

Research Article

Prediction of Shot-Put Performance under Plyometric Exercises Training - A Field Study

Raghu K^{1*} and Moiz Ahmed MD²

¹College of Physical Education, Kakatiya University, India

²Research Supervisor, Kakatiya University, India

Abstract

The present study elevates the effect of plyometric training exercises on the shot-put performance of schoolboys. In this study, the researcher has been taken sixty subjects as high school boys from a selected High School, Chimmappudi, Khammam district, Telangana region, at random and their ages, lie in between 14 to 16 years. The subjects were divided into two identical groups, which consist of thirty in each group, Experimental Group (Plyometric Exercise Training (PT) and Control Group (CG). The dependent variables, namely, shot-put and abdominal strength, were selected and measured by shot-put through a test and Jack Knife Test for this shot. The data were analyzed using SPSS 20.0 with descriptive measures and a sampling test for paired mean difference t-test at the 0.05 level of significance. The data inferred a significant improvement in the two variables, shot-put performance and Abdominal Strength, by the relevance of plyometric exercises. The regression model equation is fitted, and it is observed that all the variables, namely Speed (sec), Pullups (rep), Standing Broad jump, Jackknife showed an impact on shot put performance. This kind of Analysis is a practical effect of plyometric movements on shot-put accounts at high school levels.

Keywords: Plyometric exercise; Shot-put performance; Abdominal strength; Jack knife test; Multiple regression

Introduction

Present days, Plyometric exercises can play a significant role in Physical education and sports. Plyometric, also known as "jump training" or "plyos," are exercises in which muscles exert maximum force in short intervals of time, intending to increase power (i.e. speed-strength). 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. Plyometrics 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. Plyometrics includes explosive, powerful training exercises trained to activate the body's major muscles' quick response and elastic properties. It was initially made famous by Soviet Olympians in the 1970s, providing the core element in elite sporting athletes' strength programs worldwide. Sports using plyometrics include basketball, tennis, badminton, squash and volleyball, and football's various codes [1].

Motor fitness

The components of motor fitness refer to the several key features required to facilitate quality overall wellness. In most traditional circles, there are considered to be five general components of fitness: cardio respiratory endurance, muscular strength, muscular

endurance, flexibility, and body composition, although healthy body composition is most often a by-product of the other components and is therefore not recognized in some circles as an actual "component" of fitness. Following the five general fitness components are "motor" fitness elements, which most affect athletic performance. These include muscular power, Speed, balance, coordination, accuracy, and agility. Reaction time is also considered by some to be a component of motor fitness; however, some also contend that it is a type of Speed, i.e., "reaction speed". Improvements in endurance, stamina, strength, and flexibility come about through conditioning/training. Training refers to an activity that improves performance through a measurable organic change in the body. Concurrently, improvements in coordination, agility, balance, and accuracy are developed through practice. Practice refers to an activity that improves performance through changes in the nervous system. Power and Speed are adaptations of both training and practice [2]. Jack Knife test for nine repetitions measures of abdominal strength. Abdominal strength plays a vital role in performing various bending and stretching movements in players on apparatus and floor-about 50% of the activities belonging to the bending and stretching structure movement. The high-performance group has been found to have a significantly higher amount of abdominal strength [3].

Materials and Methodology

In this study, sixty (n=60) male shot-put-performance schoolboys represented their schools from ZPSS High School, Chimmappudi, and Khammam dist. Telangana was considered subjects at random by random sampling approach and their ages from 14 to 16. The subjects were divided into two equal groups of thirty each. The Experimental Group was given 12 weeks (Duration-12 weeks, Session-3 days/week, Duration of one Session-One hour) of plyometric exercise training. The control group was not given any specific activity. Experimental Group -I (Plyometric exercise Training (PT) was given to the experimental group. The subjects were tested on selected variables, namely shot-put performance and Abdominal Strength by

Citation: Raghu K, Moiz Ahmed MD. Prediction of Shot-Put Performance under Plyometric Exercises Training - A Field Study. World J Phys Med Rehabil. 2021; 2(1): 1013.

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Publisher Name: Medtext Publications LLC

Manuscript compiled: Sep 13th, 2021

***Corresponding author:** Raghu K, College of Physical Education, Kakatiya University, India, E-mail: raghukondeti86@gmail.com

shot-put and Jack Knife Test, respectively, for this study. Before and after the training period, the data were collected. The collected data were analysed by using some descriptive measures mean, standard Deviation, Maximum and minimum and paired t-test. The level of significances fixed at a 0.05 Level. Test for correlation were applied. In order to know the impact of variables on the shot put performance is analyzed with the help of multiple regression analysis. The complete description of each method has been explained as follows: The entire statistical was done using SPSS 20.0 ver. Software tool.

