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RESEARCH ARTICLE

# The Role of High-Intensity Interval Training (HIIT) in Reducing Cardiovascular Disease Risk in Athletes: A Sports Perspective

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**Abstract:** Exercise and sports engagement are essential in order to maintain general health and enhance athletic performance. By integrating high-intensity interval training (HIIT) aspects into sports training, athletes may have a low risk of arrhythmias or hypertrophic cardiomyopathy. HIIT has become a groundbreaking approach to fitness, upending traditional views of exercise. The effectiveness and efficiency of this dynamic training approach, which alternates short rest intervals with intense work bursts, are unmatched. The benefits of HIIT include improved cardiovascular health, increased muscle mass, and time-saving exercises for athletes with busy schedules. It has been shown that HIIT is a powerful cardiovascular fitness accelerator that influences important metabolic markers, increases aerobic capacity, and enhances heart function. The study aimed to investigate the role of HIIT in reducing the risk of cardiovascular diseases in athletes. For this experimental study, a sample of sixty male university students (N=60) between the ages of 18 and 22 were specially selected. This group was divided into two subgroups: non-athletes (n = 30) and athletes (n = 30). While the non-athlete group did not engage in any training, the athlete group underwent HIIT. We measured blood pressure using a standardized Sphygmomanometer. The Queen's College Step Test was used to measure maximal oxygen consumption (VO2max). To determine the impacts of high training stress on endothelial function between gender and competition level, the flow-mediated dilation (FMD) was used. The information gathered from the two groups, both before and after certain HIIT factors, was analyzed using the analysis of covariance (ANCOVA) method. In comparison to non-athletes, our research revealed that athletes had greater levels of enhancing endothelial function, improving Vo2 max, and reducing blood pressure. HIIT helps maintain muscle mass and reduce fat, which helps maintain a healthy body composition of athletes in sports. These findings demonstrate the importance of HIIT variables in influencing athletes' health and degree of performance satisfaction.

**Keywords:** Sport performance, Cardiovascular Disease, Blood Pressure, VO2 Max, High-Intensity Interval Training.

## INTRODUCTION

Daily physical activity and exercise training have long been seen as essential measures to maintain and control health throughout life [1]. Exercise is an effective preventive measure against at least twenty-five different medical conditions, including diabetes, cancer, heart disease, and more, according the years of research. Training with various strength or endurance exercises has been widely used for this aim [2]. A form of exercise known as high-intensity interval training (HIIT) mixes short bursts of intensive activity with rest intervals. Regular endurance training results in physiological changes that optimize life efficiency and exercise tolerance capability. On the other hand, HIIT pushes the body to perform at its best during high-intensity intervals that are promptly followed by resting periods [3]. This workout has been deemed effective because it not only improves the body's cardiovascular efficiency but also has many other beneficial effects, such as muscle growth, fat reduction, muscle retention, etc. [4]. It can increase aerobic capacity, or VO2 max, according to a number of studies. This number is a key indicator of cardiovascular fitness and shows the maximum amount of oxygen the body can consume while exercising. HIIT does this by demanding quick work bursts that increase heart rate, interspersed with short rest intervals that let the heart adapt and become more efficient [5]. A typical HIIT session consists of five steps, beginning with an initial warm-up that can be completed by jogging or running. High-intensity exercise, such as cycling or sprinting for 20 to 30 seconds, is then followed by a low-intensity interval or rest to level the heart rate for 10 to 20 seconds. This cycle is repeated up to 4 to 8 times. To restore normal body function and heart rate, a last cool-down session is performed at the end [6].

