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## Effect of combined training programmes on cardio-respiratory endurance of secondary school hockey players

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### Abstract

The purpose of the study was to evaluate the effectiveness of circuit training on endurance of secondary school hockey players. For this purpose, sixty secondary school Hockey players in the age group of 14 - 16 years were selected as subjects. The selected subjects were divided into four equal groups, in which, Group-I: Circuit Training Group (CTG) (n=15) underwent resistance and plyometric training in the form of circuit; Group-II: Interval Training Group (ITG) (n=15) underwent aerobic and anaerobic training in the form of interval; Group-III: Combined Circuit and Interval Training Group (CCITG) (n=15) underwent combined training both in the form of circuit & interval form and Group-IV: Control Group (CG) (n=15) acted as control which did not participate any training but allowed to take part in their regular Hockey training and playing game. The training programme was carried out for this study was five days per week for twelve weeks. Prior to and after the training period the subjects were tested for endurance. This was assessed by administering Cooper's 12 minutes Run/Walk. The statistical tool used for the present study ANCOVA along with Scheffé's Post Hoc Analysis. After applying ANCOVA, it was found that there was significant improvement in the cardio respiratory endurance for Circuit Training Group, Interval Training Group and Combined Circuit and Interval Training Group (CCITG) when compared with control group. Based on the results it was concluded that the CCITG experimental group was significantly improved the Endurance of secondary school Hockey players when compared with Interval Training Group (ITG) and Circuit Training Group (CTG)

**Keywords:** Combined Training Programmes, cardio respiratory endurance Hockey,

### Introduction

Hockey is one of the world greatest ball game. Present days this hockey is being played by adopting new techniques and, methods during training schedules. The motor abilities are considered as one of the important factors affecting on every game and the availability of motor abilities for the Hockey players sufficiently enable them to achieve better performance and high achievement.

The various resistance and plyometric training programmes offer new and different ways to improve aerobic and anaerobic conditioning. Interval training is the physical training consisting of alternating periods of high and low intensity activity. Circuit training is a form of body conditioning or resistance training using high-intensity aerobics. It targets strength building and muscular endurance. Both Circuit and Interval trainings are most popular form of fitness sessions used by various sports teams. These training will improve both aerobic fitness, thus this is very useful conditioning method. Hockey game requires high level of motor fitness to excel at different levels of competitions. The cardio respiratory endurance plays an important role in improving the fitness level of players.

Circuit training is the programme in which an athlete moves from one exercise station to another in a planned sequence and in the shortest possible time (Neal, 1969). Circuit training has been proved to be a very effective method for improving strength endurance (Seaton, 1983). Manikandan (2014) [8] found effect of conventional resistance training on cardio respiratory endurance among university athletes. The study revealed that eight weeks of conventional resistance training had an impact of 18.23% on cardio-respiratory endurance and

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the study suggest that conventional resistance training had significant influence in improving cardio respiratory endurance of the athletes. Mayorga-Vega; Viciano and Cocca (2013) [1] evaluated the effects of a circuit training program on muscular and cardiovascular endurance and their maintenance in schoolchildren and after the development programme, cardiovascular endurance increased significantly in the experimental group and the study concludes that the circuit training programme was effective to increase and maintain cardiovascular endurance among schoolchildren. Elamaran (2014) [3] revealed significant improvement on cardio respiratory endurance as a result of experimental treatment, where extensive interval training enhanced cardio-respiratory endurance better and the study results suggest that interval training of varied intensity may be adopted according to the need of the player. The above studies proved that both circuit and interval training are developing cardio respiratory endurance of the subjects.

**Objective of the Study**

The objective of the study was to determine the effect of combined circuit and interval training on cardio respiratory endurance of secondary school Hockey players.

**Hypothesis of the Study**

It is hypothesized that there would be a significant difference in the Cardio respiratory Endurance of experimental group by practicing combined circuit and interval training.

