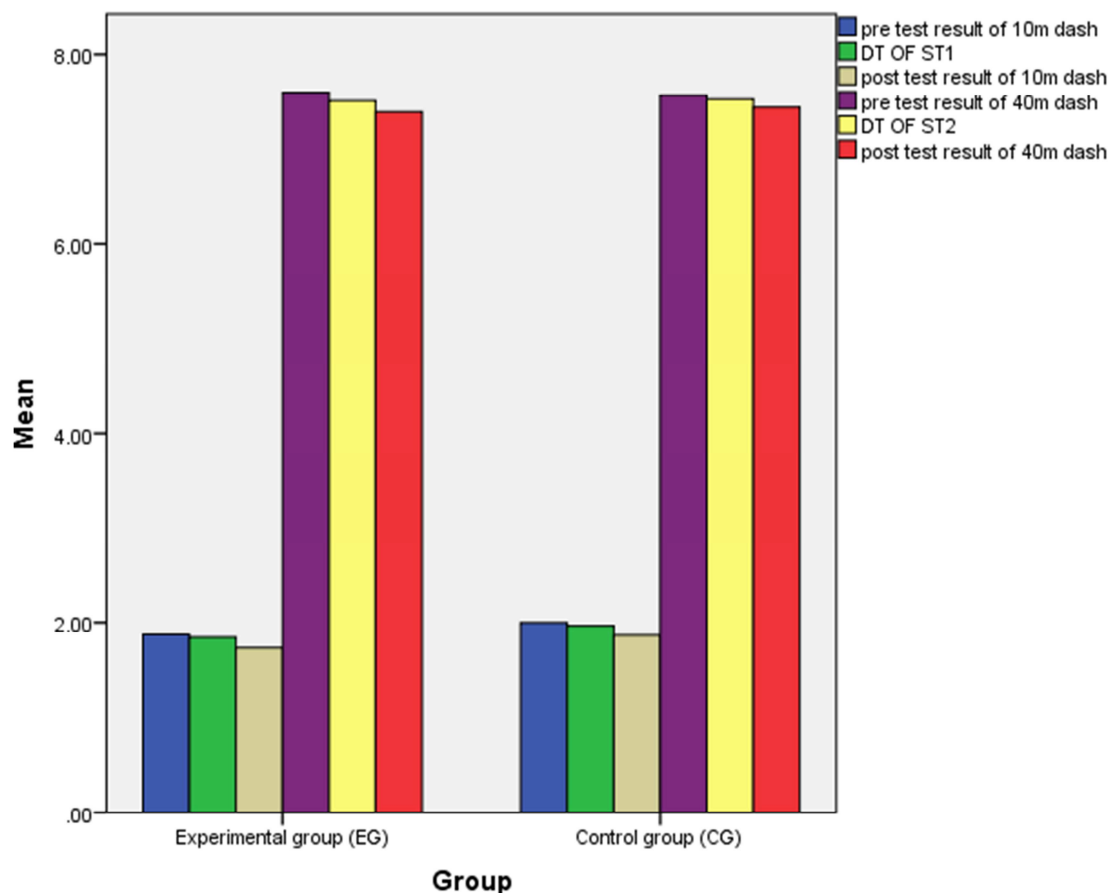
**Table 4.** PT, DT & PoT results of 10m and 40m dash tests of both groups.

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



**Figure 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 0.1392. At  $P=0.006$  and .1262 at  $P=0.020$  respectively. And also pre and post mean differences in ST2 (40 meter dash speed test) of EG and CG was 0.2015 at  $P=0.008$  and 0.1293 at  $P=0.010$  which was a little or no change between both groups were observed here. Generally, three months of anaerobic 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 Handball training has its own positive effect on such skills too.

### 3. Discussion

Handball is a fast body contact Olympic team sport that requires running, jumping, sprinting, throwing, repeated sprinting, faking, hitting, blocking and pushing. Handball requires a high standard of preparation in order to complete sixty minutes of competitive play and to achieve success. The aim of this study was to examine the effect of concurrent training on speed, agility and anaerobic power on U-17 Handball trainees. Physical fitness is the total of various independent variables. Generally these variables are performance oriented and depend upon the functioning of different systems of the body. Different sports events demand a combination of different physical variables for high quality performance. Several studies showed a significant relationship between speed and agility in handball players [8-11]. Accordingly, the ability to accelerate, defined as the rate of change in velocity, is more important to successful performance than maximum velocity [12]. Chittibabu (2014) earlier identified that back court players require greater amount of speed and endurance to have better jump shoot accuracy in handball players [13]. This shows that playing ability has significant relationship with fitness parameters. scholars stressed that more time should be dedicated to sprint training and leg muscle strength and power training, in order to increase sprint performance [14, 15, 7]. During a handball match the players has to sprint for fast break, defense and offence and similarly they perform feints, change of directions. This finding suggests that team handball players perform and changes from one type of action to another very frequent, and hence agility and speed are extraordinary important. Speed was assessed using a 10-m and 40m run, and agility was assessed using tests such as the Illinois agility and T-test. Team handball wing players are usually required to be faster and more agile than other field players. The finding of the study shows that speed has a great significant contribution to improve the playing ability the results of the study pertaining of national level player to move quickly. Just to perform shooting, shielding and throwing and to travel from back yard court to goal line of fore ground of opponent [16-18].

Handball is a fast paced moving team sport which requires

different qualities an athlete perform many accelerations, sprints, turns, jumps, and a direct body contact with opponents, for instance, while shooting, defense and offense as well as high level of aerobic capacity [19, 20]. Agility plays a significant role in the training of technique. The aim in training skills is to bring the athlete closer to the ideal form of the sequences of the movement during the competitive period. In a game situation, the controlled ability to stop, to start and to change direction rapidly and more quickly is a very essential factor and this quality decides one's performance level and the speed of acquiring any skill [21, 22]. Agility is an ability to change direction accuracy and quickly while moving rapidly. It is obviously necessary for successful handball player. The sudden change of direction, the twisting, rapid running and forward- backward running are the hall marks of player's quality [23, 13].

Jumping power is also one core capacity while shooting. Power is a key component to be successful in handball player's performance in general and jumping in particular [24-26]. The researcher also believed that scientific training like strength training will bring great effect on athlete's performance in general and handball specific physical fitness variables and handball skills performance in particular. In handball, there is a greater need of strength of shoulder and explosive power of leg [27]. Handball players are mostly using these two in shooting, throwing & passing.

### 4. Conclusions

The result of the study showed that 3 months of concurrent training has relative positive effect on agility of U-17 Handball trainees as measured by Illinois agility and T-test. The output of the study showed that 3 months of concurrent training has a significant improvement on power of U-17 Handball trainees. The finding of this study yields a significant benefit on improvement of Handball trainee's speed. In general after three months of concurrent training, statistically significant improvement and change were observed in U-17 Handball player's agility, power and speed. A 12 weeks concurrent 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 Handball speed power and agility.

### Acknowledgements

We wish to express our thanks to our family for their unconditional and unreservedly support and encouragement.

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