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Research Article

AEROBIC TRAINING PROGRAM FOR LONG TERM DOES NOT ANTI-ALLERGIC PROPERTY IN OBESE SUBJECTS

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ABSTRACT
Data from a recent observational study indicate that obesity is regarded as a potential risk factor for allergic diseases and asthma. This study aimed to investigate the effect of aerobic training for long time on immunoglobulin E (IgE) in obese males. For this purpose, twenty four untrained middle-aged obese males (age 34 ± 4 year, Height 177 ± 4.8 cm) divided into exercise (n-12) or control (n=12) groups by randomly. Exercise group underwent an aerobic training program at 60-80(%) of maximal heart rate and control subjects did not participate in any exercise program in this period. Pre and post training of anthropometrical markers and serum IgE were measured after overnight fast. Student's paired 't' test was applied to compare the pre and post training values. A p-value less than 0.05 were considered statistically significant. Significant differences were not found in body weight, other anthropometrical markers and serum IgE between two groups at baseline. Compared to pre-training, all anthropometrical markers decreased significantly ($P<0.05$) after exercise program in the exercise but not in the control groups when compared with pre-training values. Exercise training resulted in significant increase in serum IgE in the exercise but not in the control groups ($p = 0.009$). In conclusion, despite the reduction in body weight and other anthropometric markers, aerobic exercise training for long term does not anti-allergic property in obese subjects.

Keywords: *Obesity, IgE, Aerobic Training*

INTRODUCTION
Although cardiovascular diseases are important outcomes of obesity prevalence in developed and developing countries (Garrow, 1999), scientific resources have somehow supported the relationship between obesity and respiratory or allergic diseases (Schachter *et al.,* 2003; Xu *et al.,* 2000). Multiple previous studies have reported that in addition to its importance as the body's fat storage in the form of triglycerides, adipose tissue affects the function of other tissues of the body such as pancreas through secretion of various peptide intermediates including leptin, adiponectin, ghrelin, resistin, and interleukins (McMurray *et al.,* 2005).

However, the role of obesity in increasing allergic symptoms has been also frequently proposed, so that scientific resources have supported increased levels of markers of allergic or respiratory diseases such as immunoglobulin E (IgE) in the presence of obesity (Huang *et al.,* 1999). IgE and mast cells play an important role in allergic inflammation. Scientific findings suggest that IgE is a key factor contributing to inflammatory reactions and point out its important role in the pathogenesis of allergic diseases such as asthma (Nowak, 2006); although the major mechanisms by which IgE affect the severity of asthma are not yet fully understood (Mayr *et al.,* 2003).

Similar to other immunoglobulins, IgE is produced by B cells and plasma cells. The levels of circulating IgE are far lower than other immunoglobulins due to high mast cells absorbency of IgE. In addition, the rate of its synthesis by producing cells is very low. It was shown that IgE levels increase frequently in allergic conditions which subsequently increase the severity of allergic, inflammatory, and infectious diseases. On the other hand, researchers have noted that obesity is associated with allergic symptoms or elevated IgE levels (Huang *et al.,* 1999; Schachter *et al.,* 2003; Xu *et al.,* 2000). The role of exercise and physical activity in improving inflammatory or anti-inflammatory cytokine levels in obese people or related diseases have repeatedly been reported (Balducci *et al.,* 2009; Lira *et al.,* 2009); although some

studies have pointed the ineffectiveness of short- or long-term exercise programs on inflammatory profiles (Visetnoi *et al.*, 2009). However, the response of IgE to short- or long-term exercise programs, especially in obese people is less studied. Hence, the present study aimed to investigate the effect of three months aerobic exercise on serum IgE levels in obese non-athletic men.

MATERIALS AND METHODS

Subjects

Twenty four healthy non-trained middle-aged obese men (34 ± 4 years, 177 ± 4.8 cm, mean ± standard deviation) participated in the study by accessible sampling. Subjects, then, divided into exercise (3 months, 3 times/weekly, n=12) or control (n=12) groups by randomly. After the nature of the study was explained in detail, informed consent was obtained from all participants.

