

# Effect of Plyometric Training and Resistance Training on the Performance of National Level Female Basketball Players

## Abstract

A total of forty five female (N=45) School National level female basketball players ranging between 16-18 years of age were taken as subjects for the purpose of the study. The subjects were randomly selected and training was conducted at Government Senior Secondary Girls School, Mall Road, Amritsar. The subjects were divided into two groups namely: Experimental Group (30 subjects in total) and Control Group (15 subjects). The Experimental group was further sub-divided into two groups of 15 subjects in each group. Experimental Group-I was given (Plyometric Training), Experimental Group-II (Resistance Training). The following performance variables were selected for the purpose of the study: Performance (Johnson Basketball Test, C. Meyers, 1974) - Field Goal Speed Test, Basketball Throw for Accuracy, Dribble Test. In order to find out the differential effects of the two treatment groups (Plyometric and Resistance) and one control group, Analysis of Covariance (ANCOVA) test was computed with the help of SPSS computer software. The LSD post-hoc test was applied in cases where 'F'-ratio has shown significance to find out which of the differences of the paired means were significant. The level of significance chosen was .05. The results proved that plyometric group demonstrated maximum effect on all three performance variables namely dribbling ability, speed shot ability and throw for accuracy followed by resistance group as compared to control group.

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**Key words:** Resistance Training, Fitness, Female, Basketball Players

## Introduction

Sports coaches and sports scientists always look for new, better or different ways to improve performance. What is now popularly known as Plyometrics was discovered and refined over the past 30 or so years. Plyometric Exercises are specialized high intensity training technique used to develop strength and speed. Plyometric movements are those in which a muscle is loaded and then contracted in rapid sequence, use the strength, elasticity and innervations of muscle and surrounding tissues to jump higher, run faster or hit harder, depending on desired training goal. Plyometrics in the form of dynamic depth jumps, where an individual steps of a box 20 to 80 cms in height and performs an explosive vertical jump has been reported to enhance an individual's ability to rapidly develop force. Plyometrics was first known as "Jump training"? Fredwit, an American track and field coach first coined the term Plyometrics. Plyometric exercises should only be performed when an athlete is sufficiently warmed up. For example a light jog and some dynamic movements to stretch, don't overdo the warm up it isn't necessary. Absorbing the shock when landing for too long is another mistake people make. The aim is to spend the least amount on the ground because your muscles are relying on stretch reflex to explode up as fast as possible. Plyometrics are training techniques used by athletes in all types of sports to increase strength and explosiveness (Chu, 1998).

A combination of plyometrics and resistance training during a training cycle should be structured to allow maximal efficacy and physical improvement. To our knowledge, no randomized studies have compared the effects of combined plyometric training and prospective resistance training in children and adolescents. In previous reports involving youth, the effects of plyometric training were compared to a 'control' condition which

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consisted of sport training or physical education class ( Cosser et al, 1999; Diallo et al., 2001; Kotzamanidis, 2006; Matavulj et al., 2001) or the study did not have a control group (Brown et al., 1986). Since young athletes are often encouraged to perform static stretching prior to resistance exercise (Martens, 2004), it is intriguing as to whether plyometric training and resistance training (without pre-event static stretching) can provide combinatory effects in younger populations. Given the growing popularity of youth strength and conditioning programs, and the perception among most youth coaches that pre-event static stretching is beneficial (Shehab et al., 2006), it is important to ascertain the most efficacious method for enhancing fitness performance in children and adolescents. This information would be useful to physical educators, sport coaches and health care providers.

Basketball is one of the sports characterized by many of the basic and variable skills. The basketball player perfection to do such skills, defensive or offensive, needs development in the physical qualities of the basketball player, which enables him to do the required duties throughout the match. Special physical preparation in basketball is the main pillar for the players to carry out the special requirements (physical, skillful and tactical). Without these requirements, the player cannot achieve the objectives set up for the training or competition. The skillful performance is relevantly associated with the special physical motor abilities as the perfection of the skillful performance depends on the range of the development of the special physical abilities to perform such requirements, such as muscular power, endurance, agility and others. The skillful performance is often measured by the level of the player to acquire physical abilities (Abdel et.al 1992).

In the field of training, there is a new technique emerged similar to the nature of performing basketball skills by developing the ability of vertical jump, which called plyometric as it includes stretching muscles (while you perform it) followed by a direct fast muscle contraction. The tension resulted from using the plyometric training is higher than the tension resulted from using other types of training, such as the static and dynamic contraction (Boatwright et.al 1994). Therefore, the purpose of the present investigation was to compare the effects of 8-week training period of plyometric and resistance with performance in youth Basketball players.

