# IMPACT OF VARIED INTERVAL TRAINING PROTOCOLS IN MODIFYING VO$_2$MAX AND RESTING PULSE RATE OF UNDER-17 SOCCER PLAYER

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*Abstract*

The main objective was to compare the impact of two different interval training programmes - supramaximal intensity interval training (SMIT) and high intensity interval training (HIIT) – on measures of VO$_2$max and resting heart rate. A total of 30 trained male soccer players 15-17 years of age from Bishnupur district, Manipur, India, were randomly chosen as subject.They were divided into three groups of 10, group-1 was given supramaximal intensity interval training (SMIT) and group-2 was given high intensity interval training (HIIT) and group-3 act as control group (CG). Group-1 &2 was given training for 12 weeks (3days/week) and all players were tested before and after the training program. Outcome measures were: VO$_2$max and resting pulse rate to check the two parameters by12 minutes run or walk test and digital blood pressure monitor respectively. The collected data were analyzed by using paired sample t-test to present mean, mean differences, 't'-ratio and percentage of change. Further univariate (ANCOVA) was used to determine whether there are any significant differences between the groups on the dependent variable. When interaction was found significant, 'Scheffe's test' was employed. The level of confidence was fixed at 0.05.The results shown that there was a significant improvement inVO$_2$max and resting pulse ratein both experimental groups the obtained 'F' ratio for adjusted post-test scores (344.53> 3.37) on VO$_2$max and (12.95>3.37) on resting pulse rate table value for df 2 and 26 on resting pulse rate. The study shows it is possible to improve the VO$_2$max and decrease the resting pulse rate by proper varied interval training added to the normal training load. The observed effects are meaningful to the training practices of elite athletes seeking a competitive edge in team sports when otherwise well matched.

*Keywords:* interval training,VO$_2$max,resting pulse rate, supramaximal intensity interval training (SMIT), high intensity interval training (HIIT).

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## Introduction

Soccer players practice to perfect their technical, tactical, psychological, and physical skills. Indeed, due to the high level of energy expenditure required for competition matches. During a soccer game, players exercise in a variety of ways, including running, kicking, jumping, and tackling. Soccer requires running followed by short to long periods of recovery, which can be active or passive. Intensity and running periods can be switched at any time depending on the demands of the game. Accelerations, sprints, bursts, jumps, and shots are frequently used to set up goals or decisive actions. As a result, improving the ability to perform maximal and high-intensity exercise is one of the goals of training.

Aerobic capacity, on the other hand, has an effect on soccer performance. according to Helgerud et al. increased maximal oxygen uptake (VO2max) improved soccer performance as measured by distance travelled, work intensity, and the number of sprints performed during a game, Improving a soccer player's fitness through training is thus a complicated process that necessitates gains in both aerobic and anaerobic abilities.

In general, little is known about supramaximal (SMIT) and high-intensity interval training (HIIT), particularly in soccer. The activities of under-17 players are naturally composed of short, high-intensity activities. In comparison to adults, studies have shown that during repetitive bouts of sprints separated by short recovery periods, children of this age maintain their performance without significant fatigue. Repetitive intervals at high velocities close to or higher than the maximal heart rate, separated by short recovery periods, may also induce VO2max and resting pulse rate.

Effective training programmes such as SMIT and HIIT could improve VO$_2$ max and significantly reduced resting pulse rate performance while still leaving time to improve other limiting skills such as technique and tactics. The purpose of this study was to determine the impact of supramaximal intensity interval training and high intensity interval training protocols in modifying VO$_2$max andresting pulse rate of under-17 soccer player. This specific training program was compared with a control group where participants performed the usual soccer exercises. We hypothesized that the specific program would allow soccer players to increase their VO$_2$max and reduced their resting pulse rate.

## Methods

The study included a pre and post-diagnostic phase as well as one training period with two experimental groups and one control group to test the hypothesis of whether SMIT has a greater effect on VO$_2$max and resting pulse rate than HIIT. All participants completed a 12 minutes run or walk

testto calculate $VO_2$max and measured their resting pulse rate by using digital blood pressure monitor. During the intervention, participants exercised using either the SMIT or HIIT programmes. Throughout this time, all of the subjects' heart rates were monitored on a regular basis.