Cardiovascular fitness regulation has been shown to benefit from HIIT. It aids in raising the body's aerobic capacity [7], which is actually a measure of how much oxygen the body can absorb during vigorous activity. Higher cardiovascular endurance and fitness are correlated with a high aerobic capacity [8]. HIIT also increases the stroke volume, or the volume of blood a heart can pump out following each contraction. An increase in stroke volume causes the heart to pump blood more effectively, improving cardiovascular function [9]. Frequent HIIT can assist in lowering the heart's resting rate, which is frequently regarded as an indicator of heart health. Additionally, HIIT can lower both diastolic and systolic blood pressure since it regulates blood pressure. The dangers of hypertension are reduced as a result of this reduction. HIIT also improves endothelial function, which is associated with the condition of the blood vessel's inner lining. The risks of cardiovascular problems are drastically reduced as long as the blood vessels' interior lining remains healthy. The effects of HIIT can also prevent atherosclerosis, a disorder that causes arteries to harden and narrow [10].

This study contributes to the continuing growth of sports science as a multidisciplinary area by advancing our expanding our knowledge of how CVD factors affect athletic performance. The study aimed to investigate the role of high-intensity interval training in reducing the risk of cardiovascular diseases in athletes. For this experimental study, a sample of sixty male university students (N=60) between the ages of 19 and 23 was specially selected. This group was divided into two subgroups: athletes (n = 30) and non-athletes (n = 30). While the non-athlete group did not engage in any training, the athlete group underwent HIIT. We measured blood pressure using a standardized **Sphygmomanometer**. The Queen’s College Step Test was used to measure maximal oxygen consumption (VO2max). To determine the impacts of high training stress on endothelial function between gender and competition level, the flow-mediated dilation (FMD) was used. The information gathered from the two groups, both before and after certain HIIT factors, was analyzed using the analysis of covariance (ANCOVA) method.

## 2. Related Works

Men et al. [11] assess the effectiveness and safety of high-intensity interval training in kids and teenagers. We looked through eight databases. A descriptive study examining the impacts of HIIT on metabolic risk, children's and adolescents' body shape, and cardiorespiratory fitness factors for CVD. Age, participation, intervention duration, and exercise frequency were included as factors in subgroup analysis. 2995 children and adolescents participated in 47 studies. The findings demonstrated that HIIT greatly enhanced cardiorespiratory fitness indicators (SBP, DBP, HRmax, and VO2max) and CVD biomarkers (TC and HDL-C).

Wang and Wang [12] analyze and compare the impact of moderate-intensity continuous training (MICT) and high-intensity interval training (HIIT) on athletes' aerobic endurance performance metrics. The Cochrane Risk of Bias Assessment Tool was used to evaluate quality, and subgroup analysis and heterogeneity analysis were carried out. Additionally, sensitivity and regression analysis were performed. Eight weeks of moderate-intensity continuous training (MICT) did not significantly raise athletes' hemoglobin (Hb) levels; however, two to three weeks produced better outcomes.

Alibrahim and Hassan [13] assess the effects of high-intensity interval training (HIIT) on biological and physical markers in athletes participating in individual sports. Thirty members of the Kingdom of Saudi Arabia's Al-Adalah Club participated in our experiment. The experimental group and the control group. The Sergeant Jump Test (SJT) and SLJT were used to evaluate physical performance. The Lactate Pro 2 blood lactate meter was used to measure the levels of lactic acid. The Beurer BP monitor (model Bc28 | 57144) was used to measure heart rate (HR) and blood pressure, and a certified medical practitioner examined hemoglobin (Hb) levels at a medical laboratory. Heart rate (HR) and BP were measured using the BBP monitor (), and hemoglobin (Hb) levels were checked at a medical laboratory by a licensed medical professional.

Padkao and Prasertsri [14] investigated the effects of Asparagus officinalis (A. officinalis) extract intake in conjunction with HIIT on pulmonary and cardiovascular function parameters in obese and overweight people. A total of seventy-two obese and overweight individuals were divided into four groups (n = 18) at random: the CG, the HIIT group, the AOE group, and the HIIT + AOE group. HR, endothelium function, HR variability, BP, respiratory muscle strength, BP variability, pulmonary function and volume, body composition, and chest expansion were measured before and twelve weeks after the intervention. In comparison to the CON group, the HIIT + AOE group had improved HR variability with increased high-frequency power and a lower low-frequency/high-frequency ratio. Both the groups saw an increase in peak blood flow, however only the HIIT group experienced a quicker vascular recovery. The maximum expiratory pressures of the HIIT and HIIT + AOE groups were higher than those of the CON group. The HIIT + AOE group outperformed the CON group in terms of chest wall expansion, the percent-predicted FEV1/FVC, and the ratio of forced expiratory volume in one second to forced vital capacity. Compared to the CON group, the HIIT + AOE group had a lower waist-to-hip ratio. Additionally, it significantly enhances pulmonary function, chest wall expansion, expiratory muscular strength, and body composition measures in obese and overweight people.