Inclusion and Exclusion Criteria

Inclusion criteria for the test group were: healthy, middle age, obesity (BMI ≥ 30). Participants were non-athletes, non-smokers and non-alcoholics. Participants were included if they had not been involved in regular physical activity/diet in the previous 6 months. The exclusion criteria were as follows: Patients with known history of acute or chronic respiratory infections, neuromuscular disease, and cardiopulmonary disease. Furthermore patients with overt diabetic were also excluded from the study.

Anthropometry

All anthropometrical markers were measured before and after exercise program. Obesity was measured by body mass index (BMI). Body weight, height, waist circumference and % body fat measurements were obtained by standard methods. Anthropometric measurements were performed in all study participants before breakfast, with the subject wearing light clothing without shoes. All anthropometric measurements were made by the same trained general physician. Waist circumference and hip circumference were measured in the most condensed part using a non-elastic cloth meter. Waist-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. For all subjects, weight and height were measured to the nearest 0.5 kg and 0.5 cm, respectively, and BMI was measured for each individual by division of body weight (kg) by height (m2).

Biochemical Analysis and Exercise Program

Venous blood samples were obtained at rest between 8:00 and 9:00 am from the antecubital vein. Blood was drawn after 12 h of fasting and 2 day of minimal physical activity. All blood samples were collected before and 48 after lasted session of exercise program. Subjects were asked to avoid doing any heavy physical activity for 48 hours before blood sampling. Blood samples used to measure serum IgE in all subjects. The Intra- assay, inter-assay coefficient of variation and sensitivity of the method were 1.95% , 3.52% and 1.0 IU/mL respectively for IgE (Monobind Inc, CA 92630, USA).

Exercise program was three-month aerobic exercise program, three times per week with exercise intensity from 60 to 80 of maximal heart rate for each subjects, so that exercise intensity was the lowest in the first sessions and gradually duration and exercise intensity were increased in coming sessions. Each session was started with warm-up phase, then aerobic activities in the form of running on a treadmill and then ended by cool up. Target heart rate and exercise intensity were monitored by polar telemetry.

Data Analysis

Data were analyzed by computer using the Statistical Package for Social Sciences (SPSS) for Windows, version 15.0. All data were tested for normal distribution by the Kolmogorov-Smirnov test. At baseline, comparisons of parameters between the two groups were made by unpaired Student t test. Student's t-tests for paired samples were performed to determine whether there were significant within-group changes in the outcomes. A p value less than 0.05 was considered statistically signigcant.

RESULTS

Baseline and post training IgE levels and anthropometrical characteristics of groups are shown in Table 2. Data were expressed as individual values or the mean ± SD for groups.

Based on independent analysis, significant differences were not found in body weight, other anthropometrical markers and serum IgE between two groups at baseline. As mentioned, one of the aims

of present study was to determine the effect of exercise program on obesity indicators such as body weight, BMI or body fat (%). Data of paired T test showed that exercise program was associated with significant improve in all anthropometrical subjects such as body fat percentage (p = 0.005, Figure 1). Main objective of present study was serum IgE response to exercise program in obese subjects. Aerobic exercise program resulted in significant increased in this allergic predictor when compared with pre-test of exercise (p = 0.029, Figure 2) but not in control group.

Table 1: Mean and standard deviation of anthropometric and IgE before and after exercise training of studied subjects

Variables	Exercise group		Control group	
	Before	After	Before	After
Weight (kg)	101 *(14)*	96 *(15)*	102 *(11)*	101 *(13)*
Abdominal circumference (cm)	108 *(10)*	103 *(9)*	107 *(11)*	108 *(9)*
Hip (cm)	108 *(9)*	104 *(9)*	109 *(11)*	108 *(7)*
AHO (Ratio)	1.00 *(0.03)*	0.99 *(0.3)*	0.98 *(0.3)*	1.00 *(0.02)*
BMI (kg/m2)	32.17 *(3.41)*	30.58 *(3.53)*	32.92 *(3.51)*	32.61 *(2.63)*
Body fat (%)	31.9 *(4.08)*	28.1 *(2.62)*	31.7 *(3.35)*	31.6 *(3.41)*
Visceral Fat	14.1 *(2.50)*	12.3 *(2.46)*	14.3 *(2.14)*	14.5 *(3.11)*
IgE (IU/ml)	90 *(82)*	172 *(173)*	93 *(68)*	95 *(63)*

