# Effects of High Intensity Aerobic Interval Training Concurrent Low Intensity Aerobic and Resistance Interval Training on Physiological Variables of College Level Football Players

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## Abstract

The purpose of the present study was to find out the effects of high intensity aerobic interval training, concurrent low intensity aerobic and resistance interval training on physiological variables of college level football players. To achieve the purpose of this study, forty five football players from Velammal Institutions, Chennai, Tamilnadu state, India were selected as subjects at random and their age ranged from 18 to 23 years. The subjects were divided into three groups consisting of 15 each. The experimental group I was treated with the high intensity aerobic interval training (HIAIT), experimental group II was treated with the concurrent low intensity aerobic and resistance interval training (CLIARIT) and group III as control group (CG). Vo2 max was assessed by Queen's college step test and cardio respiratory endurance was measured by Cooper's 12 minutes run. analysis of covariance (ANCOVA) was computed because the subjects were selected random, but the groups were not equated in relation to the factors were examined. Whenever the adjusted post-test means were found significant, the scheffe's post-hoc test was administered to find out the paired means difference. To test the obtained results on variables, level of significance 0.05 was chosen and considered as sufficient for the study. Both the high intensity aerobic interval training group and concurrent low intensity aerobic and resistance interval training group had shown significant difference in improvement on physiological variables of college level football players. The concurrent low intensity aerobic and resistance interval training group showed significant improvement on physiological variables than the other two groups.

**Keywords:** Aerobic Interval Training, Resistance Training, Physiology, Football.

## Introduction

High intensity interval training (HIIT) is alternating between high and low intensity exercise(s) or between high intensity exercise and a short period of rest. High Intensity Interval Training is physiologically difficult to endure maximal intensities throughout the workout for a long period of time. HIIT helps to lose body fat while simultaneously retaining lean body mass and strengthening the cardiovascular system. HIIT develops sport-specific energy systems and also improves fat and carbohydrate oxidation in skeletal muscle. Moreover it develops "mental toughness". HIIT is extremely efficient as it facilitates bigger training effect with less time spent. And compared to 45 minutes of aerobics, 5 min of HIIT is a lot easier on the joints.

The inclusion of resistance training (to gain strength, hypertrophy, and power) combined with aerobic exercise (to enhance endurance) in a single program is known as concurrent training. Concurrent training programs involving strength and endurance exercises are commonly performed by the athletes to achieve adaptation specific to both forms of exercises. Research investigating the effects of concurrent training has typically compared changes in strength and endurance variables after strength training, endurance training or concurrent strength and endurance training. Concurrent training studies investigating endurance and strength performance to date have shown mixed results. Nelson et al. (1990) reported that improvements in maximal oxygen uptake ($VO_2$ max) during the second half of a twenty week programme were compromised when strength training was implemented in to an endurance programme. In contrast, a number of studies have found no interference to strength or endurance development as a consequence of concurrent training (Sale et al. 1990, Bell et al. 1991 & McCarthy et al. 1995).

Football is being played in all the countries. Though it was officially acknowledged, this game had been known by the people only after the creation of the Football association in 1863. The game rapidly had spread to Continental European countries and then to other countries. In 1904, Federation of International Football Association (FIFA) was established and after four years Football was included in Olympics (Rink, 1987).

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## Methodology

The purpose of the present study was to find out the effects of high intensity aerobic interval training, concurrent low intensity aerobic and resistance interval training on physiological variables of college level football players. To achieve the purpose of this study, forty five football players from Velammal institutions, Chennai, Tamilnadu state, India were selected as subjects at random and their age ranged from 18 to 23 years. The subjects were divided into three groups consisting of 15 each. The experimental group I was treated with the high intensity aerobic interval training (HIAIT), experimental group II was treated with the concurrent low intensity aerobic and resistance interval training (CLIARIT) and group III as control group (CG). Vo2 max was assessed by Queen's college step test and cardio respiratory endurance was measured by Cooper's 12 minutes run. analysis of covariance (ANCOVA) was computed because the subjects were selected random, but the groups were not equated in relation to the factors were examined. Whenever the adjusted post-test means were found significant, the scheffe's post-hoc test was administered to find out the paired means difference. To test the obtained results on variables, level of significance 0.05 was chosen and considered as sufficient for the study.