### Subjects

A total of 30 subjects took part in this study (15-17 years). All subjects were accustomed to a training workload and have been involved in soccer training and matches for at least 2-3 years. All the subjects were from Bishnupur district of Manipur, India. The subjects were divided into two training group and one control group randomly. All subjects were fully informed of any risks before giving their written informed consent to participate in these experiments.

### Training Protocol

Both groups' intervention was limited to endurance part of the training session and was administered as an extension of the regular soccer-specific training. The research was carried out during the winter training session withthree sessions per week for 12-weeks, 1–1.5 hours of practice. All training sessions were designed in the same manner.The training sessions began with a 7-10 minute warm-up period that included flexibility exercises and the incorporation of game-specific actions. Following that, a phase of Shuttle Runs 15 meters for 5 minutes ensued, with the focus in this phase being on determining the target heart rate. Training was equal for both groups as a result of this training design. Following the shuttle run session, SMIT or HIIT training was added, followed by a cool down session. Throughout the session, the heart rate was monitored. Both training methods included high intensity interval intervention, which included various types of interval training with and without a soccer ball, as well as rest. During SMIT, all subjects should perform at or above 100% of their individual VO2max, while HIIT should achieve or maintain 70-90% of their individual VO2max, separated by rest periods according to the training programme.

### Testing Procedure

All players within a given test procedure were tested on the same day. At first, the resting pulse rate of the subject was recorded in a sitting positing in the morning session. Further, all subjects completed a 15 minute warm-up at approximately 40–50% of their individual maximal heart rate. Then, 12 minutes run or walk test was conducted and the value was then calculated by using Cooper's $VO_2$max formula.

### Statistical Analysis

The acquired data were statistically examined descriptive analysis using paired sample t-test, and analysis of covariance (ANCOVA) to see if there were any changes between the adjusted posttest means on selected dependent variables independently for each variable. If the acquired 'F' ratio for the adjusted posttest was found to be significant, the Scheffe's test was used as a post hoc test to determine any matched mean differences. The 0.05 level of confidence was set as the level of significance for testing the 'F' ratio derived by analysis of covariance, which was deemed adequate.

*Result*

The descriptive analysis shows mean, percentage of improvement and 't' ratio of the collected data on $VO_2$max and resting pulse rate among experimental and control groups are presented in table-1.

**Table-1: Descriptive Analysis of the Data on $VO_2$max and Resting Pulse Rate Of Experimental and Control Groups**

| Variable | Training | Pre-test | Post-test | M.D | % change | T-ratio |
|---|---|---|---|---|---|---|
| **$VO_2$max** | **SMIT** | 48.28 | 50.33 | 2.05 | 4.24 | 24.65* |
| | **HIIT** | 48.23 | 48.61 | 0.38 | 0.78 | 15.40* |
| | **CG** | 48.21 | 48.29 | 0.08 | 0.16 | 1.76 |
| **Resting Pulse Rate** | **SMIT** | 69.70 | 67.10 | 2.6 | 3.73 | 9.75* |
| | **HIIT** | 70.00 | 67.20 | 2.8 | 4 | 7.79* |
| | **CG** | 70.20 | 70.10 | 0.1 | 0.14 | 0.16 |

*Table t-ratio at 0.05 level of confidence for 9(df) = 2.26*

The obtained t-ratios of 24.65, 15.40on $VO_2$max and 9.75, 7.79on resting pulse rate are greater than the required table value of 2.26. It is clear that there was a significant difference between pre-test and post-test on $VO_2$maxand resting pulse rate of SMIT and HIIT groups. As a result, it is obvious that it was determined to be significant. Further, according to the findings, SMIT caused 4.24% changes in $VO_2$max and0.78% changes in HIIT. It also shows that SMIT affected 3.73% of resting pulse rate and7.79% of HIIT.