Figure 1: Serum IgE, before and after exercise program, Aerobic exercise program resulted in significant increased in this allergic predictor when compared with pre-test of exercise in exercise group

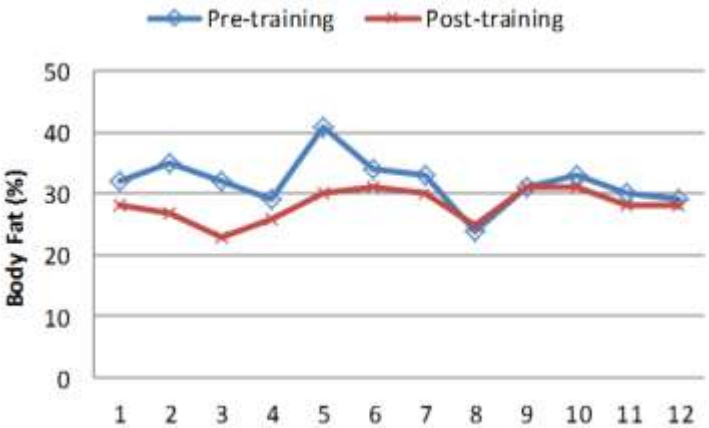

Figure 2: Body fat percentage, before and after exercise program. Aerobic exercise program resulted in significant decreased in body fat percentage when compared with pre-test of exercise

DISCUSSION

In the present study, a three-month aerobic exercise led to a significant decrease in anthropometric indicators and body fat percent in obese adult men. A significant increase in serum IgE was also observed in response to three-month exercise. These findings were not seen in the control group. Significant increase in IgE as an allergic marker in obese men studied is somewhat controversial.

Some previous studies have been noted the role of obesity in increased prevalence of allergic diseases (Luo *et al.,* 2013). A study on Chinese population showed also a significant positive association between obesity and atopic diseases (Visness *et al.,* 2009). These findings support the potential impact of obesity on allergic diseases and their exacerbation and since IgE level is a predictor and an indicator of allergic diseases, it is expected that weight loss is associated with reduced IgE levels in obese individuals; because previous studies have somehow supported higher levels of IgE in obese individuals compared to normal weight people (Winter *et al.,* 2000; Xu *et al.,* 2000). Furthermore, although studies about the response of IgE to long-term exercise programs or exercise tests in obese people are low, the findings of a recent study showed that a single session of short-term cycling led to a significant reduction of serum IgE in obese patients with asthma (Eizadi[a] *et al.,* 2011).

Since most previous studies have pointed out an improvement in the profile of inflammatory mediators in response to a variety of long-term exercises (Tang *et al.,* 2005; Fatouros *et al.,* 2005; Polak *et al.,* 2006), significant increase in IgE following this program which was also associated with a significant reduction in weight is somewhat controversial; because some previous studies have consistently emphasized that only those long-term exercises can lead to improved inflammatory cytokine which are associated with a significant reduction in body weight (Ando *et al.,* 2009; Fleisch, 2007; Kraemer *et al.,* 2002). Although a general consensus is not still seen on the minimum weight loss required for improvement of the mentioned biochemical markers; so that some studies have identified a weight loss of at least 5% and some others a weight loss of at least 10% for improvement of the inflammatory profile in obese patients (Ando *et al.,* 2009; Fleisch *et al.,* 2007; Kraemer *et al.,* 2000).

Hence, it was expected that despite a significant reduction in body weight in obese men studied, the exercise program would led to an improvement or a significant reduction in IgE levels. But the exercise was not associated with IgE improvement; rather it led to an increase in IgE in the studied subjects, unlike expectation. Hence, it seems that this unexpected finding is rooted in the type or intensity of exercise. Furthermore, findings of a recent study showed that three months of aerobic exercise did not lead to a change in IgE serum levels in asthmatic patients (Eizadi[b] *et al.,* 2011). It is possible that the exercise program was not suitable for improvement of this allergy predictor; if so, adjustment requires longer exercise periods. There is also the possibility that the intensity, volume, and duration of exercise during the sessions were higher than the subjects' tolerance, in particular in the final sessions.

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