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## Effect of plyometric and circuit training on anthropometry of Punjab state basketball players

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### Abstract

The purpose of this study was to compare the Effect of Plyometric and Circuit training on Anthropometry of Punjab State Basketball Players. The study was delimited to one hundred twenty male basketball players from Punjab. The age of the players ranged from 12 to 16 years. These players were divided into two groups: Experimental Group (n=60) and Control Group (n=60). The Anthropometric variables were measured using standardized equipment before and after a six-week training period. The players of Experimental group were trained for six days per week on alternative days (Plyometric Training on Monday, Wednesday and Friday whereas Circuit Training on Tuesday, Thursday, and Saturday). Mean and Standard Deviation of the Anthropometry were calculated. However, the Experimental Group showed a sign of improvement in Anthropometry as indicated by the significant value which was greater than Control Group.

**Keywords:** Physical training, basketball, plyometric training, circuit training, anthropometry

### Introduction

In the sports world, physical training is the most important factor because physical training increases the efficiency and the effectiveness of the sports. The player's performance depends on various factors, but the main factor of players' performance is physical training. The word 'Training' denotes the process of preparation for some task. There is no doubt that, for players, "process" in physical training is quite as valuable as "product" <sup>[1]</sup>. Physical training has benefits for all players and benefits are gained by doing, by making mistakes and by overcoming them, with emphasis on process as well as on result. Training contributes tremendously towards the achievement of such aims of this area in sports.

Training is an important activity which improves physical performance of the individual or a group. When we are talking about physical performance, it means sports performance and performance of our body to sustain our daily routine life. This shows that player's performance is important for the performance of the organization and the training and development is beneficial for the players to improve their performance. Players practice to achieve a specific goal through structured and focused training. The intent of training is to increase the player's ability and work capacity to optimize player's performance. Training is undertaken across a long period of time <sup>[2]</sup>. The player learns to cope with highly stressful stimuli in training and competitions. Physical excellence should evolve through an organized and well-planned training program based on practical experience.

Training is good for all the games. "Games for the fun of it", is a common saying and it is indicative of the pleasure one derives through participation in the games and sports. Basketball is one, among the most popular of modern games. It takes its pride of place as the most popular and more people in the U.S.A. play Basketball than any other game. The standard of this game there is so good and the game so exciting that the basketball fans of that continent

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<sup>1</sup> R. Kalley, Physical Training Games and Athletics in School (Great Britain; Willmer Bros. & Co. Ltd, 1951), pp.123-124.d

<sup>2</sup> T. Bompa & G. Haff, Periodization : Theory and Methodology of Training (Fifth Edition) (U.S.A; Kendall/Hunt Publishing Company, 2009), pp.3.

outnumber all others. This wonderful game, which originated in the United States, has spread to other countries of the world largely due to Y.M.C.A., Physical Directors, Army, Navy and Air Force personnel. The pleasure and the thrill that the game produces has impelled the people of all classes to play Basketball or witness the game the world over. From humble beginnings, Basketball has progressed to be a "world-wide game", internationally popular and universally accepted<sup>[3]</sup>.

The original method of starting play was by throwing the ball on the ground between two players at centre. Naismith, in 'inventing' basketball, evolved five fundamental principles: the ball must be played with hands; running with the ball may not be allowed; every player in any position must be able to play the ball; the goal should be horizontal and above the players; bodily contact being forbidden in any event. In the beginning as many as 40 to 50 players frequently represented a team. This was soon reduced to 7 and later to 5 on a side. The number was fixed as 5 on a side as the game became more specialised and popular. The game was played on January 18, 1896 in Iowa City, between the University of Iowa and the University of Chicago<sup>[4]</sup>. Basketball is a sport with various complicated demands that need an aggregation of fitness, skill, team tactics and strategies, as well as motivational attitude. The ability to generate top strength level has been estimated as the key to get high sports feat. However, main areas that are likely to play an implicating role in a basketball player's achievement are muscular strength, fitness and body size.

Plyometric or 'plyos' as it is sometimes called is a kind of training which develops explosive strength using nature dynamic movements such as jumping. Plyometric is recognized as jump exercise. It is a preparation method designed to enhance muscular power and explosiveness. Plyometric consists of hopping, skipping, jumping and throwing activities designed to make a player fast<sup>[5]</sup>. These can be done either on both the legs or on a single leg or alternating the legs. Keep in mind that the amount of eccentric force generated in a single leg jump is about twice that of a double leg jump and if the player's muscles are not prepared for this force, it may be injurious. Next in progression are a series of jumps having different directions, jumping over various objects and jumping onto and off various objects. Jumping over objects becomes more effective than simple jumping because it forces the player to jump a little higher, which, in turn, allows for greater development, which, in time, allows him to jump even higher.