**Procedure and Method**

The present study was conducted on forty five (45) School National level female basketball players ranging between 16-18 years of age. The subjects were randomly selected and training was conducted at Government Senior Secondary Girls School, Mall Road, Amritsar (Punjab). The subjects were divided into two groups namely: Experimental Group (30 subjects in total) and Control Group (15 subjects). The Experimental group was further subdivided into two groups of 15 subjects in each group. Experimental Group-I was given (Plyometric Training), Experimental Group-II (Resistance Training). All the

subjects were local residents. Measurements for variables were taken at the beginning (pre-test) and at the end of experimental training period after eight weeks (post-test). During data collection period, the subjects were not allowed to participate in any competition except daily training schedule. The following variables were selected for the purpose of the study: Performance (Johnson Basketball Test, C. Meyers, 1974) -Field Goal Speed Test, Basketball Throw for Accuracy, Dribble Test. In order to find out the differential effects of the two treatment groups (Plyometric and Resistance) and one control group, Analysis of Covariance (ANCOVA) test was computed with the help of SPSS computer software. The LSD post-hoc test was applied in cases where 'F'-ratio has shown significance to find out which of the differences of the paired means were significant. The level of significance chosen was .05.

**Data Analysis and Results**

The Analysis of Covariance for different Training groups (Experimental group 1: Plyometric group, Experimental group 2: Resistance group and control group of school national level female basketball players for basketball performance comprising of dribble is presented below.

**Table-1**  
**ANCOVA on Performance (Dribble) Of School**

TESTS	GROUPS (MEAN)			Source of Variance	Sum of Square	df	Mean Square	'F' Value
	EXP GP-1	EXP GP-2	CONT GP.					
Pre-Test Means	21.00	20.00	20.47	Between Groups	10.20	3	3.40	5.05*
				Within Groups	37.73	56	.674	
Post-Test Means	23.40	22.27	20.87	Between Groups	51.00	3	17.00	16.53*
				Within Groups	57.60	56	1.03	
Adj. Final Mean	22.99	22.49	20.80	Between Groups	46.900	3	15.633	20.27*
				Within Groups	42.420	55	.771	

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\*Significant at 0.05 level 'F'<sub>0.05</sub> (2, 40) = 3.23

The above results indicate that there has been a significant difference among pre-test and post-test mean scores of various training groups of school national level female basketball players among performance variables comprising of dribble as the obtained 'F' value (Pre-test : 5.05 & Post-test : 16.53) was found to be greater than the table value of 3.23, which is required to be significant at 0.05 level of

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significance. Further, the results of adjusted final means indicated significant difference among all groups at 0.05level as obtained 'F' value 20.27 was much more than the table value of 3.23. It is clear from the results that there was meaningful effect of experimental treatment on the groups as the 'F' value is higher than the table value. Therefore, LSD post-hoc test of significance was applied to find the actual effect of Experimental treatment on the groups. The results have been presented in table- 2.

**Table- 2**  
**Significant Differences between the Paired Adjusted Final Means of Dribble in Basketball Performance Variable among Different Training Groups**

PERFORMANCE	GROUPS (MEAN)			MD
	EXP. GP-1	EXP. GP-2	CONTR OL GROUP	
Dribble	22.99	22.49		.499
	22.99		20.80	2.195*
		22.49	20.80	1.696*

\*Significant at .05 level  $F_{.05}(2,40) = 0.92$

From the description presented in table-2, it has been found that there were no significant differences in the adjusted means between Plyometric and Resistance group. However, Plyometric and Resistance group recorded significant differences in comparison to control group as the adjusted mean of 2.195 and 1.696 for these groups were found greater than the obtained critical ratio (0.92). The Analysis of Covariance for different Training groups (Experimental group 1: Plyometric group, Experimental group 2: Resistance group, and control group of school national level female basketball players for basketball performance comprising of dribble is presented in table-3.