The research scholar reviewed the available scientific literature about the problem from books, journals, magazines, websites, and research papers, which revealed the importance of Plyometric Exercise Training-taking into consideration feasibility criteria and availability of the instruments, the following variables were selected for this study.

Dependent Variables: Motor Fitness Components

1. Shot-put performance
2. Abdominal Strength

Independent Variables: Plyometric Exercise Training.

1. Objectives of the Study

The study has been planned with the following objectives:

1. To study the effect of plyometric exercises on Shot-put Performance on High School Boys.
2. To study the effect of plyometric exercises on Abdominal Strength on High School boys
3. To predict the shot-put performance by Plyometric Exercises
4. Hypotheses: It has been set up the hypotheses that the plyometric training will improve shot put performance, physical fitness skills among the high school boys of ZPSS, Chimmappudi, Khammam district
5. There is no significant effect of physical fitness skills and shot-put performance among the high school boys in Control Group
6. There is a significant effect of physical fitness skills such as Abdominal Strength among the high school boys in Experimental Group
7. There is a significant effect of plyometric exercises on shot-put performance in experimental group.

Data Analysis, Results and Discussion

Table 1 reveals the Mean, Standard Deviation, Mean difference of shot-put between pre-and post-test high school boys in the Control Group by Throw (Secs) test. The mean and Standard deviations are 4.23 ± 1.27 , 4.23 ± 1.27 , respectively. The shot-put minimum and maximum values were found to be 2.61, 2.61, and 7.4, 7.4, respectively. The mean difference of shot-put between Pre-and Post-Test of on high school boys is 0.00 in the control group.

Table 2 shows the Mean, Standard Deviation, Mean difference of shot put (cm) between pre-and post-test of high school boys in plyometric training group by Standing Broad Jump Test (Mtrs) test. The mean and Standard deviations are 4.91 ± 1.15 , 6.37 ± 1.14 respectively. In the group the shot put (cm) minimum and maximum values were found to be 3.3, 3.55 and 7.45, 8.01 respectively. It is

obvious that the mean difference of shot put (cm) between Pre-and Post-Test of on high school boys is 1.46 in plyometric training group.

Table 3 shows the Mean, Standard Deviation, Mean difference of abdomen strength between pre-and post-test of school subjects in the control group by jack-knife test (in repetitions) test. The mean and Standard deviations are 9.13 ± 4.07 , 9.47 ± 4.27 , respectively. The speed minimum and maximum values were found to be 3.3 and 18, 19, respectively. The mean difference of abdomen strength between Pre-and Post-Test of on high school boys is 0.33 in the control group.

Table 4 shows the Mean, Standard Deviation, Mean difference of jackknife test in repetitions) between pre-and post-test of school subjects in the circuit training group by jackknife test 9 repetitions) test. The mean and Standard deviations are 11.33 ± 4.24 , 16.43 ± 4.33 , respectively. In the group, the jackknife test in repetitions) minimum and maximum values were found to be 5, 8, and 19, 23, respectively. It was evident that the mean difference of jackknife test in repetitions) between Pre-and Post-Test of on high school, boys are 5.10 in the Plyometric training group.

Table 5 indicates a significant improvement in the shot-put performance through plyometric exercise training. It reveals that the obtained t-statistic observed value 10.239 is substantial since the 'p' value is 0.001 lesser than the 0.05. There was a significant improvement between pre and post-tests on the selected motor fitness components. There was a considerable improvement in the Speed between the experimental group's pre and post-tests, whereas the control group showed no significant improvement. Hence, the results indicate that the shot-put performance's considerable improvement was due to the Plyometric Exercise (PT) training alone (Graph 1).

Table 6 indicates a significant improvement in abdominal muscular strength through plyometric exercise training. It reveals that the obtained t-test statistic value 8.17 is substantial because the 'p' value is lesser than the 0.05. There was a significant improvement between pre and post-tests on strength. There was a considerable improvement in the power between the experimental group's pre and post-tests,

Table 1: Shot put (Cm.) performance in pre and post test of on high school boys in control group.

Control Group	Shot put (cm.)	
	Pre-test	post-test
Mean	4.23	4.23
SD	1.27	1.27
Minimum	2.61	2.61
Maximum	7.4	7.4
Mean Difference	0.00	

Table 2: Shot put (cm.) performance in pre and post test of on high school boys in plyometric training group.

