

# EFFECTS OF EXPLOSIVE STRENGTH AND STRENGTH ENDURANCE BASED CIRCUIT TRAINING ON EXPLOSIVE POWER

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## ABSTRACT

The purpose of the study was to find out the effects of explosive strength and strength endurance based circuit training on explosive power. To achieve the purpose of the study, thirty boys' student in the age group 13 to 14 were selected as subjects at random. The selected subjects were from St. George Higher Angelo Indian School, Shenoy nagar, Chennai, Tamilnadu. The study was formulated as pre and post-test random group design, in which thirty students were divided into three equal groups. The experimental group-1 (n=10, ES<sub>b</sub>CT) underwent explosive strength based circuit training, the experimental group-2 (n=10, SE<sub>b</sub>CT) underwent strength endurance based circuit training and group 3 served as control group (n=10, CG) did not undergo any specific training. In this study, two training programme were adopted as independent variables, i.e., explosive strength based circuit training and strength endurance based circuit training. The explosive power was selected as dependent variables. The explosive power was tested by standing broad jump recorded in meters. The selected two treatment group namely explosive strength based circuit training and strength endurance based circuit training were performed five days in week for the period of six weeks, as per the stipulated training programme. The explosive power was collected before and after the training period. The collected pre and post test data was critically analyzed with apt statistical tool of one way analysis of co variance (ANCOVA), for observed the significant adjusted post-test mean difference of three groups. The Scheffe's post hoc test was used to find out pairwise comparisons between groups. To test the hypothesis 0.05 level of significant was fixed in this study. The ability of explosive power highly improved in explosive strength based circuit training than the strength endurance based circuit training.

**Key Words:** 1. Explosive Strength Based Circuit Training 2. Strength Endurance Based Circuit Training 3. Explosive power 4. ANCOVA

## INTRODUCTION:

During the early stages of strength training, especially with entry-level athlete almost any strength training method or program will result in strength development to some degree. As the athlete develops a strength foundation, however, the coach should create a specific, periodized strength training program to maximize the athlete's natural abilities. Equally important for coaches to keep in mind is that each athlete has a unique rate of response, reaction, and adaptation to a given method, and therefore, a different rate of improvement. Strength training is a long-term proposition. Athletes do not reach their highest level after four to six weeks from the beginning of the strength training program, but rather during the competitive phase, which is months away from the anatomical adaptation phase. (Bompa, 2005) Knowing the explosive power of players of different age is the direct relationship with the effects of training and it makes easier the coach to choose the methods, the process of planning and program for the players. Mostly, the explosive power depends on the number of motor units; the genetic conditionality is 80%. It is defined as the ability of sportsman, in the shortest period of time the highest possible force is produced (Zatsiorsky & Kraemer, 2009).

## METHODOLOGY:

The selected two treatment groups namely explosive strength based circuit training and strength endurance based circuit training were performed five days in a week for the period of six weeks, as per the stipulated training program.

**Training approaches for experimental group – I (ES<sub>b</sub>CT) 1 to 2 weeks**

Days	Exercise	Duration	Sets	Rec.In between sets
Monday to Friday	Half squats Push-ups Bent-knee sit ups Two legged low hops on the spot Back extensions Pull ups Burpees Shuttle run	Each exercise 20 seconds	Three	Three minutes

**Repetitions** : as many as possible in 20 seconds  
**Rest** : 30 Seconds  
**Stations/Circuit** : 8 exercise station-clock wise order  
**Time/ circuit** : 2 minutes and 40 seconds  
**Circuits/Session** : 3  
**Time/ Session** : 8 minutes  
**Frequency** : 5 days/week  
**Load of the week** : 24 minutes  
**Recovery in between circuits** : 3 minutes

**Explosive strength based circuit training (ES<sub>b</sub>CT) 3 to 4 weeks**

Days	Exercise	Duration	Sets	Rec.In between sets
Monday to Friday	Half squats Push-ups Bent-knee sit ups Two legged low hops on the spot Back extensions Pull ups Burpees Shuttle run	Each exercise 30 seconds	three	Three minutes

**Repetitions** : As many as possible in 30 seconds  
**Rest** : 30 Seconds  
**Stations/Circuit** : 8 exercise station-clock wise order  
**Time/ circuit** : 4 minutes  
**Circuits/Session** : 3  
**Time/ Session** : 12 minutes  
**Frequency** : 5 days/week  
**Load of the week** : 36 minutes  
**Recovery in between circuits** : 3 minutes

