



Serum TNF- α response to an acute bout of exercise in middle-aged men with chronic asthma

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Abstract

In order to investigate whether short term exercise test can lead to improve inflammatory state, fifteen middle-aged men with mild to moderate asthma with mean age 39.6 ± 7.9 years (mean \pm -s.e.m.) were enrolled to participate in this study by accessible sampling. For this purpose, blood samples were collected before and immediately after a cycling exercise test in order to determine serum TNF- α response to exercise test in studied subjects. Student's t-tests for paired samples were performed to determine whether there is a significant change in the outcomes. The data showed a significant decrease in serum TNF- α by exercise test when compared to pre-test. Based on this data, we conclude that moderate exercise even one session cycling for short-time can be improved systemic inflammation in asthma patients.

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Introduction

Recently, it has been found that the release of certain mediators from mast cells in the smooth muscles of the respiratory passages play an important role in the pathogenesis of the over response of respiratory pathways or narrowing of the bronchus in asthmatic patients (Brightling *et al.*, 2002). Mast cells mediators have been identified to be correlated with bronchospasm and TNF- α as a cytokine or mast cell mediator has a potential role in the respiratory pathways over response (Kips *et al.*, 1992; Thomas *et al.*, 1995). Moreover, disruption in TNF- α levels or failure to respond regularly by TNF- α has been reported in some inflammatory diseases (Eizadi *et al.*, 2011) It is also possible that TNF- α play a role in the correlation between mast cells and smooth muscles and this feature is particularly important in the prevalence of overresponse in respiratory pathways. It is possible that TNF- α may be involved in the lack of systematic inflammatory response in the respiratory pathways of asthmatic patients, because increased levels of this inflammatory protein or increased expression of it in has been reported in the respiratory pathways of asthmatic patients (Ying *et al.*, 1991; Bradding *et al.*, 1994). The use of inhaled TNF- α by normal individuals has been identified to increase over response of respiratory pathways and to lead to increase of respiratory pathways neutrophils (Coward *et al.*, 2002). In asthmatic patients too taking TNF- α leads to increased over response of respiratory pathways (Thomas *et al.*, 2002), the major mechanisms responsible for these responses, however, are not yet fully known. These findings support the direct impact of TNF- α on the smooth muscles of the respiratory pathways (Adner *et al.*, 2002). Hence, several studies have been conducted on the effects of pharmacological or environmental interventions in order to balance the levels of inflammatory cytokines in asthma patients. Meanwhile, although the short-or long-term effects of exercise on inflammatory or anti-inflammatory cytokine levels have been studied in other healthy or non-healthy populations and the findings are often contradictory and ill-aligned (Huang *et al.*, 2007;

Sheu *et al.*, 2008), few studies have aimed at the response of TNF- α to a variety of sports activities, especially a single exercise session in patients with asthma. Hence, the present study aims to determine the effect of a single biking session on the serum levels of this variable in asthmatic patients.

Material and methods

Subjects

Fifteen non-trained middle-aged men with mild to moderate asthma were included in this study by accessible sampling. This study aimed to investigate the effect of a moderate cycling test on serum TNF- α in mentioned subjects. Asthma diagnosis and its severity were determined by FEV₁/FVC. All participants gave their informed written consent before participation in accordance with the ethical guidelines set by Islamic Azad University.

Inclusion and exclusion criteria

None of the patients had participated in regular exercise for the preceding 6 months, nor did all subjects have stable body weight. Inclusion criteria to study for asthma group were as existing moderate asthma for at least 3 years. The exclusion criteria were infections, renal diseases, hepatic disorders, use of alcohol and History of diabetes and other cardiovascular diseases.

Anthropometric/biochemical measurements

The age and birth date of subjects were recorded. All anthropometric measurements were made by the same trained general physician and under the supervision of the same pediatrician following standard protocols. Height (Ht) and weight (Wt) were measured twice to ± 0.2 cm and to ± 0.2 kg, respectively, with subjects being barefoot and lightly dressed; the averages of these measurements were recorded. Waist circumference (WC) was measured with a non-elastic tape at a point midway between the lower border of the rib cage and the iliac crest at the end of normal expiration. Body mass index (BMI) was calculated as weight (kg)/ [height (m)]². In order to evaluate serum TNF- α response to exercise test, blood

samples were collected, via the cannulated antecubital vein before and immediately after a cycling exercise test (Mullis *et al.*, 1999) in all subjects. Serums were immediately separated and stored at -80° until the assays were performed. The subjects were advised to avoid any physical activity or exercise 48 hours before the blood sampling. Serum TNF- α was determined by ELISA method (Enzyme-linked Immunosorbent Assay for quantitative detection of human TNF- α total). The Intra- assay coefficient of variation and sensitivity of the method were 7.7% and 5.0 pg/mL, respectively.