**Methodology**

The purpose of the study was to investigate the effect of combined circuit and interval training on cardio respiratory endurance among secondary school Hockey players. For this purpose, sixty secondary school Hockey players in the age group of 14 - 16 years were selected as subjects. he selected subjects were divided into four equal groups, in which, Group-I: Circuit Training Group (CTG) (n=15) underwent resistance and plyometric training in the form of circuit; Group-II: Interval Training Group (ITG) (n=15) underwent aerobic and anaerobic training in the form of interval; Group-III: Combined Circuit and Interval Training Group (CCITG) (n=15) underwent combined training both in the form of circuit & interval form and Group-IV: Control Group (CG) (n=15) acted as control which did not participate any training but allowed to take part in their regular Hockey training and playing game. The training programme was carried out for this study was five days per week for twelve weeks. Prior to and after the training period the subjects were tested for endurance. This was assessed by administering Cooper’s 12 minutes Run/Walk. The data was analyzed by applying Analysis of Co-Variance (ANCOVA). The level of significance was set at 0.05.

**Analysis of data**

The findings pertaining to analysis of covariance between experimental groups and control group on cardio respiratory endurance among school Hockey players for pre-post test respectively.

**Table 1:** ANCOVA for the pre-test and post-test data on Cardio Respiratory Endurance (Meters.) of Circuit Training Group (CTG), Interval Training Group (ITG), Combined Circuit and Interval Training Group (CCITG) and Control Group (CG).

Tests		CG	CTG	ITG	CCITG	SV	df	Sum of square	Means square	‘F’ ratio
Pre-test	Mean	2443.666	2499.666	2470.666	2444.666	B	3	31530.000	10510.000	0.52 <sup>NS</sup>
	S.D.	230.948	92.049	108.180	78.637	W	56	1115763.3	19924.345	
Post-test	Mean	2452.000	2587.333	2601.666	2646.333	B	3	315608.33	105202.778	6.28 **
	S.D.	222.957	79.706	79.365	67.993	W	56	937790.00	16746.250	
Adjusted Post-test	Mean	2468.587	2559.688	2596.927	2662.131	B	3	293857.42	97952.473	22.29**
						W	55	241657.55	4393.774	

**Note:** SV: Source of Variance; B-Between Groups; W- Within Groups; S.D. – Standard Deviation

Table value at 0.05(df-2, 56) =3.15; at 0.01(df-2, 56) =4.98

\*\*Significant at 0.01 level; \*Significant at 0.05 level; <sup>NS</sup>Not Significant

As shown in Table-1, the pre-test means value of cardio respiratory endurance of Control Group, Circuit Training Group; Interval Training Group and Combined Circuit & Interval Training are 2443.666; 2499.666; 2470.666 and 2444.666 respectively. The obtained ‘F’ ratio of 0.52 for pre-test means is less than the table value 3.15 for df 2 and 56 required for significance at 0.05 level. The post-test means value of cardio respiratory endurance of Control Group, Circuit Training Group; Interval Training Group and Combined Circuit & Interval Training are 2452.000;

2587.333; 2601.666 and 2646.333 respectively. The obtained ‘F’ ratio of 6.28 on post-test means is greater than the table value 4.98 for df 2 and 56 required for significance at 0.01 level. The same table also indicated that there was a significant difference in adjusted means of cardio-respiratory endurance of secondary school Hockey players. The obtained ‘F’ ratio of 22.29 on adjusted post-test means is greater than the table value 4.98 for df 2 and 56 required for significance at 0.01 level.

**Table 2:** LSD Test for the differences between the adjusted post-test paired means of cardio-respiratory endurance.

Adjusted post-test mean				Mean Difference (MD)	Critical Difference (CD)
CG	CTG	ITG	CCITG		
2468.587	2559.688	-	-	91.100*	47.682
2468.587	-	2596.927	-	128.340*	
2468.587	-	-	2662.131	193.543*	
-	2559.688	2596.927	-	37.240	
-	2559.688	-	2662.131	102.443*	
-	-	2596.927	2662.131	65.203*	

\*Significant at 0.05 of confidence.

The table-2 shows that the adjusted post-test means difference on cardio respiratory endurance between cardio-respiratory endurance between Circuit Training Group and Control Group; Interval Training & Control Group; and Combined Circuit & Interval Training and Control Group; Circuit Training Group & Combined Circuit & Interval Training Group; Interval Training Group and Combined Circuit & Interval Training Group are 91.100, 128.340, 193.543, 102.443 and 65.203 which are higher than the critical difference of 47.682 at 0.05 level of confidence It may be concluded from the results that there is significant difference

on cardio-respiratory endurance between Circuit Training Group and Control Group; Interval Training & Control Group; and Combined Circuit & Interval Training and Control Group. The combined circuit and interval training had better endurance than interval training and circuit training respectively.

