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Effect of HIIT And MIT On TNF-α Levels And Blood Profile For Obesity Therapy

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Abstract

Studi Purpose. Discusses the outcomes of Moderate Intensity Training (MIT) and High Intensity Interval Training (HIIT) on Tumor Necrosis Factor-alpha (TNF-α) and blood profiles to be used as a treatment option for obesity.

Material and Methods. This research is a true experimental laboratory with a post-test-only control group design. Using 39 obese male Wistar rats with the distribution of 13 Wistar HIIT groups, 13 Wistar MIT, and 13 Wistar control. The exercise intervention consists of HIIT intensity (90-100% of baseline ability), MIT intensity (60-80% of baseline ability), and control without training for six weeks. A specialized rat treadmill was used for the exercises. Measuring of TNF-α levels with an enzyme-linked immunosorbent assay (ELISA). Hematology test used to determine levels of eritrosit, leukosit, trombosit. Data analysis used the Anova test.

Result. TNF-α levels in MIT and HIIT were significantly higher than control levels, as indicated by P values of 0.003 (HIIT vs Control) and 0.001 (MIT vs Control). There weren't any big differences. in the blood tests for erythrocytes, leukocytes, and platelets between groups. At body weight, HIIT is lower than the control P=0.000, and MIT is also lower than the control P=0.002.

Conclusion. Exercise with HIIT and MIT for 6 weeks can be used as an alternative to overcome obesity because it can reduce weight obesity, but not accompanied by a decrease in TNF-α and Erythrocytes, Leukocytes, and Platelets.

Keywords

MIT, HIIT, TNF-α, Blood Profile, Obesity

Introduction

Obesity is a critical health issue at this time that must be addressed. Obesity is a serious condition brought on by a buildup of body fat [1]. The expanded overabundance of body weight or heftiness is likewise firmly connected with the event of metabolic disorder. The occurrence of physiological disorders like diabetes mellitus, hypertension, atherosclerosis, dyslipidemia, and hyperglycemia are hallmarks of metabolic syndrome [2,3]. In the meantime, according to the International Diabetes Federation (IDF), metabolic syndrome is the root cause of diabetes mellitus, high blood pressure, and cardiovascular disease [4]. Obesity is a metabolic syndrome that can lead to dangerous diseases such as cancer. According to epidemiological evidence, an increased risk of cancer is linked to being overweight [5]. Metabolic syndrome can lead to dangerous diseases such as coronary heart disease, stroke, cancer, and kidney insufficiency [6]. Obesity or overweight is the most common physiological disorder that contributes greatly to metabolic disease [7]. Obesity-related physiological disorders are also inseparable from the influence of pro-inflammatory cytokines, specifically TNF-α, which can ultimately result in metabolic syndrome. [8].

Adipose tissue in obesity can increase TNF-α levels [9]. In individuals who are overweight or obese, there will be an excess accumulation of triglycerides in fat tissue which can increase in adipose tissue size (hypertrophy) and quantity (hyperplasia) [10]. Obesity causes the inducement and accumulation of macrophages 1 (M1) and T cells which induce an increase in proinflammatory cytokines, namely TNF-α in response to inflammation and metabolic dysfunction [11]. The production of TNF-α can be increased by this type of M1 macrophage [12].

Additionally, Obesity can activate inflammatory pathways through NF-κB [13]. The NF-κB protein is retained in the target cell cytoplasm by inhibitors called κB inhibitors (IκBs) [14]. TNF-α can have a negative effect on physiological conditions like insulin resistance when NF-B target genes are overexpressed [15]. Various types of metabolic syndrome disorders type

2 diabetes, cancer, cardiovascular disease, and metabolic disorders are greatly facilitated by TNF-α. [16,17]. This inflammatory condition is certainly inseparable from changes in the condition of the blood profile, especially those related to white blood cells. White blood cells correlate with TNF-α levels [18].

Metabolic syndrome can be resolved and prevented with exercise. The risk factors for sufferers of metabolic syndrome can be reduced by increasing physical fitness [19]. Exercise can increase antioxidant capacity, regulate fat and glucose metabolism, improve insulin function and improve blood pressure control in obesity [20]. Exercise can suppress TNF-α production [21]. The pro-inflammatory cytokine TNF-α can be reduced through exercise using the HIIT and MIT models [22]. The exercise model with MIT can lower metabolic syndrome risk factors by reducing body fat levels, increasing insulin sensitivity, and reducing TNF-α levels [23,24]. Increased activation of adiponectin and anti-inflammatory cytokines, A lower body fat will prevent damage to fat cells and hypoxia. This will also reduce the activation of the pro-inflammatory cytokine TNF-α [25]. Modeling exercises with HIIT also works to improve insulin sensitivity, increase the induced of anti-inflammatory molecules, and improve lipid profiles [26,27]. Based on these problems, this research was conducted to find out molecular indicators so that they can be used as information and recommendations for rehabilitation therapy to overcome obesity.

Materials and methods

Animal

The study used 39 males Rattus norvegicus, obese lines, aged 2 to 3 months, and weighing more than 160 grams. Wistar is kept in a separate cage with a temperature of 22 degrees Celsius, 50 to 55 percent humidity, and a 12-hour light-dark cycle.

