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Effects of Explosive Strength and Strength Endurance Based Circuit Training on Breath Holding Time

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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 Breath holding time. 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 RCM High School, Natarajapuram, Sivagangai (DT), 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_bCT) underwent explosive strength based circuit training, the experimental group-2 (n=10, SE_bCT) 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 Breath holding time was selected as dependent variables. The Breath holding time was tested by holding the breath in seconds. 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 Breath holding time performance 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, for observed the significant adjusted post-test mean difference of three groups. The Scheffe's post hoc test was used to find out pair-wise comparisons between groups. To test the hypothesis 0.05 level of significant was fixed in this study. The ability of Breath holding time highly improved in strength endurance based circuit training than the explosive strength based circuit training.

Keywords: Explosive Strength Based Circuit Training (ES_bCT), Strength Endurance Based Circuit Training (SE_bCT) and Breath holding time.

1. INTRODUCTION

Circuit training was first proposed by Morgan and Adamson (1959) of Leeds University as a method for developing general fitness. Their initial circuit training routine considered of several stations arranged in a circle (hence the name circuit training) so as to work muscle groups alternately from station to station. As circuit training grew in popularity, other authors began to provide additional information. Perhaps the best book on the market is Circuit Training for All sports (Scholich, 1992).

2. 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_BCT) 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

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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_bCT) 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_bCT) 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

3. TRAINING APPROACHES FOR EXPERIMENTAL GROUP – II

Strength endurance based circuit training (SE_bCT) 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_bCT) 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_bCT) 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	Each exercise 40 seconds	Three	Three minutes

	Pull ups Burpees Shuttle run			

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

TABLE I

THE RESULTS OF ANALYSIS OF COVARIANCE ON BREATH HOLDING TIME OF DIFFERENT GROUPS (Scores in seconds)

Test Conditions		Group 1 ES_BCT	Group 2 SE_BCT	Group 3 CG	SV	SS	Df	MS	'F' Ratio
Pre test	Mean	12.15	11.02	11.11	B	7.90	2	3.95	1.14
	S.D.	2.64	0.99	1.20	W	93.65	27	3.47	
Post test	Mean	14.03	15.04	9.70	B	160.50	2	80.25	28.56*
	S.D.	2.33	0.92	1.15	W	75.88	27	2.81	
Adjusted post test	Mean	13.47	15.35	9.94	B	150.45	2	75.22	94.02*
					W	20.86	26	0.80	

* 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.

4. RESULTS OF BREATH HOLDING TIME

The pre test mean and standard deviation on breath holding time scores G1, G2, and G3 were 12.15±2.64, 11.02±0.99 and 11.11±1.20 respectively. The obtained pre test F value of 1.14 was lesser than the required table F value3.35. Hence the pre test means value of explosive strength based circuit training, strength endurance based circuit training and control group on breath holding time 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 breath holding time of G1, G2 and G3 were 14.03±2.33, 15.04±0.92 and 9.70±1.15 respectively. The obtained post test F value of was 28.56 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 breath holding time were found to be significant at 0.05 level of confidence for the degrees of freedom 2 and 26. The results proved that the selected two training interventions explosive strength based circuit training and strength endurance based circuit training on breath holding time were produced significant difference among the groups. The adjusted post test means on breath holding time scores of G1, G2 and G3 were 13.47, 15.35 and 9.94 respectively. The obtained adjusted post test F value of 94.02 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 breath holding time 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 and strength endurance based circuit training on breath holding time were produced significant difference among the groups. In order to find out the superiority effects among the treatment and control groups the Seheffe's post hoc test were administered.

TABLE - II

THE RESULTS OF SCHEFFE'S POST HOC TEST MEAN DIFFERENCES ON BREATH HOLDING TIME AMONG THREE GROUPS (Scores in seconds)

Group 1 ES_bCT	Group 2 SE_bCT	Group 3 C G	Mean Differences	Confidence Interval Value
13.47	15.35		1.88*	0.23
13.47		9.94	3.53*	0.23
	15.35	9.94	5.40*	0.23

* Significant at .05 level of confidence.

Result of Scheffe's post hoc test on breath holding time

Table II shows the paired mean differences of explosive strength and strength endurance based circuit training control group on breath holding time. The pair wise comparisons results as follows. First comparison: Group 1 and Group 2**:** The pair wise mean difference of group 1 and group 2 values 1.88 was higher than the confidential interval value of 0.23. Hence the first comparison was significant. The results of this comparison clearly proved that both training have produced different improvements on breath holding time. Second comparison: Group 1 and Group 3: The pair wise mean difference of group 1 and group 3 values 3.53 was higher than the confidential interval value of 0.23. Hence the second comparison was significant. The results of this comparison clearly proved that explosive strength based circuit raining have produced greater improvements on breath holding time than the control group. **Third comparison: Group 2 and Group 3:** The pair wise mean difference of group 2 and group 3 values 5.40 was higher than the confidential interval value of 0.23. Hence the third comparison was significant. The results of this comparison clearly proved that strength endurance based circuit raining have produced greater improvements on breath holding time than the control group.

Discussion on Breath holding time

After analyzing the statistical end results the researcher found that the selected training groups have significantly improved the quality of breath holding time 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(12.15 $\pm$ 2.64.),to post(14.03$\pm$2.33) and strength endurance based circuit training group from pre (11.05 $\pm$ 0.99) to post (15.04$\pm$0.92) have significantly changed the pre to post results. The present study demonstrates an increase in breath holding time of 0.01% and 0.04% for explosive strength and strength endurance based circuit training groups respectively 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 Babu1.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.

5. CONCLUSION

The results of this study indicate the capacity of breath holding time highly improved in strength endurance based circuit training than the explosive strength based circuit training. The explosive strength based circuit training also produces better improvement on breath holding time than the control group. The control group did not show any significant changes on breath holding time.

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