The comparison of pre, post and adjusted post-test mean values on cardio-respiratory endurance among various experimental and control groups are graphically depicted in Fig.1.

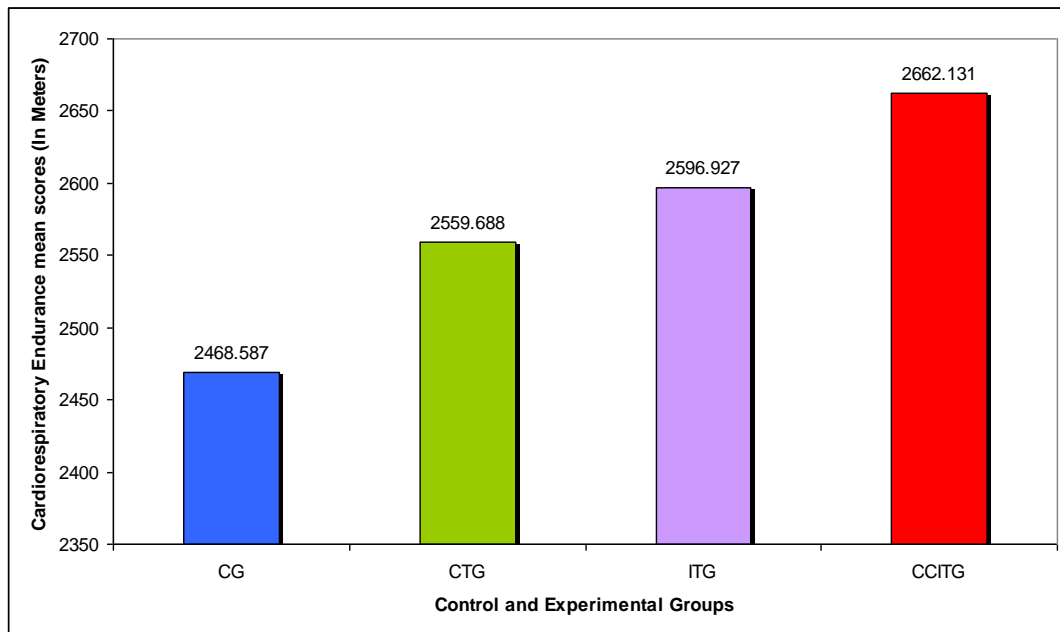


Fig 1: Bar diagram of Pre, Post and Adjusted Post-test Means on Cardio-respiratory Endurance among various groups.

### Discussions on findings

The finding of the study shows that there was a significant difference in the Cardio respiratory Endurance of experimental group by practicing interval training, circuit training and combined circuit and interval training. The cardio-respiratory endurance results between pre and post (12 weeks) tests have been found significantly higher in experimental groups in comparison to control group. This is possible because due to practice of regular circuit and interval training which may also bring sudden spurt in cardio respiratory endurance. The findings of the present study have strongly indicates that combined circuit and interval training of twelve weeks have significant effect on cardio respiratory endurance. Hence the hypothesis earlier set that circuit training programme would have been significant effect on cardio respiratory endurance in light of the same the hypothesis was accepted.

The similar results concurred with the previous studies (Seaton, 1983) and Manikandan (2014) [8] revealed that eight weeks of conventional resistance training had an impact of 18.23% on cardio-respiratory endurance Mayorga-Vega; Viciana and Cocca (2013) [2] found circuit training programme was effective to increase and maintain cardiovascular endurance among schoolchildren. Elamaran (2014) [3] revealed significant improvement on cardio respiratory endurance as a result of experimental treatment, where extensive interval training enhanced cardio-respiratory endurance better. The above studies proved that both circuit and interval training are developing cardio respiratory endurance of the subjects.

### Conclusion

On the basis of findings and within the limitations of the study the following conclusions were drawn:

1. The combined circuit training, interval training and circuit training had positive impact on cardio-respiratory endurance among secondary school Hockey players.
2. The combined circuit and interval training group showed better improvement on cardio respiratory endurance among secondary school Hockey players than interval training, circuit trainings.

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