

## Effects of 12-Week Plyometric Exercises Training on Selected Physical Fitness Variables among Short Distance Athletes: The Case of Shire City Female Athletics Project

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### Abstract

Training program is most important for the athletes due to their long term effect and several methods have been developed to get reliable information about the plyometric exercise and Anthropometric performances of short distance runners. The purpose of this study was to examine the effects of selected plyometric exercises on agility, speed, power and strength of short distance female athletes aged  $16.54 \pm .658$  from shire city athletics project. A total of 30 female athletes were selected as a sample using census method. They were assigned in two groups, Experimental group and control group. Each group consisted of 15 subjects. Before training, both groups of 15 athletes has done pre-tests: TAT and IAT for agility, SBJT and VJT for power, SUPT and WST for strength, and 60M and 35M Dash for speed and recorded. The selected plyometric exercise were implemented on the EG four days per week, (50-70) Seconds per a day. After three months, post-test measurement on the same parameters was taken. The difference between the test were analyzed statistically, with paired sampling t-test at ( $p \leq 0.05$ ) consequently it was observed that selected plyometric exercises implemented brought about significant improvements from pre-test and post-test results of agility in which duration to complete T-test and Illinois test was decreased by mean difference of (1.47 at  $p=.000$  and 1.75 at  $p=.000$ ) respectively. Power in which length and height of SBJ and VJ test results were increased by a mean difference of (0.204 at  $p=.000$  and 9.93 at  $p=.000$ ) respectively. Strength in which duration of sit-up and wall squat strength test result was increased by a mean difference of (15.46 rep/seconds at  $p=.000$  and 13 seconds resist at  $p=.000$ ) respectively, and speed in which duration to complete (35m and 60m dash) was decreased by a mean difference of (1.08 seconds at  $p=.000$  and 1.04 seconds at  $p=.000$ .) Thus it has been concluded that selected plyometric exercises training conducted for three months relatively improve agility, power, strength and speed of short distance athlete. The investigators recommended the incorporation of selected plyometric exercise program for athletes involved in short distance events.

**Keywords:** Plyometric Exercise, 12-Week Training, high intensity, Physical Fitness

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## Introduction

The plyometric training is popular among individuals involved in dynamic sports and plyometric exercise such as jumping, skipping and bounding are executed with a goal to increase dynamic muscular performance (Michaleet *al.*, 2006)

Plyometric, also known as "jump training" or "plyos", exercise in which muscle exert maximum force in short interval of time, with the goal of increasing power (speed-strength). Study that indicate Plyometric are primarily used by athletes, especially martial artists, sprinters and high jumpers, to improve performance, and are used in the fitness field to a much lesser degree (Savithri, 2014).

Success in many sports depends heavily up on the athlete's explosive leg power and muscular strength. In jumping throwing track and field event and other activities the athlete must be able to use strength as quickly and forcefully as possible this display comes in the form of speed strength or power (McNeely, 2007).

The plyometric are technique used by the athletes in all types of sports to increase strength and explosiveness plyometric consist of rapid stretching of the muscles followed by a concentric or shortening action of the same muscle and connective tissue. The stored elastic energy within the muscles is used to produce more force than can be provided by a concentric action alone. This training focuses on learning to move from a muscle extension to a contraction in a rapid or "explosive" manner, such as in specialized repeated jumping.

## Materials and Methods

For data collection first permission was taken from respective sources. All the necessary information about the study (purpose, procedures, etc.) was explained for the participants in advance. Consent was obtained from the participants by filling and returning back every requirement detailed in the Consent Form and Physical Activity Readiness Questionnaire (PAR-Q) was also administered to assess health conditions of the participants. Tests were conducted in accordance with the Fitness Testing Programs where *T-Agility Test (TAT)* and *Illinois Agility Test (IAT)* were administered for Agility while *Standing Broad Jump Test* and *Vertical Jump Test* were administered for Explosive Power. On the other hand *Wall Squat Test* and *Sit Ups Test* were given to measure Muscular Strength whereas *60m-Speed Test* and *35m-Speed Test* were administered for Speed.