## Results

**Table I.** Computation of analysis of covariance of means of high intensity aerobic interval training, concurrent low intensity aerobic and resistance interval training and control groups on $vo_2$ max (in ml/kg/min)

| Test | HIAIT | CLIARIT | CG | Source of Variance | Sum of Squares | df | Means Squares | F-ratio |
|---|---|---|---|---|---|---|---|---|
| **Pre-Test Means** | 42.67 | 42.78 | 42.78 | BG | 0.12 | 2 | 0.06 | 0.01 |
| | | | | WG | 142.62 | 42 | 3.39 | |
| **Post-Test Means** | 44.88 | 46.83 | 42.80 | BG | 121.44 | 2 | 6.72 | 18.17* |
| | | | | WG | 140.32 | 42 | 3.34 | |
| **Adjusted Post-Test Means** | 44.91 | 46.81 | 42.79 | BG | 121.51 | 2 | 60.75 | 20.64* |
| | | | | WG | 120.66 | 41 | 2.94 | |

B- Between Group Means  
W- Within Group Means  
df- Degrees of Freedom  

\* - Significant  
(Table Value for 0.05 Level for df 2 & 42 = 3.22)  
(Table Value for 0.05 Level for df 2 & 41 = 3.23)

An examination of table - I indicated that the pre-test means of high intensity aerobic interval training, concurrent low intensity aerobic and resistance interval training and control groups were 42.67, 42.78 and 42.78 respectively. The obtained F-ratio for the pre-test was 0.01 and the table F-ratio was 3.22. Hence the pre-test mean Vo2 max F-ratio was insignificant at 0.05 level of confidence for the degree of freedom 2 and 42. The post-test means of the high intensity aerobic interval training (HIAIT), concurrent low intensity aerobic and resistance interval training (CLIARIT) and control group (CG) were 44.88, 46.83 and 42.80 respectively. The obtained F-ratio for the post-test was 18.17 and the table F-ratio was 3.22. Hence the post-test mean Vo2 max F-ratio was significant at 0.05 level of confidence for the degree of freedom 2 and 42. The adjusted post-test means of the high intensity aerobic interval training (HIAIT), concurrent low intensity aerobic and resistance interval training (CLIARIT) and control group (CG) were 44.91, 46.81 and 42.79 respectively. The obtained F-ratio for the adjusted post-test means was 20.64 and the table F-ratio was 3.23. Hence the adjusted post-test mean $VO_2$ max F-ratio was significant at 0.05 level of confidence for the degree of freedom 2 and 41. The pre, post and adjusted post-test mean values of high intensity aerobic interval training (HIAIT), concurrent low intensity aerobic and resistance interval training (CLIARIT) and control groups (CG) on Vo2 max are graphically represented in figure -I.

**Figure I.** Bar diagram showing the pre post and adjusted means of the HIAIT, CLIARIT and CG on vo$_2$ max
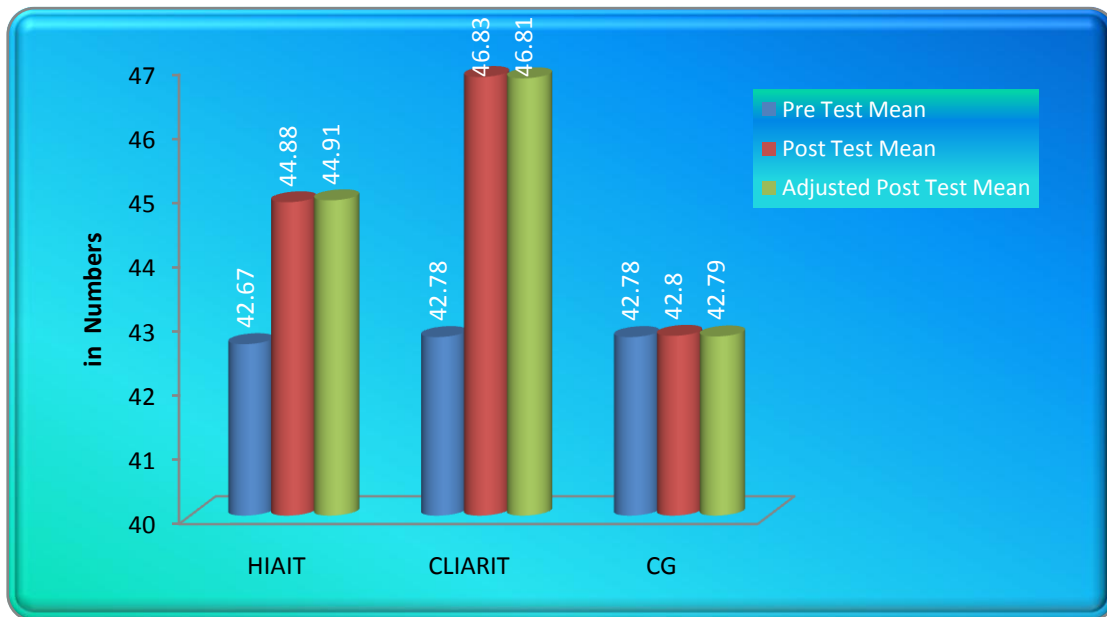