# MATERIAL AND METHODS:

The study aimed to examine the role of HIIT in reducing the risk of CVD in the sports performance of university students. A randomized, controlled trial was used in the current study. The non-athlete group comprised of thirty male players, and the athlete group consisted of thirty individuals. The raw data were described and categorized using descriptive statistics, which were also utilized to measure the mean, frequency, standard deviation, and table drawing. Athletes' sport performance was predicted using stepwise regression. The SPSS program was used for data analysis, and a 96% confidence level was taken into account. The working strategy of the proposed methodology is shown in Figure 1.

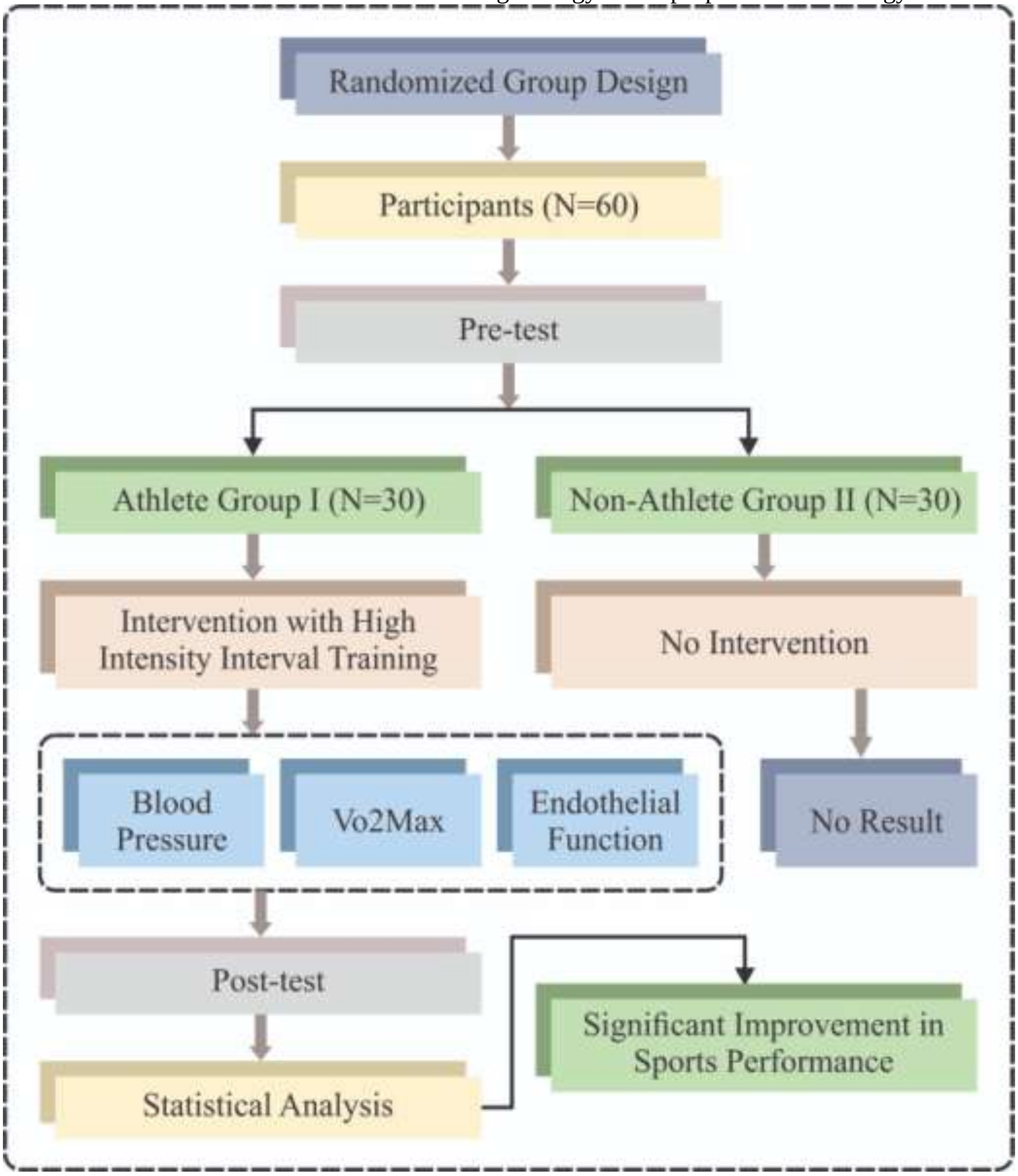


**Figure 1.** Working Strategy of the Proposed Methodology

**Design**

The experimental conditions were assigned to the participants at random. The university issued a research registration code prior to beginning, and the data gathering procedure was approved by the institutional ethics committee. In order to participate in the study, participants and their parents gave their informed consent. Individuals with significant mental or physical health-related problems at the time of data collection or those who declined to take part in the study were excluded [15].

**Students**

A sample of sixty male university students in the range of 18–22 years was specifically chosen to take part in this experimental study. This study group consisted of 60 males, aged 22.66 ± 1.91. Two subgroups were created from this group: non-athletes (n = 30) and athletes (n = 30).

**Procedure**

A pre-and post-test design was used in the study. Researchers evaluated athletes' baseline levels of VO2 Max, blood pressure, and endothelial function during the pre-test. A standardized test intended to gauge intrapersonal intelligence was used to measure this. Through physiologically related activities, the athletes' group was given a program that emphasized respect, goal-setting, picturing a successful outcome, and mindfulness training. While the non-athletes' group didn't participate in any training programs, however athlete group participated in HIIT. Finally, a post-test evaluated the changes in the intended variables.

**Data analysis**

The effects of time, group, and their interaction on three dependent variables— blood pressure, VO2 Max, and endothelial function were assessed statistically using SPSS. We measured blood pressure using a standardized