The primary data was collected after 12-weeks of moderate to high intensity training and were analyzed, interpreted and tabulated into meaningful idea using Statistical Package for Social Sciences (SPSS version 20). Descriptive statistics such as group mean value and standard deviations were calculated. The *Paired Sample T-Test* was applied to compare significant mean difference between pre-test and post-test results of the groups. The level of significance error was set at  $p \leq 0.05$ .

## Results and Discussions

### Physical characteristics of participants

As athletes were from under-17 athletics project category, their mean age, height, and weight were  $16.54 \pm 0.658$ ,  $1.582^a \pm 0.0687$ , and  $46.73 \pm 3.034$  respectively.

**Mean difference of T-Test and Illinois Agility Test**

Table 1: Mean values and standard deviation of T-test and Illinois agility tests of pre and post test results

Groups	N	PT(X, ±SD)	PoT(X, ±SD)	X(PoT and PT)	P
T-Test result of EG	15	13.756±.473	12.28±.684	1.472	.000
T-Test result of CG	15	13.74±.237	13.66±.216	.0753	.016
Illinois Test result of EG	15	20.98±.472	19.22±.630	1.756	.000
Illinois Test result of CG	15	21.024±.450	20.975±.425	.0493	.006

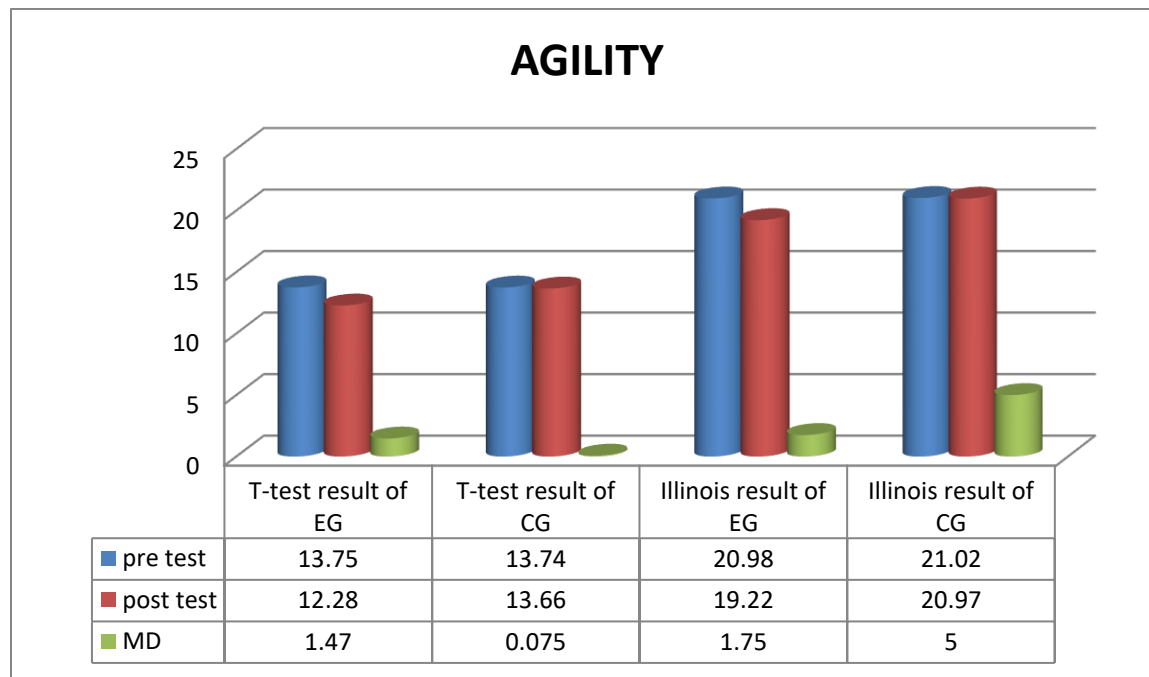
EG = experimental groups, CG = control groups, T-agility test, Illinois test, X=mean value of each tests, X= (MD) mean difference, PT=pre-test result, PoT= post test results, p=significance level

As shown on the table 1, the Paired Sample Test results from the two tests (T-Test and Illinois Agility Test) indicated that there was statistically significant mean difference between Pre and Post tests on the agility of the athletes (except for control group) after 12-weeks of plyometric training, which was consistent result.

