**Introduction**

Heart Failure is a pathophysiological state in which a chronic ventricular dysfunction occurs, generating a neuroendocrine inflammatory response, with symptoms such as breathlessness, fatigue and edema, leading to a deterioration of functional capacity. Exercise is a non-pharmacology strategy implemented in cardiovascular rehabilitation programs in patients with heart failure to improve functional capacity, quality of life, progression and increased peak oxygen consumption.

In studies they have provided explanations of pathophysiological mechanisms governing the likely benefits of high intensity interval exercise in these patients. It is a non-pharmacology strategy implemented in cardiovascular rehabilitation programs in patients with heart failure to improve functional capacity, quality of life, progression and increased peak oxygen consumption.

**Purpose**

The aim of this study was to determine the cardiovascular markers variation (left ventricular ejection fraction, peak oxygen uptake) and systemic inflammatory response (C-reactive protein) before and after high intensity interval training. (HITT) in patients with heart failure and optimal treatment at 2640 m above sea level.

**Significance**

Previous studies in patients with heart failure had used cardiovascular rehabilitation protocols with concomitant exercise. In the last decade, various studies on heart failure with HTT have provided explanations of pathophysiological mechanisms governing the likely benefits with this training. Even if there are numerous studies and meta-analyses demonstrating the benefit of exercise against heart diseases, right now, do not known in depth the HIIT benefits in patients with heart failure at 2640 m above sea level and the impact on cardiovascular and inflammatory markers.

**Design**

Uncontrolled study before and after

**Methods**

Six male patients diagnosed with heart failure, (left ventricular ejection fraction (LVEF) less than 40% in optimal treatment, who met the inclusion criterion as the study after signing informed consent, performed 36 sessions in a cardiac rehabilitation program. It was used as a method of training, high-intensity interval training (HITT), cardiopulmonary exercise testing (CPET) with gas analyzer Jaeger Oxycon Mobile was used to measured peak oxygen uptake (VO2peak) and ventilatory variables, with an incremental exercise test on treadmill with Naughton protocol. The criteria used to complete maximal test cardiopulmonary exercise were: maximum heart rate, symptoms of patients, patient request, RER > 1. The VO2peak results were expressed in ml/min/kg.

To measure the ejection fraction (LVEF) an isotopic ventriculography with radionuclide ventriculography was performed according to protocol from nuclear medicine Department Shaio Clinic Foundation. To measure C-reactive protein (CRP) and NT-pro b-type natriuretic peptide (NT-proBNP) were measured with venous blood sample according to the Clinical Laboratory protocol from Shaio Clinic Foundation. The results were expressed in mg/l and pgi respectively.

All the samples were taken one week before starting the cardiac rehabilitation program with high intensity interval training (HITT) and a week after completing the 36 sessions.

Cardiac rehabilitation protocol with HIIT was: warm up 10 minutes at 40 to 50% VO2peak, 36 minutes Intervals: Three minutes at 80 to 90% VO2peak, Three minutes at 40 - 50% VO2peak. Cycling down 10 minutes at 30 to 40% VO2peak.

Data were recorded in a matrix of stacked data (Excel spreadsheet). For quantitative variables, the average confidence intervals with a significance level of 95% (p = 0.05) were determined. Qualitative variables were measured with absolute and relative frequency (proportions). The Shapiro-Wilk test after HIIT, was used to analyze mean difference for repeated measures (studies before and after) and in quantitative variables and significance was estimated of the differences observed, by the t Student test for related samples (paired), assuming a significance level of 95%, for a statistical error of 5% of the difference hypothesis. Spearman Rho correlation with VO2peak versus CRP NT-proBNP, LVEF measured after HIIT in order to check whether the increased peak oxygen consumption has a positive or negative relationship on other variables; with a significance level of 95% (p = 0.05). Data were analyzed with the statistical software SPSS version 22.0.

**Results**

The average age of patients was 68 years. 63.3% had ischemic heart failure with LVEF 30.6 ± 6.8. Four patients were in functional class NYHA II and two in NYHA III (Table 1). All patients tolerated and completed the cardiovascular rehabilitation program.

**Conclusions**

HITT is a safe non-drug strategy and could be an adjacent to these patients; improves aerobic capacity, body composition modifications, apparently it could be a non-pharmacology help to improve cardiac remodeling.

**Implications**

These findings may have important benefits when HITT is performed in patients with compensated heart failure; must undergo cardiopulmonary exercise testing integrated for prescribing exercise, proper medical evaluation, exercise sessions should be monitored stopping generate significant benefits in this type of cardiovascular disease. In the future larger studies are needed to confirm these results.