Plyometric training is an excellent way to train for the players' demands of basketball. Training programmes should include repeated high intensity work, followed by period of recovery that imitates the specific tasks related to basketball. Other terms used in combination with Plyometric training are depth jump, box jump and jump training. Plyometric training has been used in basketball training program as a useful method for improving motor performance. These exercises are used mainly to increase the maximal power output and jumping ability. It includes training loads with a number of rebounds and intervals between sets of exercises and drills. In plyometric training, athletes perform stopping, starting, and changing directions in an explosive way, which help to improve agility. Plyometric training is ranked as the most often used method for improvement in team games and is also

included in rehabilitation programmes. These abilities are the necessary skills in many team games including basketball because they enable players to do activity during the game at the required height, speed and at the right moment. Several researchers have used Plyometric training in their research and have shown that it improves power output and increases explosiveness by training the muscles to do more work in a shorter amount of time (Adams, *et. al.*1992; Holcomba, 1996) Circuit training is a term that is usually linked with strength building but the principles that apply to building strength also apply to improving the basketball. When a player undergoes circuit training, he/she goes to various stations that are set up so that he/she can work on a variety of skills throughout the practice session. Circuit training refers to a number of specially selected exercises arranged consecutively. In the original format, there are 9-12 stations which comprised the circuit; this number may vary according to the circuit's design. Each circuit training participant moves from one station to the next with little (15-30 seconds) or no rest, performing a 15 to 45 second work sessions of 8-20 repetitions at each station using a resistance of about 40%-60% of One Repetition Maximum (1RM). The Circuit Training workout program may be performed with exercise machines, hand held weight, elastic resistance, calisthenics or any combination of any of these.

There are numerous factors which are responsible for the performance of an athlete. The physique and body composition, including the size, shape and form are known to play a significant role in this regard. The performance of the athlete in any game or event depends on skill training, motivation and on various other factors of physiological and biochemical nature. But the game of basketball has evolved to have a high priority on body size and physical fitness by coaches and athletes. 'Anthropometry' means the measurement of man, whether living or dead, and consists primarily in the measurement of the dimensions of the body. Anthropometry- the measurements of man- provides scientific method and observations on the living man and the skeleton. Anthropometry represents the typical and traditional tool of human biology, physical anthropology and auxology. Recently it has taken a strong bonded relationship with physical education and sports sciences<sup>[6]</sup>.

### Objectives

- To find out the effect of Plyometric and Circuit Training on Anthropometric Variables of male basketball players of experimental group.

### Hypothesis

- There would not be significant difference in Plyometric and Circuit Training on Anthropometric Variables between Experimental Group and Control Group.

### Delimitations

- The research was delimited to male basketball players of Punjab who took part in Inter District Competition.
- The study was delimited to one hundred and twenty male basketball players (sixty in Experimental Group and sixty in Control Group).
- All the subjects are selected randomly, age ranging from 12 to 16 years.
- The training programme of Plyometric and Circuit

<sup>3</sup>S. Srivatsan, Basketball (N.I.S. Publication, 1971), pp. 2.

<sup>4</sup> R. H. Perry, Men's Basketball. (N.A), pp.2.

<sup>5</sup>D. A. Chu, Explosive Power & Strength; Complex Training for Maximum results (U.S.A; Versa Press, 1996), pp.6.

<sup>6</sup>H.S. Sodhi, Sports Anthropometry (Mohali; Anova Publications, 1991), pp.68.

Training was restricted to one hour for three days each in a week on alternate days continued for six weeks.

### Training Schedule

The Plyometric and Circuit Training will be administrated thrice a week on alternate days. Plyometric Training would be

carried out on Monday, Wednesday, Friday and Circuit Training on Tuesday, Thursday, Saturday per week for six weeks. The load for the training programme will be progressively increased from the beginning to the end of the training session.

**Table 1: Plyometric Training Programme**

	Week 1 & Week 2		Week 3		Week 4 & Week 5		Week 6	
	Rep	Sets	Rep	Sets	Rep	Sets	Rep	Sets
Monday								
Jump Squat	15	2	20	2	20	3	20	4
Box Jump	15	2	20	2	20	3	20	4
Side Jump	15	2	20	2	20	3	20	4
Strides	15	2	20	2	20	3	20	4
Skipping	15	2	20	2	20	3	20	4
Wednesday								
Side way box jump	15	2	20	2	20	3	20	4
Tuck Jump	15	2	20	2	20	3	20	4
Sumo Jump	15	2	20	2	20	3	20	4
Hamstring Curl	15	2	20	2	20	3	20	4
Jumping on Toes	15	2	20	2	20	3	20	4
Friday								
One Leg Hop jump	15	2	20	2	20	3	20	4
Box Jump	15	2	20	2	20	3	20	4
Side Way Jump	15	2	20	2	20	3	20	4
Depth Jump	15	2	20	2	20	3	20	4
Scissor Jump	15	2	20	2	20	3	20	4

**Table 2: Circuit Training Programme**

	Week 1 & Week 2		Week 3 & Week 4		Week 5 & Week 6	
	Duration(sec)	Sets	D (sec)	Sets	D (sec)	Sets
Tuesday, Thursday, Saturday						
Jumping Jacks	20	3	30	3	45	3
Kicking Back	20	3	30	3	45	3
High Knee Strides	20	3	30	3	45	3
Side Hops	20	3	30	3	45	3
Squat	20	3	30	3	45	3
Flutter Kick	20	3	30	3	45	3
Pilates Leg Pulls (up)	20	3	30	3	45	3
Pilates Leg Pulls (down)	20	3	30	3	45	3