**Sphygmomanometer**. The Queen's College Step Test was used to measure maximal oxygen consumption (VO2max). To determine the impacts of high training stress on endothelial function between gender and competition level, the flow-mediated dilation (FMD) was used. Dependent sample ANOCVA was employed to investigate group differences at each time point as well as changes within each group from baseline to post-intervention.

**Inclusion criteria**

The following inclusion criteria were used to choose the study: (1) intervention programs that consider a pre-and post-test in their analysis; (2) studies that assess the impact on physiolcogical factors associated with sports performance optimization; (3) a sample of elite athletes who play professional sports at varying ages; (4) both quantitative and qualitative methods can be used to evaluate therapies [16].

# RESULTS AND DISCUSSIONS:

According to the results, athletes with the demographic data shown below (Table 1). The findings also demonstrated that among personality qualities, players' performance is positively and significantly correlated with physiological components. It is crucial to research how CVD factors affect athletic performance. As a result, a coach can assign their players to suitable positions depending on this characteristic.

**Table 1.** Demographic Data of Athletes

| Characteristics | | Frequency | Percentage |
|---|---|---|---|
| Age | Between 19-23 | 60 | 30 |
| Playing history | Between 2-4 | 160 | 62.23 |
| | Between 5-7 | 88 | 55.45 |
| Academic degree | Diploma | 108 | 76.72 |
| | Associate degree | 106 | 88.23 |

**Performance Analysis of Blood Pressure**

The anthropometric and biochemical traits of the athlete and non-athlete groups and CGs before and after the test are contrasted in Figure 2. The Athlete group demonstrated a significant weight reduction ($p = 0.004$) and BMI ($p = 0.008$), but the Non-athlete group did not significantly change from the pre-test, and there was no dissimilarity between the both groups after the intervention. Table 2 illustrates the characteristics of the athlete and non-athlete groups. In the athlete group, the DBP ($p < 0.05$) and SBP ($p < 0.01$) levels dramatically improved. Following the intervention, non-athlete BP remained unchanged. There was a substantial difference between the SBP of the athlete and the non-athlete before and after the test.

