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The Effects of a 8-Week Plyometric Training Program on Horizontal Jump

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Abstract
The purpose of the study was to determine the effect of 8 week plyometric training programme on "Horizontal jump". Total forty (n= 40) students, age ranging from 20 to 25 years, in which two groups were formed randomly (N=20) for Experimental and (N=20) for Control Group for this study. The experimental group performed 8 week plyometric training program of 50 minute a day, 3 times in a week in the morning sessions and the control group did not perform. Standing Broad Jump (SBJ) was used to analyze the performance. The data was analyse by using paired and grouped t-test at 0.05 level of significance. On the basis of statistical findings, the paired statistic shows the difference within the experimental and for control group; $t(19) = 5.93$ $p < 0.001$, $t(19) = 3.17$ $p < 0.001$ respectively. The grouped statistic shows the difference between experimental and control group; $t(38) = 6.64$ $p < 0.001$.So, the null hypothesis was rejected in the both cases, ultimately the experimental group post score means was statistically significantly higher than the control group, where Cohen's D was also estimated at 2.15 which itself explanatory. So, it was conclude that there was a significant improvement on horizontal jump due to eight weeks training of selected plyometric exercises.
Keywords: Plyometrics, Horizontal jump

Introduction

Plyometric training is a type of strength training in which muscle exert force in short intervals of time, with the aim of increasing power. These types of exercises consists of a rapid stretching of a muscle immediately followed by a concentric or shortening action of the same muscle and connective tissue (Baechle and Earle, 2000). Plyometric exercises are defined as eccentric loading immediately followed by a concentric contraction. (R Ford, D Myer, E Hewett)

These exercises have three phases Eccentric phase (landing phase), Amortization phase (transition phase) and concentric phase (take-off phase).

In Eccentric phase storing potential energy in the muscles. Amortization phase is the time between the concentric and eccentric phases. This time needs to be as short as possible otherwise the energy stored during the eccentric phase dissipates. The shorter amortization phase gives us more powerful results. During concentric phase, uses the stored energy to increase the force of the movement.

A single plyometric training session suggests that adult athletes with novice experience should use a training volume with 80 to 100 foot contacts per session while adult athletes with more experience can use 120 to 140 foot contacts per session. (Chu and Myer, 2013). Plyometric training techniques are used by athletes in all types of sports to increase strength and explosiveness (Chu, 1998)

Aim and Objectives of the Study:

To find out the effect of 8 week plyometric training programme on "Horizontal jump".

METHODOLOGY

Selection of Participants

A group of forty (n= 40) students in the age group of 20 to 25 years studying in Department of Physical Education Aligarh Muslim University Aligarh were randomly selected for the experiment of this study. Subjects were randomly assigned to two groups for the experiment namely Experimental Group (N=20) and Control Group (N=20). All the participants free of upper, lower extremity injuries, and were not involved in any type of plyometric training at the time of the study. All the participants were informed about the aim and methodology of the study. The experiments were explained in detail.

Table 1
Demographic data, Data are means (±SD).

	Control group n =20 (♂=15, ♀=5)	**Training group n =20 (♂=16, ♀=4)**
Age (yrs)	24.72 (2.19)	22.88 (1.18)
Height (m)	1.67 (0.094)	1.68 (0.061)
Weight (kg)	68.55 (13.03)	62.94 (11.01)

Selection of Variables
Dependent variables: "Horizontal jump" was the dependent variable, selected in this study.
Independent variables: plyometric training as a training method had been selected & implemented on to the selected participants, in which following items were performed during whole training schedule.
1. Ankle Hops
2. Box Jump
3. Depth Jump
4. Jump Squat
5. Plyometric Step up
6. Alternating Lunge Jumps

Training Protocol:
All participants were full time students attending their classes according to department curriculum. The researcher gave orientation to them.

During due course of time, morning session was selected to performed 8 week plyometric training program of 50 minute a day, 3 times in a week on experimental group, and the control group did not perform any plyometric training techniques. Subjects were always tested in the morning. Each plyometric training session started with proper warming up.