**Table II.** The scheffe's test for the differences between the adjusted post test paired means on agility

| Adjusted Post-test means | | | Mean Difference | Confidence Interval |
|---|---|---|---|---|
| HIAIT | CLIARIT | CG | | |
| 44.91 | 46.81 | --- | 1.91* | |
| 44.91 | --- | 42.79 | 2.11* | 1.58 |
| --- | 46.81 | 42.79 | 4.02* | |

*\* Significant at 0.05 level of confidence*

Table II shows that the mean difference between high intensity aerobic interval training group, concurrent low intensity aerobic and resistance interval training group and control groups and between high intensity aerobic interval training group and concurrent low intensity aerobic and resistance interval training group were 1.92 and 2.11 respectively on Vo$_2$ max are greater than the confidence interval value 0.34, which shows significant difference at 0.05 level of confidence. The mean difference between high intensity aerobic interval training group and control group were 4.02 on Vo$_2$ max is greater than the confidence interval value 0.34, which shows significant difference at 0.05 level of confidence.

**Table III.** Computation of analysis of covariance of means of high intensity aerobic interval training, concurrent low intensity aerobic and resistance interval training and control groups on cardio respiratory endurance (in meters)

| Test | HIAIT | CLIARIT | CG | Source of Variance | Sum of Squares | df | Means Squares | F-ratio |
|---|---|---|---|---|---|---|---|---|
| Pre-Test Means | 2297.33 | 2314.00 | 2308.00 | BG | 2137.77 | 2 | 1068.88 | 0.06 |
| | | | | WG | 696493.33 | 42 | 16583.17 | |
| Post-Test Means | 2488.66 | 2606.66 | 2304.66 | BG | 694920.00 | 2 | 347460.00 | 15.55* |
| | | | | WG | 938480.00 | 42 | 22344.76 | |
| Adjusted Post-Test Means | 2498.19 | 2598.76 | 2303.04 | BG | 678201.38 | 2 | 339100.69 | 78.57* |
| | | | | WG | 176948.70 | 41 | 4315.82 | |

B- Between Group Means                                          *   - Significant
W- Within Group Means                                (Table Value for 0.05 Level for df 2 & 42 = 3.22)
df- Degrees of Freedom                              (Table Value for 0.05 Level for df 2 & 41 = 3.23)

   An examination of table - III indicated that the pre-test means of high intensity aerobic interval training, concurrent low intensity aerobic and resistance interval training and control groups were 2297.33, 2314.00 and 2308.00 respectively. The obtained F-ratio for the pre-test was 0.06 and the table F-ratio was 3.22. Hence the pre-test mean cardio respiratory endurance F-ratio was insignificant at 0.05 level of confidence for the degree of freedom 2 and 42. The post-test means of the high intensity aerobic interval training (HIAIT), concurrent low intensity aerobic and resistance interval training (CLIARIT) and control group (CG)  were 2488.66, 2606.66 and 2304.66 respectively. The obtained F-ratio for the post-test was 15.55 and the table F-ratio was 3.22. Hence the post-test mean cardio respiratory endurance F-ratio was significant at 0.05 level of confidence for the degree of freedom 2 and 42. The adjusted post-test means of the high intensity aerobic interval training (HIAIT), concurrent low intensity aerobic and resistance interval training (CLIARIT) and control group (CG)  were 2498.19, 2598.76 and 2303.04 respectively. The obtained F-ratio for the adjusted post-test means was 78.57 and the table F-ratio was 3.23. Hence the adjusted post-test mean cardio respiratory endurance F-ratio was significant at 0.05 level of confidence for the degree of freedom 2 and 41. The pre, post and adjusted post-test mean values of high intensity aerobic interval training (HIAIT), concurrent low intensity aerobic and resistance interval training (CLIARIT) and control  groups (CG) on cardio respiratory endurance are graphically represented in figure -II.