**Table 2 –** Characteristics of the Athletes and Non-Athletes Groups

| Variables | Athlete Group (n = 30) | Non-Athlete Group (n = 30) | p-value |
|---|---|---|---|
| Male | 18:23 | 30:50 | – |
| Age (years) | 52.8 ± 7.0 | 50.8 ± 8.3 | 0.022 |
| SBP (mm/Hg) | 119.3 ± 14.1 | 121.4 ± 13.6 | 0.054 |
| DBP (mm/Hg) | 56.7 ± 5.8 | 76 ± 5.9 | 0.568 |

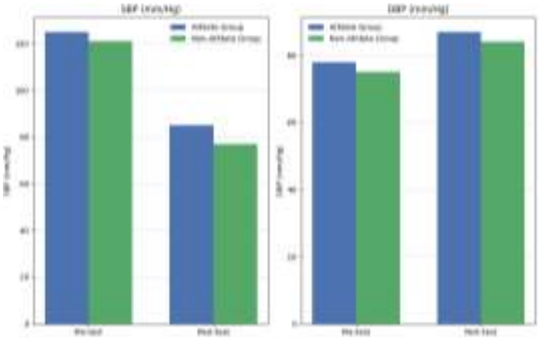

**Figure 2.** Performance Analysis of Blood Pressure

**Performance Analysis of VO2 Max**

The physiological variables, such as **$VO_2$ Max,** are considered. We measured cognitive performance using a standardized S-test. The average scores of the components and the overall index of **$VO_2$ Max** in the athletes and non-athlete groups differed significantly after the intervention, according to the results (see Table 3 and Figure 3). Additionally, results show that the pre-and post-test scores differ significantly ($p < 0.01$) with $VO_2$ Max increased, and resting heart rate decreased.

**Table 3. $VO_2$ Max** Performance of Athletes and Non-Athlete Groups

| Task/Subscale | Group | Mean (M) | Standard Deviation (SD) | P-value | %Change |
|---|---|---|---|---|---|
| **$VO_2$ Max (ml/kg/min)** | Atheletes | 41.6 ± 3.1 | 46.9 ± 3.2 | 0.001 ** | ↑ 12.7% |
| | Non-athletes | 41.3 ± 3.0 | 41.7 ± 3.0 | 0.201 | ↑ 1.0% |