The decrease in mean value after training on speed for EG (TAT= 12.28±.684 and IAT= 19.22±.630) as compared to CG (TAT= 13.66±.216 and IAT= 20.975±.425) indicates that athletes performed the given task (running 35m and 60m distance) within a short period of time since speed was measured in seconds.

Thus, the output of this study is similar with the findings of (Martin S, 2010) plyometric training improves power and agility in Jamaica national netball team.

**Figure 1: Showing comparative Means of Pre-test and Post-test results of T-Test and Illinois agility.**



**Mean Difference of Standing Broad Jump Test and Vertical Jump Test**

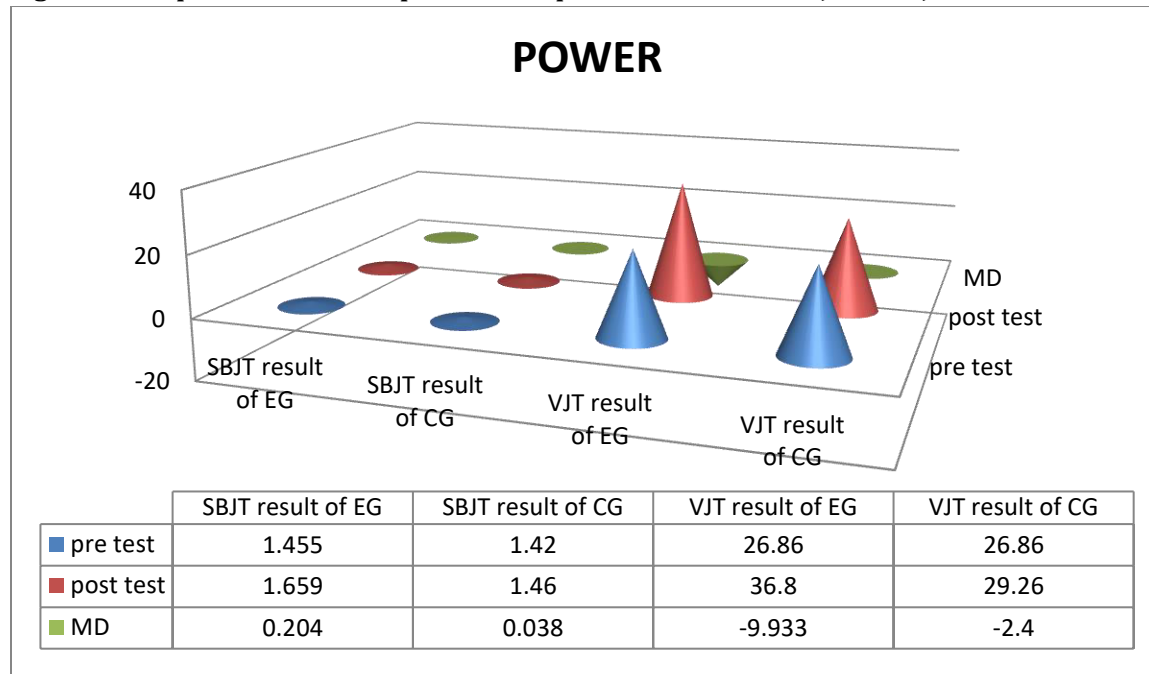
Table 2: Means value and standard deviation of SBJT and VJT in pre and post tests

Groups	N	PT(X,±SD)	PoT(X, ±SD)	X(PoT and PT)	P
SBJT result of EG	15	1.455±.057	1.659±.0776	0.204	.000
SBJT result of CG	15	1.42±.0485	1.46±.0410	.0380	.058
VJT result of EG	15	26.86± 2.996	36.80±3.144	-9.933	.000
VJT result of CG	15	26.86±2.774	29.266±2.120	-2.400	.063