### Method and Procedure

The study is experimental in nature. In this study, the sample of one hundred and twenty male basketball players were selected from Punjab, age ranging between 12 and 16 years. The selected male basketball players were further divided into two groups (one is Experimental Group and second is Control Group) with sixty players in each. Experimental group went through Plyometric and Circuit Training for one hour, after 15 minutes of warm-up and stretching exercise, for six weeks, whereas the control group did not undergo any special training. Anthropometric variables were measured using standardized equipments. The data would be collected by the pre- test (T1) and the post-test (T2) of experimental and control group after six weeks training. The scores were collected for all the above mentioned categories of Experimental Group and Control Group.

### Experimental Variables

Based on the available scientific literature and in consultation with experts, the following variables were selected.

### Dependent Variable

Plyometric and Circuit training were considered as the criterion variable.

### Independent Variables (Anthropometric Variables)

1. Height
2. Weight
3. BMI
4. Upper Leg Length
5. Fore Leg length
6. Thigh Girth
7. Knee Girth
8. Calf Girth

### Statistical Techniques/ Inferential Analysis

To analysis of the data collected from pre and post test of Experimental Group and Control Group of basketball players. Mean and Standard Deviation was computed. For this purpose, 't-test' was applied and for testing the hypothesis, the level of significance was set at 0.05%.

**Table 3:** Difference of Pre-Test between Experimental and Control Group on Anthropometric variables of Punjab State Basketball Players

Sr. No	Pre-test	Experimental Group		Control Group		t-value
	Variables	Mean	SD	Mean	SD	
1	Height	163.1	7.79	162.58	10.54	0.76
2	Weight	49.63	8.51	51.6	11.48	0.29
3	BMI	18.68	3.04	19.52	4.09	0.21
4	Upper Leg Length	43.07	4.67	42.92	4.81	0.86
5	Fore Leg Length	36.5	2.91	36.03	4.02	0.47
6	Thigh Girth	40.88	5.03	39.93	5.08	0.31
7	Knee Girth	33.6	2.89	32.43	3.36	0.05
8	Calf Girth	31.08	3.37	30.92	3.25	0.79

From Table 3, it was inferred that no significant difference exists of pre-test between Experimental and Control Group of Punjab State Basketball Players.

Hence the hypothesis that “There will be no significant difference in pre-test between Experimental and Control Group on Anthropometric variables” is accepted.

**Table 4:** Difference of Post-Test between Experimental and Control Group on Anthropometric variables of Punjab State Basketball Players

Sr. No	Post-test	Experimental Group		Control Group		t-value
	Variables	Mean	SD	Mean	SD	
1	Height	166.37	7.66	164.22	10.6	0.21
2	Weight	51.57	7.85	53.92	11.16	0.19
3	BMI	18.67	2.79	20.02	3.99	0.04
4	Upper Leg Length	44	4.78	43.47	4.94	0.55
5	Fore Leg Length	37.42	2.69	36.63	4.03	0.22
6	Thigh Girth	43.6	5.25	41.58	5.03	0.04
7	Knee Girth	35.68	2.98	34.02	3.31	0.01
8	Calf Girth	33.93	3.54	32.4	3.28	0.02

From Table-4, it was inferred that no significant difference exists of post-test between Experimental and Control Group of Punjab State Basketball Players.

Hence the hypothesis that “There will be no significant difference in post-test between Experimental and Control Group on Anthropometric variables” is accepted.

**Table 5:** Difference of Experimental Group between Pre-test and Post-test on Anthropometric variables of Punjab State Basketball Players

Sr. No	Experimental group Variables	Pre-test		Post-test		t-value
		Mean	SD	Mean	SD	
1	Height	163.1	7.79	166.37	7.66	7.02*
2	Weight	49.63	8.51	51.57	7.85	1.18
3	BMI	18.68	3.04	18.67	2.79	0.87
4	Upper Leg Length	43.07	4.67	44	4.78	3.39*
5	Fore Leg Length	36.5	2.91	37.42	2.69	3.00*
6	Thigh Girth	40.88	5.03	43.6	5.25	6.91*
7	Knee Girth	33.6	2.89	35.68	2.98	6.08*
8	Calf Girth	31.08	3.37	33.93	3.54	2.69*

\* Significant at 0.01 level

From Table 5, it was inferred that no significant difference exists of Experimental Group between Pre-test and Post-test of Punjab State Basketball Players.

Hence the hypothesis that “There will be no significant difference in Experimental Group between pre-test and post-test on Anthropometric variables (Height, Upper Leg Length, Fore Leg Length, Thigh Girth, Knee Girth, Calf Girth) is rejected and Anthropometric Variables (Weight, BMI)” is accepted.

### Discussion and Conclusion

The Plyometric and Circuit training improved from pre to post training but to a little expand. The Plyometric and Circuit training brings positive affect in Anthropometric variables on Punjab basketball players.

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