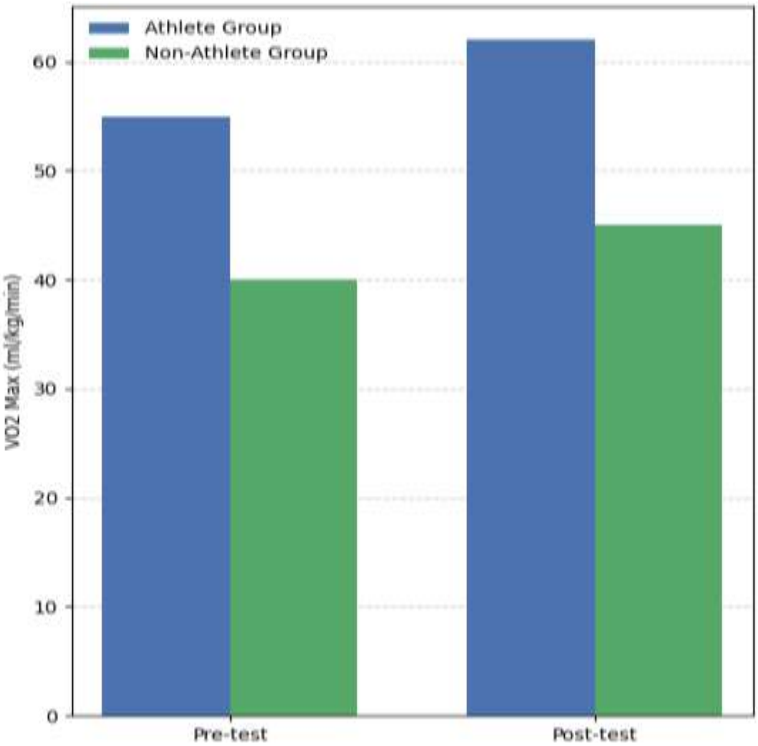


**Figure 3.** Performance Analysis of **$VO_2$ Max**

**Performance Analysis of Emotional Regulation**

The five aspects of endothelial function were FMD, Nitric Oxide (NO) Levels, Endothelin-1, Reactive Hyperemia Index (RHI), and Arterial Stiffness. To determine the impacts of high training stress on endothelial function between gender and competition level, the flow-mediated dilation (FMD) was used. The average scores of the components and the overall index of emotion regulation in the athletes and non-athlete groups differed significantly after the intervention, according to the results (see Table 4 and Figure 5). Additionally, results show that the pre-test and post-test endothelial function scores differ significantly ($p < 0.01$).

**Table 4.** Endothelial Function Performance of Athletes and Non-athlete Groups

| Variable | Athletes | Non-Athletes | P-value |
|---|---|---|---|
| Flow-Mediated Dilation (FMD), % | 7.2 ± 1.1 | 11.0 ± 1.3 | < 0.001 |
| Nitric Oxide (NO) Levels (μmol/L) | 30 ± 4 | 45 ± 5 | < 0.001 |
| Endothelin-1 (pg/mL) | 2.2 ± 0.3 | 1.5 ± 0.2 | 0.002 |
| Reactive Hyperemia Index (RHI) | 1.70 ± 0.15 | 2.20 ± 0.20 | < 0.001 |
| Arterial Stiffness (AIx, %) | 22 ± 3 | 15 ± 2 | < 0.001 |

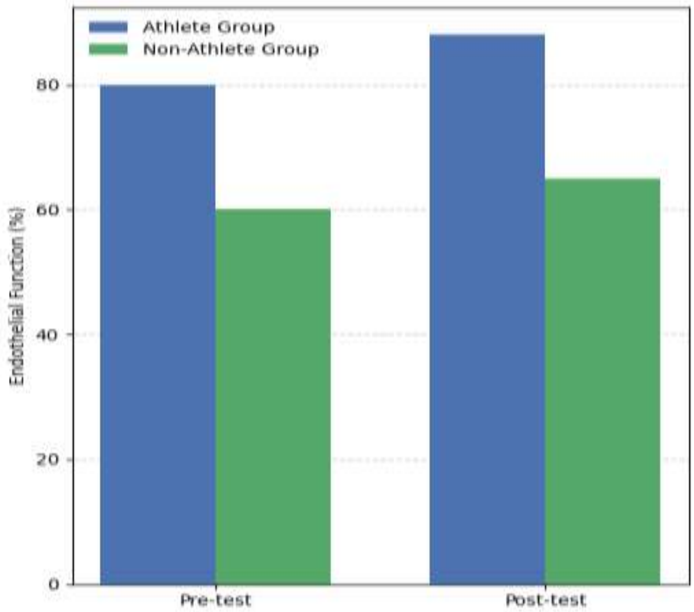


**Figure 4.** Performance Analysis of Endothelial Function

**Table 5.** Overall Performance Comparison between Athletes and Non-Athletes Groups

| Measure | Groups | Mean | SD | P value |
|---|---|---|---|---|
| Blood Group (ml/kg/min) | Athletes | 45.0 | 5.0 | 0.03 |
| | Non-athletes | 40.2 | 6.1 | |
| $Vo_2$ Max | Athletes | 55.5 | 5.5 | < 0.001 |
| | Non-athletes | 42.3 | 1.3 | |
| Endothelial Function (%) | Athletes | 11.0 | 1.3 | < 0.001 |
| | Non-athletes | 7.2 | 1.1 | |