**Explosive strength based circuit training (ES<sub>b</sub>CT) 5 to 6 weeks**

Days	Exercise	Duration	Sets	Rec.In between sets
Monday to Friday	Half squats Push-ups Bent-knee sit ups Two legged low hops on the spot Back extensions Pull ups Burpees Shuttle run	Each exercise 40 seconds	three	Three minutes

**Repetitions** : As many as possible in 30 seconds

**Rest** : 30 Seconds  
**Stations/Circuit** : 8 exercise station-clock wise order  
**Time/ circuit** : 5 minutes 20 seconds  
**Circuits/Session** : 3  
**Time/ Session** : 16 minutes  
**Frequency** : 5 days/week  
**Load of the week** : 48 minutes  
**Recovery in between circuits:** 3 minutes

**TRAINING APPROACHES FOR EXPERIMENTAL GROUP – II**  
**Strength endurance based circuit training (SE<sub>b</sub>CT) 1 to 2 weeks**

Days	Exercise	Duration	Sets	Rec.In between sets
Monday to Friday	Half squats Push-ups Bent-knee sit ups Two legged low hops on the spot Back extensions Pull ups Burpees Shuttle run	Each exercise 20 seconds	Three	Three minutes

**Repetitions** : as many as possible in 20 seconds  
**Rest** : 30 Seconds  
**Stations/Circuit** : 8 exercise station-clock wise order  
**Time/ circuit** : 2 minutes and 40 seconds  
**Circuits/Session** : 3  
**Time/ Session** : 8 minutes  
**Frequency** : 5 days/week  
**Load of the week** : 24 minutes

**Strength Endurance based circuit training (SE<sub>b</sub>CT) 3 to 4 weeks**

Days	Exercise	Duration	Sets	Rec.In between sets
Monday to Friday	Half squats Push-ups Bent-knee sit ups Two legged low hops on the spot Back extensions Pull ups Burpees Shuttle run	Each exercise 30 seconds	Three	Three minutes

**Repetitions** : As many as possible in 30 seconds  
**Rest** : 30 Seconds  
**Stations/Circuit** : 8 exercise station-clock wise order  
**Time/ circuit** : 4 minutes  
**Circuits/Session** : 3  
**Time/ Session** : 12 minutes  
**Frequency** : 5 days/week  
**Load of the week** : 36 minutes

**Strength Endurance based circuit training (SE<sub>b</sub>CT) 5 to 6 weeks**

Days	Exercise	Duration	Sets	Rec.In between sets
Monday to	Half squats	Each	Three	Three

Friday	Push-ups Bent-knee sit ups Two legged low hops on the spot Back extensions Pull ups Burpees Shuttle run	exercise 40 seconds		minutes
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**Repetitions** : As many as possible in 30 seconds  
**Rest** : 30 Seconds  
**Stations/Circuit** : 8 exercise station-clock wise order  
**Time/ circuit** : 5 minutes 20 seconds  
**Circuits/Session** : 3  
**Time/ Session** : 16 minutes  
**Frequency** : 5 days/week  
**Load of the week** : 48 minutes

**RESULTS AND DISCUSSION**

**TABLE I**  
**THE RESULTS OF ANALYSIS OF COVARIANCE ON EXPLOSIVE POWER OF DIFFERENT GROUPS**  
**(Scores in Meters)**

Test Conditions		Group 1 ES <sub>b</sub> CT	Group 2 SE <sub>b</sub> CT	Group 3 CG	SV	SS	Df	MS	'F' Ratio
Pre test	Mean	1.53	1.53	1.54	B	0.001	2	0.0004	2.0
	S.D.	0.01	0.02	0.01	W	0.006	27	0.0002	
Post test	Mean	1.59	1.58	1.55	B	0.011	2	0.0057	19.00*
	S.D.	0.01	0.01	0.02	W	0.007	27	0.0003	
Adjusted post test	Mean	1.59	1.58	1.54	B	0.013	2	0.0067	40.30*
					W	0.004	26	0.0002	

\* Significant at .05 level of confidence. The required table value for test the significance was 3.35, and 3.37, with the df of 2 and 27, 2 and 26 respectively.