Statistical analysis

The data were reported as mean and standard deviation, and analyzed using the SPSSW statistical package, version 16.0 (SPSS Inc., Chicago, IL, USA) for Windows W. Normal distribution of variables performed with a Kolmogorov–Smirnov test, and the parametric variables with skewed distribution were expressed as mean \pm SD. Student’s t-tests for paired samples were performed to determine significance of changes in variables by exercise test in asthma subjects. A P-value of < 0.05 was considered to be statistically significant.

Results

As mentioned in previous section, main objective of present study was to evaluate the effect of an acute bout of exercise on serum TNF- α in males with mild to moderate asthma. According to descriptive statistics, the data showed that the studied patients have age 39.6 ± 7.9 years; height 173.1 ± 2.2 ; body weight 91.8 ± 8.8 kg; body mass index 30.67 ± 5.21 kg/m²; abdominal circumference 104 ± 10 cm; hip circumference 105 ± 6 ; body fat percentage 29.2 ± 3.4 %. These patients have also FEV₁/FVC 68 ± 2.8 . The data of Student’s t-tests for paired samples showed a significant increase in serum TNF- α after exercise test when compared to pre test in studied subjects (Fig 1).

Discussion and conclusion

In addition to inflammation of the respiratory pathways, some of the main limitations of asthmatic

patients are the lack of ventilatory reserve and muscular inactivity. The severity of airways obstruction is a substantial degradation factor in the physical fitness of the patients. Scientific evidence shows that the implementation of rehabilitation activities leads to beneficial changes in healthy individuals or patient populations. Meanwhile, physical activity is identified as a perfect method in rehabilitation of respiratory patients in particular those with asthma; as the beneficial effects of periods of 2 to 12 weeks of intense exercise on asthmatic patients has been demonstrated repeatedly (Meyer *et al.*, 1997).

As mentioned in the methodology section, this study aimed to investigate serum TNF- α response to a short-time moderate cycling test in middle-aged asthma patients. Based on this aim, the finding of study showed a significantly decrease in serum TNF- α immediately after exercise test when compared to pretest values.

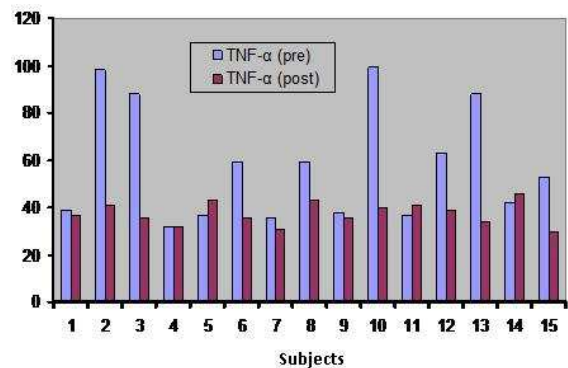


Fig. 1. This fig illustrate pre and post exercise of serum TNF-a in each subjects. Each pair of vertical columns represents one subject. This Fig shows that Except for a few subject, serum TNF α in the other subjects decreased significantly by exercise test.

Researchers have emphasized that long-term exercise programs for even an hour a week by adult patients would be quite effective in reducing asthmatic patients referring to the hospital and in increasing their cardio-respiratory fitness. Apart from this, regular exercise along with pharmaceutical treatment leads to beneficial effects on physiological parameters of asthmatic patients (Ramazanoglu *et al.*, 1985).

In this regard, longitudinal studies have shown that regular exercise has anti-inflammatory effects and leads to decreased levels of inflammatory cytokines (Hammett *et al.*, 2006). Reduced adipose tissue mass in other obesity-related illnesses such as diabetes through exercise led to reduced TNF- α , IL-6 and to increased adiponectin and insulin sensitivity (Aldhahi *et al.*, 2003). Also the findings of Jang *et al.* study showed that weight loss through exercise and diet would improve metabolic risk factors in obese people by changing certain cytokines and inflammatory factors in these patients (Jung *et al.*, 2008).

However, the effect of short-term training or a single exercise session on inflammatory mediators in these patients has not yet been reported. While some previous studies accentuate the stressing and inflammatory characteristics of a single session of exercise on cytokines in other healthy or ill individuals this study seems support for the first time the anti-inflammatory feature of a short single exercise session with relatively modest intensity on the serum levels of TNF- α in patients with asthma.

According to the findings, it appears that exercise, even for a short-time single session, but with moderate intensity would reduce secretion of TNF- α by adipose tissue and other secreting tissues and refers to the anti-inflammatory property of such activities in asthmatic patients. It is also likely that the said exercise not directly but indirectly by an impact on other inflammatory or anti-inflammatory mediators influences the serum levels of TNF- α . Of course it must be mentioned that only by measuring TNF- α as one of the several inflammatory cytokines, the anti-inflammatory property of this type of exercise cannot be supported, because there are also several other inflammatory cytokines, including CRP, IL-6, IL-1B the response of which to this type of exercise has not been studied in patients with asthma.

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