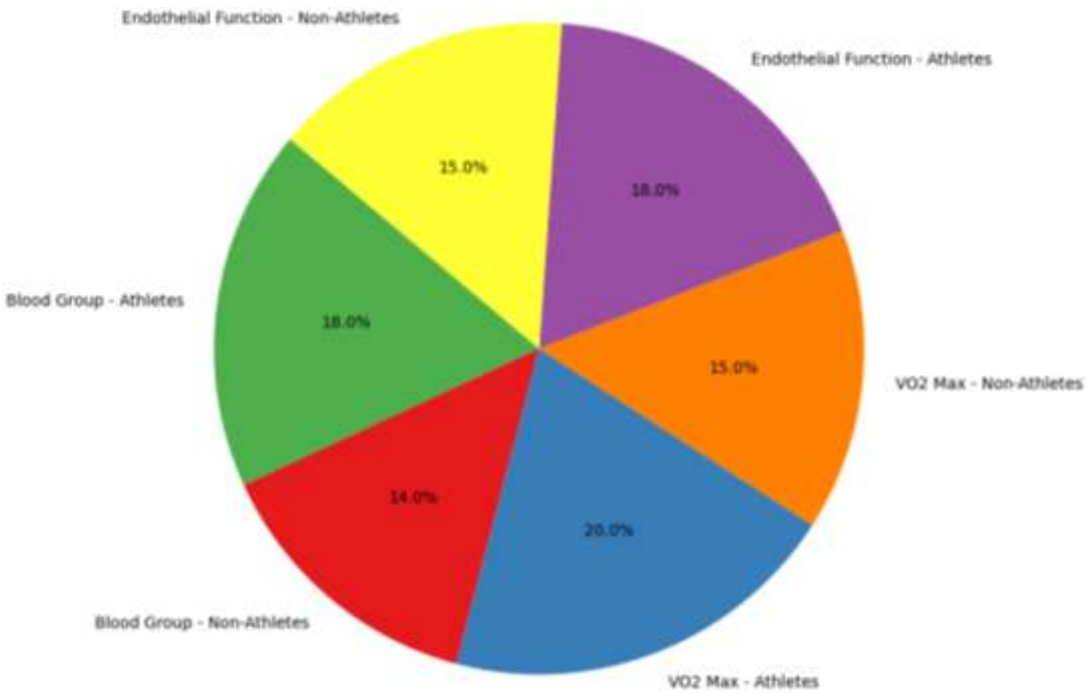


**Figure 5.** Overall Comparison between Athletes and Non-Athletes Groups

These findings indicates that athletes with high degrees of discipline, responsibility, accomplishment drive, and goal orientation have outperformed non-athlete groups in the game, as seen in Figure 5 and Table 5. Athletes with better VO2 Max, endothelial function, and blood sugar may have a lower risk of CVD and manage performance expectations and sustain optimism in sports.

## CONCLUSION

In this study, we examine the role of high-intensity interval training in reducing the risk of CVD in sports athletes. For this experimental study, a sample of sixty male university students (N=60) between the ages of 19 and 23 was specially selected. This group was divided into two subgroups: athletes (n = 30) and non-athletes (n = 30). While the non-athlete group did not engage in any training, the athlete group underwent HIIT. We measured blood pressure using a standardized Sphygmomanometer. The Queen's College Step Test was used to measure maximal oxygen consumption (VO2 Max). To determine the impacts of high training stress on endothelial function between gender and competition level, the flow-mediated dilation (FMD) was used. The information gathered from the two groups, both before and after certain HIIT factors were tested, using the analysis of covariance (ANCOVA) method. In comparison to non-athletes, our research revealed that athletes had greater levels of improved VO2 max, reduced blood pressure, and enhanced endothelial function. HIIT helps maintain muscle mass and reduce fat, which helps maintain a healthy body composition in sports. These findings demonstrate the importance of HIIT variables in influencing athletes' health and degree of performance satisfaction.

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