EG =experimental group, CG =control group, SBJT = standing board jump test, VJT = vertical jump test, X = mean value of each tests, SD = standard deviation, X(MD) mean difference, PT = pretest, PoT = posttest, P = significance level

As Table 2 shows that the mean values of pre and post test results of *SBJ Test* of EG was 1.455 and 1.659 while PT and PoT result of *SBJ Test* for CG was 1.42 and 1.46 respectively. Besides, the mean values of pre and posttest results of *VJ Test* for EG was, 26.86 and 36.8 while it was 26.86 and 29.26 for CG respectively. Thus, *Paired Sample T Test* revealed that there was statically significant difference as P value (0.00) is less than Alpha Value (0.05) which indicates a gradual improvement between PT and PoT test results on the EG. But, no statistically significant mean difference observed between Pretest and Post-test of both tests for CG as P value was higher than alpha value.

**Figure 2: comparative Means of pre-test and post-test results of SBJT and VJT**



**Mean Difference of wall Squat and Sit up Repetition per Second**

Table 3: Mean values and standard deviation of WST and SUPT in pre and post tests

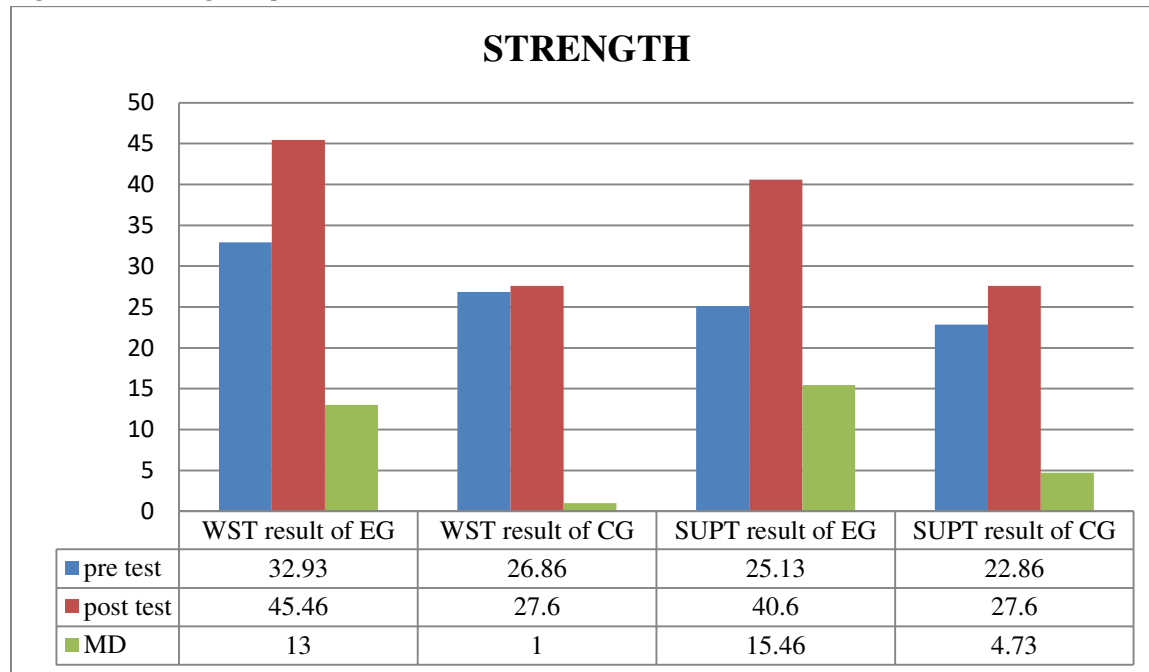
Groups	N	PT(X, ±SD)	PoT(X, ±SD)	X(PoT and PT)	P
SUPT result of EG	15	25.133±4.969	40.600±3.355	15.466	.000
SUPT result of CG	15	22.86±3.090	27.60±3.376	4.733	.058
WST result of EG	15	32.93± 2.120	45.466 ±2.559	13	.000
WST result of CG	15	26.86±2.774	27.600±2.914	1	.083