**Figure II.** Bar diagram showing the pre post and adjusted means of the HIAIT, CLIARIT and CG on cardio respiratory endurance
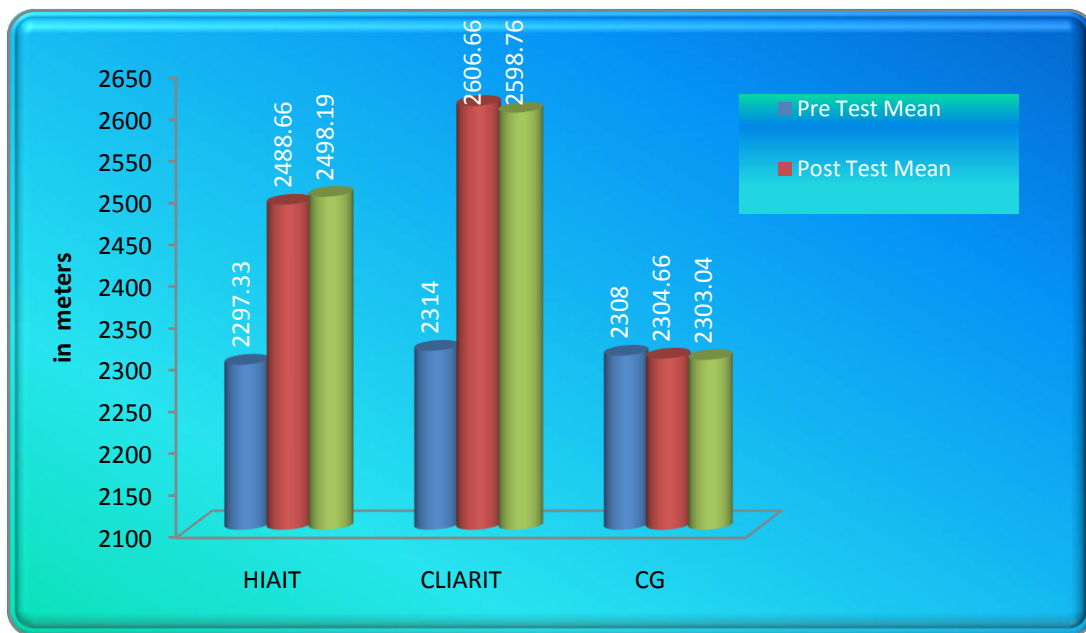


**Table VI.** The scheffe's test for the differences between the adjusted post test paired means on cardio respiratory endurance

| Adjusted Post-test means | | | Mean  Difference | Confidence Interval |
|---|---|---|---|---|
| **HIAIT** | **CLIARIT** | **CG** | | |
| 2498.19 | 2598.76 | --- | 100.57* | |
| 2498.19 | --- | 2303.04 | 195.15* | 60.87 |
| --- | 2598.76 | 2303.04 | 292.75* | |

*\* Significant at 0.05 level of confidence*

Table IV shows that the mean difference between high intensity aerobic interval training group, concurrent low intensity aerobic and resistance interval training group and control groups and between high intensity aerobic interval training group and concurrent low intensity aerobic and resistance interval training group were 100.57 and 195.15 respectively on cardio respiratory endurance are greater than the confidence interval value 0.34, which shows significant difference at 0.05 level of confidence. The mean difference between high intensity aerobic interval training group and control group were 292.72 on cardio respiratory endurance is greater than the confidence interval value 0.34, which shows significant difference at 0.05 level of confidence.

## Conclusion

Both the high intensity aerobic interval training group and concurrent low intensity aerobic and resistance interval training group had shown significant difference in improvement on physiological variables of college level football players. The concurrent low intensity aerobic and resistance interval training group showed significant improvement on physiological variables than the other two groups.

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