Training Week	**Training Volume (foot contacts)**	**Plyometric Drills**	**Sets x Reps**	**Training Intensity**
Week 1	**Monday (80)**	Ankle hops	2 x 16	Low
		Box jump	3 x 8	
		Jump squats	3 x 8	
	Wednesday (80)	Ankle hops	2 x 16	Low
		Box jumps	3 x 8	
		Jump squats	3 x 8	
	Friday (80)	Ankle hops	2 x 16	Low
		Box jump	3 x 8	
		Jump squats	3 x 8	
Week 2	**Monday (90)**	Ankle hops	2 x 15	Low
		Box jump	3 x 10	Medium
		Jump squats	3 x 10	
	Wednesday (90)	Ankle hops	2 x 15	Low
		Box jumps	3 x 10	Medium
		Jump squats	3 x 10	
	Friday (100)	Ankle hops	2 x 15	Low
		Box jump	3 x 8	
		Jump squats	3 x 10	Medium
		Plyometric Step up	2 x 8	
Week 3	**Monday (110)**	Ankle hops	2 x 15	Low
		Box jump	3 x 10	Medium
		Jump squats	3 x 10	
		Plyometric Step up	2 x 10	
	Wednesday (105)	Ankle hops	3 x 15	Medium
		Box jumps	3 x 10	
		Jump squats	3 x 10	
	Friday	Ankle hops	2 x 15	Low
		Box jump	3 x 10	

	(110)	Jump squats	3 x 10	Medium
		Plyometric Step up	2 x 10	
Week 4	**Monday (120)**	Ankle hops	2 x 15	Low
		Box jump	3 x 10	Medium
		Jump squats	3 x 8	
		Plyometric Step up	3 x 8	
		Depth Jump	2 x 6	
	Wednesday (110)	Ankle hops	2 x 15	Low
		Box jumps	3 x 8	
		Jump squats	2 x 8	Medium
		Plyometric Step up	3 x 8	
		Depth Jump	2 x 8	
	Friday (120)	Ankle hops	2 x 15	Low
		Box jump	3 x 10	Medium
		Jump squats	3 x 8	
		Plyometric Step up	3 x 8	
		Depth Jump	2 x 6	
Week 5	**Monday (120)**	Ankle hops	2 x 15	Low
		Box jump	3 x 10	Medium
		Jump squats	3 x 10	
		Depth Jump	2 x 7	
		Alternating Lunge Jumps	2 x 8	
	Wednesday (120)	Ankle hops	3 x 16	Medium
		Box jumps	3 x 8	
		Jump squats	2 x 8	
		Depth Jump	2 x 8	
		Alternating Lunge Jumps	2 x 8	
	Friday (120)	Ankle hops	2 x 15	Low
		Box jump	3 x 10	Medium
		Jump squats	3 x 8	
		Depth Jump	2 x 8	
		Alternating Lunge Jumps	2 x 10	
Week 6	**Monday (130)**	Ankle hops	2 x 15	Low
		Box jump	2 x 10	Medium
		Jump squats	3 x 10	High
		Depth Jump	3 x 8	
		Alternating Lunge Jumps	2 x 13	
	Wednesday (130)	Ankle hops	2 x 15	Low
		Box jumps	2 x 10	Medium
		Jump squats	3 x 10	High
		Depth Jump	3 x 8	
		Alternating Lunge Jumps	2 x 13	
	Friday (140)	Ankle hops	2 x 15	Low
		Box jump	2 x 10	Medium
		Jump squats	3 x 10	High
		Depth Jump	3 x 10	
		Alternating Lunge Jumps	2 x 15	
Week 7	**Monday (140)**	Ankle hops	2 x 15	Low
		Box jump	2 x 10	Medium
		Jump squats	3 x 10	High
		Depth Jump	3 x 10	
		Alternating Lunge Jumps	2 x 15	
	Wednesday (130)	Ankle hops	2 x 15	Low
		Box jumps	2 x 10	Medium
		Jump squats	3 x 10	High
		Depth Jump	3 x 8	

		Alternating Lunge Jumps	2 x 13	
	Friday (140)	Ankle hops	2 x 15	Low
		Box jump	2 x 10	Medium
		Jump squats	3 x 10	High
		Depth Jump	3 x 10	High
		Alternating Lunge Jumps	2 x 15	
Week 8	**Monday (120)**	Ankle hops	2 x 15	Low
		Box jump	2 x 10	Medium
		Jump squats	3 x 8	
		Depth Jump	2 x 8	
		Alternating Lunge Jumps	2 x 15	High
	Wednesday (100)	Ankle hops	2 x 15	Low
		Box jumps	2 x 10	Medium
		Jump squats	2 x 10	
		Plyometric Step up	2 x 15	
	Friday (100)	Ankle hops	2 x 15	Low
		Box jump	2 x 10	Medium
		Jump squats	2 x 10	
		Plyometric Step up	2 x 15	

All subjects were under direct supervision and were instructed on how to perform each exercise during the whole training session.

Testing procedure
Standing broad jump (SBJ) was the main tool to access the performance of training program, fourth item of American Alliance for Health Physical education and recreation (AAHPER) youth physical fitness test.