EG = experimental groups, CG, control groups, WST= wall squat, SUPT=sit up test

X=mean value of each tests, X= (MD) mean difference, PT=pre test result, PoT= post test results, p=significance level

Table 3 shown the WST and SUPT results of EG of where the mean value difference of PT and PoT was also 13 and 15.466 respectively and p value is 0.000. This indicated that there was statistically significant mean difference observed on WST and SUPT of pre and post test results. On the other hand, the mean value PT and PoT of WST and SUPT results of CG of was 1 and 4.73 with a p value .058 and 0.83 which indicated that there was statically no significant mean difference on WST and SUPT between pre and post test results.

Figure 3: Showing comparative Means of Pre and Post test results of WST and SUPT



**Mean Difference of 60 Meter speed and 35 Meter Speed Test per second**

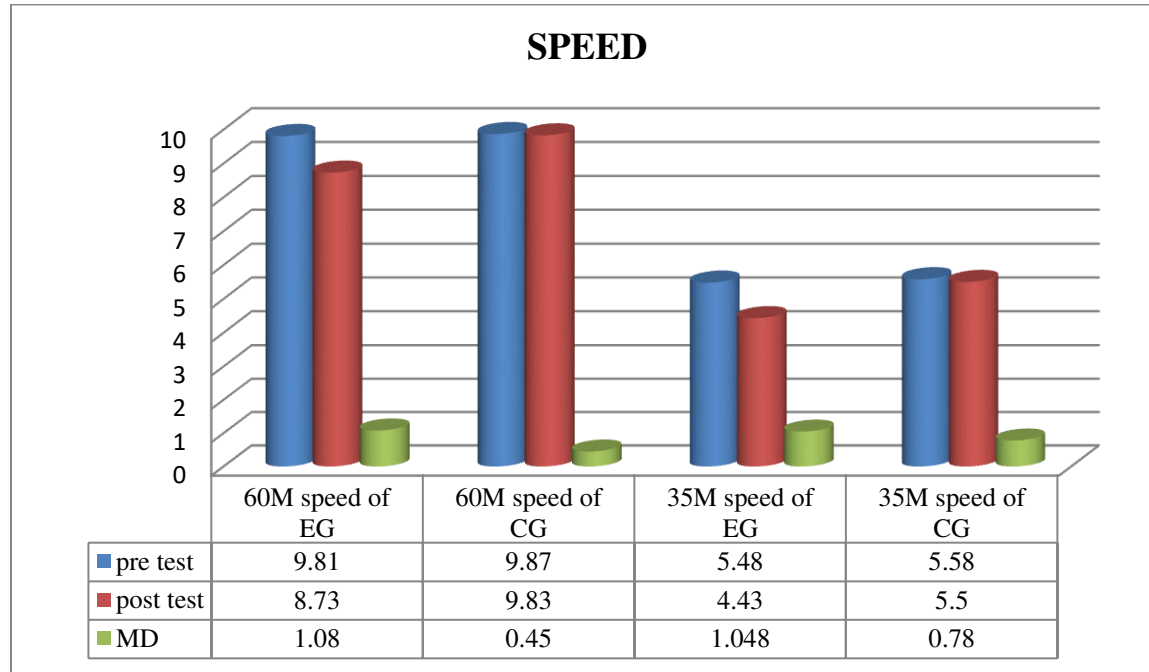
Table 4: Mean values and standard Deviation 60m speed and 35m speed pre and post-test.

