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Research Article

NO SIGNIFICANT RESPONSE OF SERUM TNF-A TO SINGLE BOUT EXERCISE IN ADULT OBESE INDIVIDUALS

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ABSTRACT
Accumulating evidence suggest that obesity is associated with low grade inflammation. TNF-α is an inflammatory cytokine and related with insulin resistance and chronic metabolic diseases. In present study, we aimed to determine acute and recovery response of serum TNF-α to one bout exercise in non-trained adult obese men aged 39.2 (1.60) years and 93 (7.5) kg of body weight. Blood samples were obtained pre and immediately and 60 min and 24 hour after exercise test in fourteen non-trained obese men. Significant difference in serum TNF-α between pre-test and acute or recovery response to exercise test was determined by repeated-measures ANOVA. Data by statistical analysis showed no significant differences in serum TNF-α between pre-test and acute or recovery response to exercise. Based on these data, it is concluded that acute moderate exercise can not affect acute or recovery of serum TNF-α in obese subjects.

Keywords: *Low Grade Inflammation, Exercise, Obesity*

INTRODUCTION
Clinical studies in adults showed that chronic inflammation is effective in pathogenesis of such diseases as atherosclerosis, diabetes, cancer, several neurological diseases, cardiovascular diseases and immune system disorders (Julia *et al.*, 2010). Nowadays, obesity as one of the most significant non-communicable metabolic disorder is significantly considered by health science researchers. Obesity increases inflammatory cytokine secreted from adipose tissue and other tissues such as C-reactive protein (CRP), Interleukin 6 (IL-6), alpha Tumor necrosis factor alpha (TNF-α), resistin and interleukin 1 beta (IL-1b). Obesity collectively increases incidence and severity of these diseases (Arnson *et al.*, 2010; Dilyara *et al.*, 2007; Feskens *et al.*, 1989).

TNF-α is an inflammatory cytokine secreted from several preinflammatory cells such as macrophages and mast cells. It is known that this factor causes inflammatory responses and regulates the immune system. Levels of this factor in obese individuals are higher than normal-weight individuals. This cytokine is known as a regulator of inflammatory response in human body, which plays an important role in the association between obesity and inflammatory diseases such as diabetes, metabolic syndrome, atherosclerosis and chronic heart failure (Aggarwal, 2003; Maedler *et al.*, 2009). Nowadays, creating appropriate strategies for maintaining normal levels of inflammatory cytokines in susceptible individuals or patients is significantly considered by health researchers. Several studies showed that the balance between cytokines and inflammatory factors through exercise and diet in obese or overweight individuals improves metabolic risk factors (Takizawa, 1998).

The role of exercise in reducing systemic levels of inflammatory cytokines was studied frequently. Training programs have differently affected levels of these inflammatory or anti-inflammatory markers as well as other cardiovascular risk factors (de Salles *et al.*, 2010; Marcell *et al.*, 2005). Several other studies also showed changes in response of these variables to training programs (Dekker *et al.*, 2007; Hersoug *et al.*, 2007). Although numerous studies defined the effects of short-or long-term training programs on cytokine levels in healthy or patients, athletic and non-athletic populations, the immediate and delayed response of TNF-α as an inflammatory cytokine to an exercise session was not determined yet, even in

obese patients. Hence, the present study aimed to determine the immediate and delayed response of TNF-α to a moderate-intensity exercise session in obese men.

MATERIALS AND METHODS

Human Subjects

Participants included thirteen non-trained adult obese men aged 39.2 (1.60) years and 93 (7.5) kg of body weight that participated in this study by accessible samples. All participants gave written informed consent prior to enrolment in the study.

Inclusion Criteria and Anthropometry

Subjects were chosen that were not currently taking, and had not previously taken, anabolic steroids, growth hormone, or related performance enhancing drugs of any kind. A medical history to retrieve information about health status, current medications, alcohol consumption was performed. Participants were non-athletes and non-alcoholics. Participants had no evidence of coronary artery disease; participation in exercise/diet programs and diabetes treatments.

The measurements for weight, height, waist circumference were first performed. Height of the barefoot subjects was measured to the nearest 0.1 cm. Weight was measured by an electronic balance. Body mass index (BMI) was calculated as weight (kg) divided by squared height (m). Abdominal-to-hip ratio was calculated as abdominal circumference divided by hip circumference as measured to the nearest 0.5 cm with a standard measuring tape.

Blood Sampling and Exercise Test

All participants refrained from any severe physical activity 48 h before measurements. Blood samples were collected prior to exercise, at the end of exercise, and at 1 and 24 hours following exercise. Exercise test was performed at 70 (%) of HRmax included 40 min running with no slope. Target heart rate was monitored by polar. Conditions were the same fo all participants. Blood samples were analyzed for serum TNF-α. Blood samples were dispensed into EDTA-coated tubes and centrifuged for 10 minutes in order to separate serum. Serum TNF-α (Austria) was quantified using commercially available enzyme-linked immunosorbent assay kits. The inter- and intra-assay coefficients of variance were 6.0 and 6 % for resistin, 7.4 and 3.4% for TNF-α.

Data Analysis

Data were analyzed by computer using SPSS software version 15.0. Kolmogorov-Smirnov test was used to determine of normal status of the data. Comparisons of exercise data between pre-test and acute or recovery response were analysed by the repeated measures ANOVA model. A p-value < 0.05 was considered to be statistically significant.