**Table II: Analysis of Covariance on $VO_2$max and Resting Pulse Rate of Experimental and Control groups**

| | SMIT | HIIT | CG | SOV | SOS | df | M.S | f-ratio |
|---|---|---|---|---|---|---|---|---|
| **$VO_2$max** | 50.29 | 48.62 | 48.32 | BG | 22.58 | 2 | 11.29 | 344.53* |
| | | | | WG | 0.85 | 26 | 0.03 | |
| **Resting Pulse Rate** | 67.33 | 67.17 | 69.89 | BG | 46.67 | 2 | 23.33 | 12.95* |
| | | | | WG | 46.82 | 26 | 1.80 | |

*(Table value – 3.35 (df =2 & 27) and 3.37 (df =2 & 26).        \*Significant (.05 level).*

The adjusted post-test mean values of SMIT, HIIT and control groups are 50.29, 48.62 and 48.32on $VO_2$max67.33, 67.17 and 69.89on resting pulse rate respectively.The obtained 'F' ratio of $VO_2$max and resting pulse rate are 344.53and 12.95 which was greater than the required table value of 3.37 for df 2 and 26 for significance at 0.05 level of confidence. It was concluded that, there was a significant differences exist among the SMIT, HIIT, and control groups on $VO_2$max and resting pulse rate.

**Table-3: Scheffe's Test for the Differences between the Adjusted**
**Post Test Paired Means on VO$_2$max and Resting Pulse Rate**

|  | SMIT | HIIT | CG | MD | CIV |
|---|---|---|---|---|---|
| VO$_2$max | 50.29 | 48.62 | - | 1.67* | |
| | 50.29 | - | 48.32 | 1.97* | 0.20 |
| | - | 48.62 | 48.32 | 0.30* | |
| Resting Pulse Rate | 67.33 | 67.17 | - | 0.16 | |
| | 67.33 | - | 69.89 | 2.56* | 1.55 |
| | - | 67.17 | 69.89 | 2.72* | |

*Significant at .05 level.*

As shown in table-3, the Scheffe's post hoc test analysis proved that significance mean differences existed between SMIT and HITT groups; SMIT and control groups; HIIT and control groups; on VO$_2$max. Since, the mean differences 1.67, 1.97 and 0.30 are higher than the confident interval value 0.43. Hence, it is concluded that due to the effect of SMIT and HIIT the VO$_2$max was significantly improved among trained under-17 soccer players. It was also concluded that SMIT group was better than HIIT and control groups in improving VO$_2$max among under-17 male soccer players.

The above analysis proved that there was no significance mean differences existed between SMIT and HIIT groups, 0.16 is lesser then the confident interval value 1.55; However, mean differences existed between SMIT and control groups; HIIT and control groups; on resting pulse rate. Since, the mean differences values2.56 and2.72 are higher than the confident interval value 1.55. It is also concluded that due to the effect of SMIT and HIIT the resting pulse rate was significantly reduced among trained under-17 soccer players.

**Figure-2: Bar Graph Showing the Adjusted Post Mean Values on VO$_2$max and**
**Resting Pulse Rate of SMIT, HIIT and Control Groups**
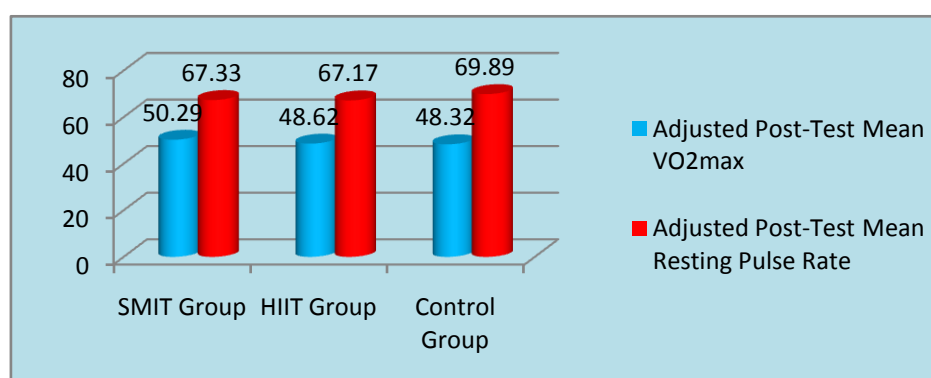