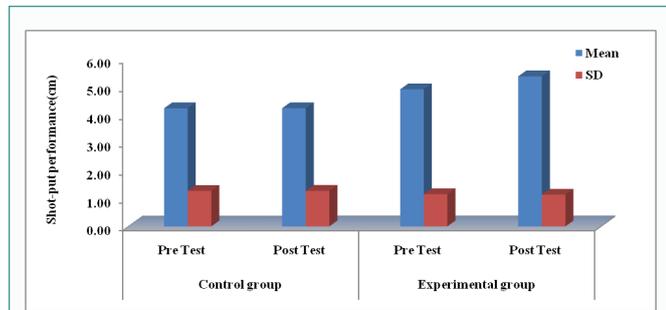
Plyometric Group	Shot put(cm.)	
	Pre test	post test
Mean	4.91	6.37
SD	1.15	1.14
Minimum	3.3	3.55
Maximum	7.45	8.01
Mean Difference	1.46	

Table 3: Abdomen strength in pre and post test of on high school boys in control group.

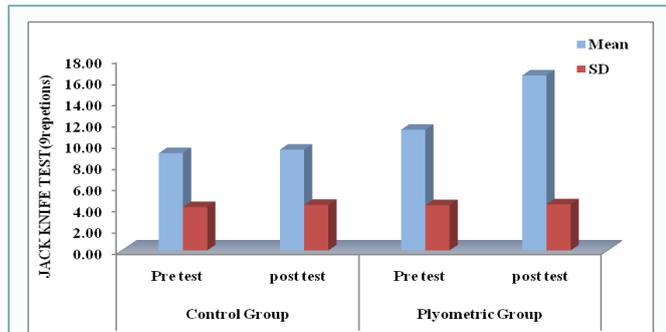
Control Group	Jack Knife Test (in repetitions)	
	Pre-test	post-test
Mean	9.13	9.47
SD	4.07	4.27
Minimum	3	3
Maximum	18	19
Mean Difference	0.33	

Table 4: Descriptive analysis of strength in pre and post test of on high school boys in-plyometric training group.

Plyometric Group	Jack Knife Test (repetitions)	
	Pre-test	post-test
Mean	11.33	16.43
SD	4.24	4.33
Minimum	5	8
Maximum	19	23
Mean Difference	5.10	



Graph 1: Showing the mean difference of pre and post tests shot-put performance of in control group and experimental group.



Graph 2: Showing the mean difference between pre and post tests abdomen strength in control group and experimental group.

whereas the control group showed no significant improvement. Hence, the results indicate that the strength was substantial due to the Plyometric Exercise (PT) training alone (Graph 2).

Results about the Hypothesis- III, the null hypothesis is "there is no significant impact of variables namely Speed (sec) Pullups (rep) Standing Broad jump, Jackknife on shot put performance in post-test

whereas the control group showed no significant improvement. Hence, the results indicate that the strength was substantial due to the Plyometric Exercise (PT) training alone (Graph 2).

Results about the Hypothesis- III, the null hypothesis is "there is no significant impact of variables namely Speed (sec) Pullups (rep) Standing Broad jump, Jackknife on shot put performance in post-test of on high school boys in the plyometric training group.

Multiple regression analysis

Know the impact of variables on the shot put performance is analysed with the help of multiple regression analysis. The cause and effect between dependent and independent variables are carried out by this Analysis. Hence, the regression equation is represented as [4]

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_k X_k$$

To analyze the impact of other variables on shot put performance

Test performed: Multivariate (Multiple) Regression Analysis

It is a procedure of regressing multiple dimensions while simultaneously removing those that aren't important. Stepwise regression ensures multiple regressions several times, each time removing the weakest correlated variable. Finally, the left-out variables explained the best contribution. The requirements for proceeding to this method are

1. The data should be normally distributed (or rather, that the residuals are), and
2. There is no correlation between the independent dimensions known as collinearity.

Impact of variables on shot put performance

Multiple Regression Analysis Beta-Coefficients appear in the final models which were predicted. All Beta-coefficients are significant in the model, which was shown in Tables 7-11.

Results and Discussion

It is revealed that the variables showed a significant favourable influence on shot put performance. Finally, the model equation for shot put performances.

$$Y_1 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4$$

Where Y_1 =Shot put Performance, X_1 =Speed, X_2 =Pullups, X_3 =Explosive power, X_4 =Jack-knife

Table 5: Hypothesis-I test on paired mean difference in pre and post tests on shot-put in experimental and control groups.

Group	Test	Mean	SD	Df	Mean Diff	t-value	p-value
Experimental	Pre-Test	4.91	1.15	29	0.47	10.239	0.001*
	Post -Test	5.37	1.17				
Control	Pre-Test	4.23	1.26	29	0.01	2.021	0.067
	Post-Test	4.24	1.27				

Table 6: Hypothesis-II test on paired mean difference in pre and post tests on abdomen strength experimental and control groups.