RESULTS

As above mentioned, this study aimed to determine of acute and recovery response of serum TNF-α to one bout moderate running test in obese male subjects. Anthropometric characteristics of the study participants are described in Table 1. All values are represented as mean ± SD. Data by statistical analysis by repeated measure showed that exercise test was not associated with acute and recovery response in serum TNF-α to in studied obese subjects. On the other hand, one bout exercise test involved 40 min moderate running on a surface without slope can not affect serum TNF-α to at immediate after exercise or during 24 recovery after test in adult obese men (see table 3). Mean and standard deviation of serum TNF-α to at pre, acute and recovery response to exercise test are shown in table 2.

Table 1: Mean and standard deviation of anthropometric characteristics of the study participants

Age (years)	**Weight** (kg)	**Height** (cm)	**Abdominal** (cm)	**Hip** (cm)	**AHO**	**BMI** (kg/m^2)	**Body fat** (%)
39.2 (1.60)	93 (7.5)	172 (5)	104 (4.8)	105 (4.9)	0.98 (0.02)	31.6 (1.24)	32.3 (1.65)

Table 2: Acute and recovery response of TNF-α to exercise test in studied obese subjects (M ± SE)

Serum TNF-α	Mean	Standard deviation
Pre-exercise	40.62	3.22
Acute response	39.47	2.51
Recovery (1 hour)	40.58	5.46
Recovery (24 hours)	41.69	7.16

Table 3: Acute and recovery response of serum TNF-α to exercise test in studied subjects (1: pre test, 2: acute response, 3: one hour recovery, 4: 24 hour recovery)

TNF		Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	1.146	1.381	.423	-1.863	4.155
	3	.038	3.923	.992	-8.509	8.586
	4	-1.069	6.401	.870	-15.016	12.877
2	1	-1.146	1.381	.423	-4.155	1.863
	3	-1.108	3.595	.763	-8.940	6.725
	4	-2.215	5.699	.704	-14.633	10.202
3	1	-.038	3.923	.992	-8.586	8.509
	2	1.108	3.595	.763	-6.725	8.940
	4	-1.108	3.428	.752	-8.577	6.362
4	1	1.069	6.401	.870	-12.877	15.016
	2	2.215	5.699	.704	-10.202	14.633
	3	1.108	3.428	.752	-6.362	8.577

Discussion

Several previous studies addressed improvement in inflammatory profile in response to an exercise session (Bouassida *et al.*, 2010; Yang *et al.*, 2001; Zwetsloot *et al.*, 2014). However, other studies reported no changes in cytokine levels in response to an exercise session (Hosseini *et al.*, 2011; Abedi *et al.*, 2011; Hosseini-Kakhk *et al.*, 2012). Several other studies addressed the inflammatory effects of exercise on cytokine levels. In other words, these studies showed that an exercise session leads to a significant increase in inflammatory cytokine (Ostrowski *et al.*, 1999; Pedersen *et al.*, 2000).

In the present study, serum TNF-α level did not change significantly in men after 40 minutes relatively moderate-intensity running exercise compared to men with no exercise. In line with findings of the present study, several previous studies reported that there are no significant changes in other inflammatory cytokine in immediate circumstances after exercise test in healthy populations or patients. For example, a circular strength training session led to no significant changes in plasma levels of leptin in overweight girls (Hosseini-Kakhk *et al.*, 2012). In another study, an exhaustive incremental exercise led to no changes in serum leptin levels in young trained men (Hosseini *et al.*, 2011). In addition, a strength training session led to no significant changes in serum adiponectin levels as an anti-inflammatory cytokine in healthy non-athletic men (Ostrowski *et al.*, 1999).

However, several other studies reported significant improvement of the inflammatory profile in response to a one-exercise session in different populations. For example, an intense interval training session led to

a significant increase in IL-10 in active men (Zwetsloot *et al.,* 2014). Based on this evidence, several researchers noted decreased or enhanced leptin levels after an exercise session, which lasts for more than 60 minutes. More than 60 minutes exercise stimulates the release of free fatty acids or lead to a higher than 800 kcal energy expenditure (Højbjerre *et al.,* 2007; Kraemer *et al.,* 2000). It should be noted that the amount of required energy was far less than the 800 kcal in an exercise session, which lasts for 40 minutes in the present study. On the other hand, several researchers addressed that changes in cytokine in response to an exercise session is quite delayed. In this context, findings of several studies showed that adiponectin levels significantly increased 30 minutes after a training session with intensity above the anaerobic threshold (Bouassida *et al.,* 2010; Yang *et al.,* 2001).

Despite these observations, TNF-α serum levels did not change significantly even after one-hour recovery time after the exercise in the present study. However, TNF-α level did not change even 24 hours after the exercise test in the present study. No change in TNF-α in response to exercise may be attributed to changes in the levels of other cytokines. In this context, the literature has revealed that IL-6 has an inhibitory effect on secretion of TNF-α (Schindler *et al.,* 1990; Matthys *et al.,* 1995; Mizuhara *et al.,* 1994). It is known that exercise is associated with increased IL-6 levels (18, 19). In this regard, IL-6 secretion was significantly increased even in response to moderate intensity exercise, particularly in the active muscles (Fischer *et al.,* 2004; Pedersen *et al.,* 2004). Based on this evidence, it can be concluded that increased IL-6 in response to exercise is associated with inhibition of increased secretion of TNF-α from adipose tissue and other tissues. In addition, the inhibitory effect of IL-6 on secretion of TNF-α and IL-1ß was reported previously in several studies (Schindler *et al.,* 1990; Matthys *et al.,* 1995; Burns *et al.,* 2007).

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