There are three groups of Wistar. Wistar from the control group (n=13) was not exercise any sedentary activities. HIIT (n=13) using High Intensity Interval Training (HIIT) model. MIT

(n = 13) using moderate intensity training. Ethical clearance was obtained from the animal care and use committee of the Brawijaya University in Indonesia approving all research procedures.

Exercise Protocol

The exercise program uses the MIT and HIIT methods. HIIT uses an intensity of 90-100% of the total maximum speed/baseline with 1:1 intervals (2 minutes on : 2 minutes off) for 15 minutes each exercise. MIT uses intensity of 50-60% of the total maximum speed/baseline with a duration of 30 minutes for each exercise. The increase in training load is given by increasing the treadmill speed by 1 m/min in one week. Exercises were carried out four times a week for a total of six weeks of treatment. MIT and HIIT workouts using a treadmill for Wistar

TNF-α & Whole Blood Measurement

TNF-α biomarker was taken from blood serum. Blood sampling was carried out in a manner that met the requirements of the Biosciences Laboratory of the University of Brawijaya. The blood serum will be analyzed with the enzyme-linked immunosorbent assay (ELISA) test to decide TNF-α levels. The levels of platelets, white blood cells, and red blood cells were determined using a complete blood hematology laboratory test.

Statistical Analysis

Preliminary data processing uses descriptive statistics to explain the average results of each variable. The Shapiro Wilks test is used to find the normality of the data and Levene's test is used to determine the homogeneity of the data. Furthermore, to determine differences in levels of TNF-α, Erythrocytes, Leukocytes, and Platelets at MIT and HIIT were tested using ANOVA SPSS 24.

Result

Blood test results revealed that the sedentary group had a lower average TNF-α than the exercise group. There is no significant difference in blood profile indicators

Table 1. Blood test results

**Significantly different; TNF-α control vs HIIT (P= 0.003), control vs MIT (P=0.001) ; Weight HIIT vs Control*

Group	TNF-α (pg/ml)	weight	Eritrosit	Leukosit	Trombosit
Control	116.07±78.6	291±24.8	7.59±0.47	6.16±2.60	857.43±64.21
HIIT	246.43±68.5*	249±23.7*	8.12±0.49	6.98±1.97	824.83±94.02
MIT	258.16±124.0*	258±19.6*	8.03±0.51	5.83±1.45	916.67±142.92

(P= 0.000), MIT vs Control (P=0.002).

According to the test results, the TNF-α levels in HIIT and MIT groups were higher than those the control. There is a significant difference that TNF-α levels in HIIT are higher than the controls(P=0.003). The MIT had a significantly higher level (*P*=0.001), but there is no significant difference in TNF-α levels between MIT and HIIT(*P*=0.945).

Hematology test results showed that HIIT had higher levels of erythrocytes and leukocytes than the MIT and control groups and platelet levels, HIIT was lower than the MIT and Control groups, but this was not significantly different. The test results also showed that MIT platelet levels were the highest compared to HIIT and controls.

Discussion

This study showed that the exercise groups had higher TNF levels than the sedentary group. This study's findings differ from some of the findings of previous studies which stated that TNF-α levels in the HIIT and MIT groups were lower in obesity after routine exercise [28].

The results in this study support previous findings which stated that in the exercise group, there was a higher increase in TNF-α levels than in the control group [30]. The hematology test in this review showed that the erythrocytes in the HIIT and MIT bunches were higher than in the benchmark group, however there was no tremendous distinction. In the three groups, the number of leukocytes did not differ significantly from one another. Meanwhile, there was no significant difference in Platelets either.

The results of these researchers still cannot claim that the higher TNF-α in the HIIT and MIT groups has a harmful effect on the body. In the HIIT and MIT groups, the increase in TNF-α may increase adipocytolysis and produce free fatty acids that muscles use to contract. [31]. In the subcutaneous white adipose tissue (scWAT), it was discovered that increased TNF-α

expression functions as a myokine to increase lipid metabolism. [32]. Through the exercise pathway, elevated levels of TNF-α can induce satellite cell activation, which in turn can increase regeneration and the expression of calcineurin, which in turn causes the formation of new muscle fibers. TNF-α can also increase NF-κB activation which can increase proliferation [33].

The fact that the function of TNF-α depends on the receiving receptor is another issue that needs to be rethought. There are two types of receptors in the cell membrane—TNFR1 and 2, The pro-inflammatory properties that are typically associated with proteins, particularly those found in adipose tissue, are those that bind to TNFR 1 [34]. Additionally, it has been determined at this time that TNF-α can increase lipolysis in adipose tissue [35].

the findings in this study indicate that training with HIIT and MIT can induce weight loss, but not accompanied by low levels of TNF-α. In another mechanism, TNF-α has a role that helps in the performance of metabolism in addition to its role in inflammatory markers.

Conclusion

Practicing with the HIIT and MIT models for a long time with 4x activities seven days can lessen body weight however not joined by a diminishing in TNF-α levels. The MIT and HIIT groups had even higher TNF-α than the control group. In addition, There was not much of a difference in the degrees of erythrocytes, leukocytes, and platelets. From these results, training with MIT and HIIT can at least be used as an alternative therapy for obesity in losing weight and improving health

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