Group	Test	M	SD	Mean diff.	df	t-value	p-value
Experimental	Pre-Test	9.13	4.07	0.34	29	25.54*	0
	Post-Test	9.47	4.27				
Control	Pre-Test	11.33	4.24	5.1	29	1	0.34
	Post-Test	16.43	4.33				

significance at 0.05 level; df=degree of freedom

Table 7: Multiple regression analysis plyometric training (post-test analysis) - Descriptive statistics.

Descriptive Statistics			
	Mean	Std. Deviation	N
Shotput performance	5.37	1.14	30
Speed(sec)	4.83	0.34	30
Pullups(count)	8.67	3.35	30
Standing broad jump	195.70	20.93	30
Jack knife	16.43	4.33	30

and $\beta_0 = 9.25$, $\beta_1 = -1.32$, $\beta_2 = -0.01$, $\beta_3 = 0.01$, $\beta_4 = 0.15$

From the above model equation, all the Speed (sec) Pullups (sec) Standing Broad jump Jack-knife showed an impact on shot put performance.

Findings of the study

1. The study results reveal that the twelve weeks of plyometric

Table 8: Multiple regression analysis plyometric training (post-test analysis) - Correlations.

Correlations						
		Shotput	Speed	pullups	Standing Broad jump	Jack knife
Pearson Correlation	Shotput	1.00	-0.69	0.58	0.45	0.77
	Speed	-0.69	1.00	0.67	0.51	0.57
	Pullups	0.58	-0.67	1.00	0.52	0.62
	Standing Broad jump	0.45	-0.51	0.52	1.00	0.45
	Jack knife	0.77	-0.57	0.62	0.45	1.00
Sig. (1-tailed)	Shotput	.	.000	.000	.007	.000
	Speed	.000	.	.000	.002	.001
	Pullups	.000	.000	.	.002	.000
	Standing Broad jump	.007	.002	.002	.	.006
	Jack knife	.000	.001	.000	.006	.
N	Shotput	30	30	30	30	30
	Speed	30	30	30	30	30
	Pullups	30	30	30	30	30
	Standing Broad jump	30	30	30	30	30
	Jack knife	30	30	30	30	30

Table 9: Multiple regression analysis plyometric training (post-test analysis) - Model summary.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. An error of the Estimate
1	0.83 ^a	0.69	0.64	0.69

^aPredictors: (Constant), jack knife, standing broad, Speed, pullups

Table 10: Multiple regression analysis plyometric training (post-test analysis) - ANOVA.

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.75	4	6.44	13.73	.000 ^b
	Residual	11.73	25	.47		
	Total	37.48	29			

^bPredictors: (Constant), jack knife, standing broad jump, Speed, pullups

exercise training on the selected dependent variables. There was a significant improvement in shot-put performance through Plyometric Exercise Training (PT). Since the 'p' value is lesser than the 0.05. There was a significant improvement between pre and post-tests on shot-put performance.

2. The study results reveal that the twelve weeks of plyometric exercise training on the selected dependent variable. There was a significant improvement in Abdomen strength through plyometric exercise training (PT). Since the 'p' value is lesser than 0.05, there was a significant improvement between pre and post-tests on strength.
3. The study reveals that there is a influence of plyometric exercises on shot-performance.

Delimitations

The study was conducted on 60 High school boys of ZPSS, Chimmappudi, Khammam only. A selected few plyometric exercises are taken for the study. Only boy Students was taken for the study.

Table 11: Multiple regression analysis plyometric training (post-test analysis) - Coefficients.

Coefficients								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	9.25	3.49		2.65	0.01	2.05	16.45
	Speed(sec)	-1.32	0.54	-0.39	2.44	0.02	0.21	2.42
	Pullups(sec)	0.01	0.06	0.04	2.23	0.02	0.10	0.13
	Standing Broad jump	0.01	0.01	0.02	2.11	0.04	0.01	0.02
	Jack-knife	0.15	0.04	0.56	3.78	0.000	0.07	0.23

Limitations

1. As very few related literatures regarding the few plyometric fitness components was available
2. Selection of student was made in random and height, weight was not to be taken into consideration
3. Food habits was not taken in to consideration for the study
4. Significance of the Study:
5. This study helps to investigate the improvement in physical fitness test.
6. This research suggests improving among the high school boy's shot put performance.
7. This study may help the coaches and physical education teachers and other Related with the field to the imp of performance.
8. This work may also help to bring new scope related to physical fitness in case of children improvement skills of Shot put.

Conclusions

From the result of the study, the conclusions have been drawn as follows: There was a significant difference in abdominal strength and shot-put throw performance on schoolboys. Also, all the figures show the difference in the mean of abdominal muscle and shot-put. It was concluded that there was a significant improvement in the selected dependent variables, namely shot-put performance, and explosive power, by plyometric exercise training.

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