Standing Broad Jump
Purpose: This test measures the explosive strength of legs.
Equipments: Long jump pit, measuring tape etc.
Test procedure: A demonstration of the standing broad jump was given with feet slightly apart. The subject stands behind take off line. With swinging of the arms and bending of the knees to provide forward drive, the subject used a two foot take-off and landing. The subject attempts to jump as far as possible, landing on both feet without falling backwards. Two attempts were allowed.
Scoring: Record the longest distance jumped of two trials was recorded The measurement was taken from take-off line to the nearest point of contact on the landing..
Scoring: Maximum distance measured to the nearest centimeters was the score and the better of two trials was recorded.

STATISTICAL ANALYSIS:
Pre and post values for the dependent variables were analyzed to determine wether the distributions were normal by using Kolmogorov-Smirnov goodness-of-fit test and the Shapiro-Wilk Normality test. To access the Changes in the scores in between (post – pre) were computed for each of the dependent variables i.e. Horizontal Jump in both the groups**,** and the bivariate Pearson correlation coefficient (with a two-tailed test of significance) for each pair of variables were analyzed. And to test for differences in between the score of Plyometric Training for the dependent variable in Experimental and Control group Independent t-test was performed to access the changes into scores using the post test values. Alpha was established a priori at $p < 0.05$. The Statistical Package for Social Science (SPSS version 20) was used to calculate the statistics.

RESULTS AND DISCUSSION
To test the hypothesis of the dependent t-test results were presented in the table no 3, in which the means, standard deviations, std. error mean with t(df)=p-value . Prior to conducting the analysis the assumptions met and tests of normality indicated that dependent variables were normally distributed.

Table No. 3 Paired Samples Statistics								
Group		**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**t**	**df**	**Sig. (2-tailed)**
Experimental	Pre-test	20	0.18	0.13	0.03	5.932	19	<0.000
	Post-test							
Control	Pre-test	20	-0.07	-0.10	0.02	3.171	19	<.005
	Post-test							

There was a significant difference in experimental group of horizontal jump pre test performance (m= 2.09, SD=.225) and post test (m= 2.27, SD=.257) condition; t (19) = 5.93 $p < 0.001$

There was a significant difference in control group of horizontal jump pre test performance (m= 1.89, SD=.320) and post test (m= 1.82, SD=.318) condition; t (19) = 3.17 $p < 0.001$

So, from the pair test t-test it shows a significant increase in the performance of plyometric-training programme on experimental group (2.09 ± 0.22 m to 2.27 ± 0.25 m ($p < 0.001$); an improvement of 0.17 ± 0.03 m was examined and, for control group (1.89 ± 0.320 m to 1.82 ± 0.318 m ($p < 0.001$); deterioration of -0.07 ± 0.002 m was examined. The Paired Samples Correlation table also added the information that post and pre scores are significantly positively correlated (r = .851; r=.950) for experimental group and control group respectively. And the average, post scores were 24 points higher than pre scores (95% CI [0.24, 0.11])**.**

The results of the Independent t-test are presented in the table no 4, in which the means, standard deviations, std. error mean with t (df)=p-value.

Table No. 4 Group Statistics								
	Group	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**t**	**df**	**Sig. (2-tailed)**
Horizontal Jump	**Experimental**	20	0.18	0.13	0.03	6.64	38	<0.001
	Control	20	-0.07	0.10	0.02			

From the above table no.4 it was examined that, there were significant difference found in the performance of horizontal jump in experimental (m= 0.18, SD=0.13) and control group (m= -0.07, SD=0.10) post test scores and; t (38) = 6.64 $p < 0.001$

So, from the Independent t-test it shows a significant increase in the performance of plyometric-training programme on experimental group (2.09 ± 0.22 m to 2.27 ± 0.25 m ($p < 0.001$); an improvement of 0.25 ± 0.03 m was examined. And the average, post scores were 17 points higher than pre scores (95% CI [0.17, 0.32])**.**

CONCLUSION

Our decision and conclusions were made from the output given by SPSS we take the following statistics; t(degrees of freedom) = t-value, p = significance level and bivariate Pearson correlation coefficient (with a two-tailed test of significance) for each pair of variables entered, and tested, from the output results we concluded from the above table no.3 which shows the statics for experimental group score (post - pre); t (19) = 5.93 $p < 0.001$, and for control group score (post – pre) ; t (19) = 3.17 $p < 0.001$. And from table no.4 which itself explanatory and shows the statics between experimental and control group score (Post-experimental –Post-control); t (38) = 6.64 $p < 0.001$. So, the null hypothesis was rejected in the both cases, when means were compared within the groups and between groups. Ultimately the experimental group post score means was statistically significantly higher than the control group, where Cohen's D was estimated at 2.15 which is large effect on cohen's (1992) guidelines. On the basis of statistical findings of the study it was conclude that there was significant improvement on horizontal jump due to eight weeks training of selected plyometric exercises.

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