**Table-3**  
**ANCOVA on Performance (Field Goal Speed Shot) of School National Level Basketball Players**

TESTS	GROUPS (MEAN)			Source of Variance	Sum of Square	df	Mean Square	'F' Value
	EXP GP-1	EXP GP-2	CONT GP.					
Pre-Test Means	10.47	10.47	9.93	Between Groups	7.20	3	2.40	1.57
				Within Groups	85.73	56	1.53	
Post-Test Means	12.87	12.20	10.47	Between Groups	75.65	3	25.22	16.53*
				Within Groups	55.60	56	.993	
Adj. Final Mean	12.69	12.03	10.57	Between Groups	77.657	3	25.886	42.25*
				Within Groups	33.697	55	.613	

\*Significant at 0.05 level  $F_{0.05}(2, 40) = 3.23$

The above results indicate that there has been a significant difference among post-test mean scores of various training groups of school national level female basketball players among performance variables comprising of speed shot as the obtained 'F' value (Post-test: 16.53) was found to be greater than the table value of 3.23, which is required to be significant at 0.05 level of significance. Further, the results of

adjusted final means indicated significant difference among all groups at 0.05level as obtained 'F' value 42.25 was much more than the table value of 3.23. It is clear from the results that there was meaningful effect of experimental treatment on the groups as the 'F' value is higher than the table value. Therefore, LSD post-hoc test of significance was applied to find the actual effect of Experimental treatment on the groups. The results have been presented in table- 4.

**Table-4**  
**Significant Differences Between The Paired Adjusted Final Means Of Field Goal Speed Shot In Basketball Performance Variable Among Different Training Groups**

PERFORMANCE	GROUPS (MEAN)			MD
	EXP. GP-1	EXP. GP-2	CONT. GP.	
Speed Shot	12.69	12.03		.667
	12.69		10.57	2.13*
		12.03	10.57	1.46*

\*Significant at .05 level  $F_{.05}(2, 40) = 0.82$

It is observed from table-4 that the mean differences between adjusted-paired means were statistically significant in all cases at 0.05 level of significance as the adjusted mean difference was higher for all three groups than the critical ratio ( $F=0.82$ ) except for plyometric and resistance group. All the experimental groups showed significant improvement in speed shot as compared to control group. The Analysis of Covariance for different Training groups (Experimental group 1: Plyometric group, Experimental group 2: Resistance group, Experimental group 3: Combined group) and control group of school national level female basketball players for basketball performance comprising of dribble is presented below.

**Table-5**  
**ANCOVA on Performance (Throw for Accuracy) of School National Level Female Basketball Players**

TESTS	GROUPS (MEAN)			Source of Variance	Sum of Square	df	Mean Square	'F' Value
	EXP GP-1	EXP GP-2	CONT GP.					
Pre-Test Means	15.60	11.60	12.07	Between Groups	271.87	3	90.62	5.97*
				Within Groups	849.87	56	15.18	
Post-Test Means	17.93	13.67	12.80	Between Groups	500.33	3	166.78	14.25*
				Within Groups	655.60	56	11.71	
Adj. Final Mean	16.69	15.42	14.20	Between Groups	89.132	3	29.71	9.147*
				Within Groups	178.649	55	3.248	

\*Significant at 0.05 level  $F_{0.05}(2, 40) = 3.23$

The above results indicate that there has been a significant difference among pre-test and post-test mean scores of various training groups of school national level female basketball players among performance variables comprising of throw for

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accuracy as the obtained 'F' value (Pre-test : 5.97 & Post-test : 14.25) was found to be greater than the table value of 3.23, which is required to be significant at 0.05 level of significance. Further, the results of adjusted final means indicated significant difference among all groups at 0.05 level as obtained 'F' value 9.147 was much more than the table value of 3.23. It is clear from the results that there was meaningful effect of experimental treatment on the groups as the 'F' value is higher than the table value. Therefore, LSD post-hoc test of significance was applied to find the actual effect of Experimental treatment on the groups. The results have been presented in table- 6.

**Table-6**

**Significant Differences between the Paired Adjusted Final Means of Throw for Accuracy in Basketball Performance Variable among Different Training Groups**

PERFORMANCE	GROUPS (MEAN)			MD
	EXP. GP-1	EXP. GP-2	CONT. GP.	
Throw For Accuracy	16.69	15.42		1.270
	16.69		14.20	2.486*
		15.42	14.20	1.216

\*Significant at .05 level I .05 (2, 40) = 1.90

It has been observed from table- 32 that the differences between adjusted final means were statistically significant in plyometric and combined group as compared to control group, resistance and combined group as the difference between their adjusted means 2.486, 3.637 and 2.421 were found to be greater than critical ratio. However the mean differences between the remaining groups when compared to each other were far below the required critical ratio (I=1.90).

**Conclusion**

From the above analysis, it revealed that plyometric group demonstrated maximum effect on performance ability containing dribbling ability, speed shot ability and throw for accuracy followed by resistance group as compared to control group.

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