*Discussion on Findings*

VO$_2$maximproved in experimental groups as a result of supramaximal intensity interval training and high intensity interval training when the time to complete each test was compared between groups. Both the experimental groups show better improvement while compared to control group. When the experimental groups were compared, the SMIT group outperformed the HIIT group. SMIT, in summary, provides the most benefits for under-17 male soccer players in terms of

concurrent improvements in VO$_2$max performance.

On the other hand resting pulse rate reduced in experimental groups as a result of supramaximal intensity interval training and high intensity interval training when the time to complete each test was compared between groups. Both the experimental groups show better improvement while compared to control group. And the experimental groups were again compared there were no significant difference among the groups; in summary SMIT and HIIT have similar improvement in resting pulse rate.

These findings of the study are in conformity with the results of the following studies by **Clark, *et al.,* (2019)** found that 6 week of two high intensity regime can increased VO$_2$max by 4–5% in response to training ($p = 0.045$) with no group-by-time interaction ($p = 0.79$). **Poulos*et al.,* (2018)** found that 16 training sessions of high- intensity interval training (HIIT) and continuous moderate intensity training (CONT) 2 days per week improved VO$_2$max and VT 4.6, 3.6 and 5.6% only after HIIT training and also a tendency for better adaptations the time efficient was found after HIIT training.

**Mitranun, (2017)** establish that 10 weeks training of supramaximal high-intensity interval training (SIT) and functional high-intensity interval training (FIT) increased significantly Maximal oxygen consumption in both groups further he explained both SIT and FIT programs exerted beneficial effects on health-related physical fitness and flow-mediated dilatation (FMD). **Astorino *et al.,* (2017)** found that maximal stroke volume was increased with HIIT ($P = 0.04$), increases in VO$_2$max in HIIT + sprint interval training (SIT), HIIT + high-volume interval training (HIIT$_{HI)}$ and HIIT + periodized interval training (PER) which were significantly increases in maximal CO ($20.0 \pm 3.1$ L·min$^{-1}$ to $21.7 \pm 3.2$ L·min$^{-1}$, $P = 0.04$).

***Conclusion***

From the results of the study and discussion, the following conclusions are drawn.

1. Due to the impact of supramaximal intensity interval training and high intensity interval training, the VO$_2$max of under-17 soccer players was significantly improved.

2. Due to the impact of supramaximal intensity interval training and high intensity interval training, the resting pulse rate of under-17 soccer players was significantly reduced.

3. Supramaximal intensity interval training and high intensity interval training was better than the control group while improving VO$_2$max and reducing resting pulse rate among under-17 soccer players.

4. Supramaximal intensity interval training was better than the high intensity interval training in improving VO$_2$max among under-17 soccer players.

5. Supramaximal intensity interval training and high intensity interval training had no significant in reducing resting pulse rate.

***Reference:***

1. Poulos, S., Zacharogiannis, I., Paradisis, G., Dagli, F., &Maridaki, M. (2018). High Intensity Interval Training Does Not Improve Cardiorespiratory Parameters In Trained Young Soccer

Players: 3171 Board #40 June 2 8 00 AM - 9 30 AM. *Medicine & Science in Sports & Exercise,50*(5S), 779.

2. Astorino, T. A., Edmunds, R. M., Clark, A., King, L., Gallant, R. A., Namm, S., Fischer, A., & Wood, K. M. (2017). High-Intensity Interval Training Increases Cardiac Output and V˙O2max. *Medicine & Science in Sports & Exercise,49*(2), 265–273.

3. Clark, A., De La Rosa, A. B., DeRevere, J. L., &Astorino, T. A. (2019). Effects of various interval training regimes on changes in maximal oxygen uptake, body composition, and muscular strength in sedentary women with obesity. *European Journal of Applied Physiology,119*(4), 879–888.