The pre test mean and standard deviation on explosive power scores G1, G2, and G3 were 1.53±0.01, 1.53±0.02 and 1.54±0.01 respectively. The obtained pre test F value of 2.0 was lesser than the required table F value 3.35. Hence the pre test means value of explosive strength based circuit training, strength endurance based circuit training and control group on explosive power before start of the respective treatments were found to be insignificant at 0.05 level of confidence for the degrees of freedom 2 and 27. Thus this analysis confirmed that the random assignment of subjects into three groups were successful. The post test mean and standard deviation on explosive power of G1, G2 and G3 were 1.59±0.01, 1.58±0.01 and 1.55±0.02 respectively. The obtained post test F value of 19.00 was higher than the required table F value of 3.35. Hence the post test means value of explosive strength based circuit training and strength endurance based circuit training on explosive power were found to be significant at 0.05 level of confidence for the degrees of freedom 2 and 27. The results proved that the selected two training interventions explosive strength and strength endurance based circuit training on explosive power were produced significant difference among the groups. The adjusted post test means on explosive power scores of G1, G2 and G3 were 1.59, 1.58 and 1.54 respectively. The obtained adjusted post test F value of 40.30 was higher than the required table F value of 3.37. Hence the adjusted post test means value of explosive strength based circuit training and strength endurance based circuit training on explosive power were found to be significant at 0.05 level of confidence for the degrees of freedom 2 and 26. The results confirm that the selected two training interventions namely explosive strength based circuit training and strength endurance based circuit training on explosive power were produced significant difference among the groups.

In order to find out the superiority effects among the treatment and control groups the Scheffe's post hoc test were administered.

**TABLE - II**  
**THE RESULTS OF SCHEFFE'S POST HOC TEST MEAN DIFFERENCES ON EXPLOSIVE POWER AMONG THREE GROUPS**  
**(Scores in Meters)**

Group 1 ES <sub>b</sub> CT	Group 2 SE <sub>b</sub> CT	Group 3 CG	Mean Differences	Confidence Interval Value
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1.59	1.58		0.01*	0.0034
1.59		1.54	0.05*	0.0034
	1.58	1.54	0.04*	0.0034

\* Significant at .05 level of confidence.

### Result of Scheffe's Post Hoc Test on explosive power

Table II shows the paired mean differences of explosive strength and strength endurance based circuit training control group on explosive power. The paired wise comparisons results as follows. First comparison: Group 1 and Group 2: The pair wise mean difference of group 1 and group 2 values 0.01 was higher than the confidential value of 0.0034. Hence the first comparison was significant. The results of this comparison clearly proved that both training have produced different improvements on explosive power. Second comparison: Group 1 and Group 3: The pair wise mean difference of group 1 and group 3 values 0.05 was higher than the confidential value of 0.0034. Hence the second comparison was significant. The results of this comparison clearly proved that explosive strength based circuit raining have produced greater improvements on explosive power than the control group. Third comparison: Group 2 and Group 3: The pair wise mean difference of group 2 and group 3 values 0.04 was higher than the confidential value of 0.0034. Hence the third comparison was significant. The results of this comparison clearly proved that strength endurance based circuit raining have produced greater improvements on explosive power than the control group.

### Discussion on Explosive power

After analyzing the statistical end results the researcher found that the selected training groups have significantly improved the quality of explosive power from the base line to post interventions. The pre to post intervention was present as follows. The explosive strength based circuit training group from pre(1.53±0.01),to post(1.59±0.01) and strength endurance based circuit training group from pre (1.53±0.02) to post (1.58±0.01) have significantly changed the pre to post results. The present study demonstrates an increase in explosive power performance of 0.0006% and 0.0005% for explosive strength and strength endurance based circuit training groups respectively. The result of the present study is in line with the following studies. The results of Venkatachalapathy R (2015) conducted a study on effect of circuit training programme on speed and agility. His study revealed that was found that there was a significant improvement on speed and agility for circuit training group when compared with the control group. The research findings of Ramesh Kannan, S Dr. B. Chittibabu, Dr. P.C. Tripathy, M.D. (2015) effect of intensive sports specific endurance circuit training on selected motor fitness components of male handball players during preparatory phase. They concluded that intensive sports specific endurance circuit training for 12 weeks is effective enough in maintaining motor fitness components like speed and power of handball players. The research findings of Sudhakar Babul.M, P. P. S. Paul Kumar (2013) conducted a study on the effect of selected circuit training exercises on sprinters of high school girls. They concluded that there was significant effect on speed, through selected circuit training exercises.

### Conclusion:

The results of this study indicate the ability of explosive power highly improved in explosive strength based circuit training than the strength endurance based circuit training.

The strength endurance based circuit training also produces better improvement on explosive power than the control group. The control group did not show any significant changes on explosive power.

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