Groups	N	PT(X, ±SD)	PoT(X, ±SD)	X(PoT and PT)	P
60m ST result of EG	15	9.812±142	8.730±.242	1.082	.000
60m ST result of CG	15	9.87±.141	9.83±.126	0.453	.730
35m ST result of EG	15	5.48±.141	4.43±.339	1.048	.000
35m ST result of CG	15	5.58±0.074	5.50±.098	0.780	.710

EG = experimental groups, CG, control groups, 60m speed test, 35m speed test, X=mean value of each tests, X= (MD) mean difference, PT= pretest result, PoT= post-test results, p=significance level

Table 4 shows that Pre and Post test results of 60m Speed Test and 35m Speed Test for EG and CG on speed of the athletes. As indicated on the above table, Paired Sample T Test revealed statistically significant mean difference between Pretest and Post-test of the two groups after twelve weeks of plyometric exercise training. But, no statistically significant mean difference observed between Pretest and Post-test of both tests for CG as P values (.730 and .710) was higher than alpha value (0.05).

Figure 4: Showing comparative Mean of Pre-test and Post-test results of 60M and 35M Speed.



### Findings and Discussions

Plyometric, also known as “Jump training” or “plyos”, are exercises based around having muscle exert maximum force in short interval of time, with the goal of increasing agility, speed, strength and power. The aim was this study was to examine the effect of selected plyometric exercise on agility, power, strength and speed of under -17 short distance female trainee with average Age 15-17 years which consists of 30 subjects, and half of them were purposively selected as Experimental groups and the remaining as control group for this study. And all of them took a pre T-agility test (TAT) and Illinois agility test (IAT) for agility, Vertical Jump Test (VJT) and Broad Jump Test (BJT) for Explosive power, Wall Squat Test (WST) and Sit Up Test (SUPT) for strength and 35m Dash Test and 60m dash of speed test. Then the regular ordinal training has been continued besides the selected plyometric exercise training on the EG four day per week, up to 60min a day for three months by the investigator himself and one assistance coach. After three months, post-test measurement on the same parameters was taken. The mean difference between the tests were analyzed statistically, with paired Sample T Test at P<0.05.

Implemented on short distance female athletes, brought about significant improvements between pre and post test results of agility in which duration of Agility T-Test(TAT)and Illinois Agility Test (IAT)result was

decreased by (PT and PoT mean difference) 1.472 seconds at  $P=0.000$  and 1.753 seconds at  $P=0.000$  respectively. Thus, the output of this study is similar with the findings of (Corey.M et al., 2006) conducted four-week plyometric training program on measurement of power in male collegiate hockey player. Similarly, Heydar et al. (2013) Conducted on The effect of six-week plyometric exercise on performance of male athlete aged between 11-14 years old showing significant increment in performance on the Standing Broad Jump, vertical jump, Sprint, and Shuttle Run tests and recommend that polymeric exercises can improve general performance of athletes. Moreover, the findings of Mohammed (2016) and Liao (2005) plyometric training with deferent intensity significantly improved the explosive power, vertical and horizontal power enhancement.

Regarding Explosive Power, in which duration to complete BJT (Broad jump test) and VJT (vertical jump test) was increased by (PT and PoT mean difference) 20.4 cm at  $P=0.000$  and 9.93 cm at  $P=0.000$ . And strength, in which WST (Wall squat test) and SUPT (Sit up test) test result were increased by (PT and PoT mean difference) 13 second resist at  $P=0.000$  and 15.46 repetition within 30 second at  $P=0.000$  respectively. Thus, the result of this study is agreed with the finding of Ozbar (2015) carried out on the Effects of plyometric training on explosive strength, speed, and kicking speed in female soccer players.

Speed, in which duration of 35m Dash and 60m Dash speed test result was decreased by (PT and PoT mean difference) 1.08 seconds at  $P=0.000$  and 1.048 seconds at  $P=0.000$  respectively for EG but with no changes for CG. Thus, the results of the current study is in agreement with the findings Aalizadeh (2015) carried out on the effects of Short-term Plyometric training Program on Sprint and Strength.

### Conclusions

The selected plyometric exercises are significant determinant factors on the performance improvement of short distance female athlete's athletics trainees. Thus it has been concluded that selected plyometric exercises training conducted for three months relatively improve agility, power, strength and speed of short distance athlete.

As a result the investigators recommended the incorporation of selected plyometric exercise program for athletes involved in short distance events.

### Interest conflict

We, both the Author and the Co-author do not have interest conflict in case on our authorship and correspondence.

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