

Impact of Mild Versus Moderate Intensity Aerobic Exercise Training on Leptin and Selected Innate Immune System Response in Obese Asthmatic Patients

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Abstract: Asthma is a significant global problem, estimated to affect over 300 million people worldwide. Obesity has adverse consequences on immune system, causing immunosuppression and thus, obese individuals have higher incidence of infections and certain types of cancer. The aim of this study was to compare changes in leptin and selected innate immune system response after mild and moderate intensity aerobic exercise training in obese asthmatic patients. Forty obese asthmatic male subjects, their age ranged between 25 to 43 years old. The subjects were included into 2 equal groups; group received moderate intensity aerobic exercise training. The second group (B) received mild intensity aerobic exercise training for 3 months. Plasma leptin level and the level of serum protein of the complement system were measured. The mean values of C3, C4, BMI and Leptin were significantly decreased in group (A) and group (B). Also; there was a significant difference between both groups after treatment. The results indicated that moderate intensity aerobic exercise training on treadmill is appropriate to improve innate immune system response asthmatic obese male patients.

Key words: Aerobic exercise % Innate immune system % Leptin % Asthma and obesity

INTRODUCTION

Asthma is a complex disorder and evidence now suggests that it is not solely attributable either to allergy or eosinophilia. The innate immune system responds to a variety of triggers, including viral and bacterial components which are known non-allergic triggers of asthma. The innate immune response may be involved in both the development of and protection against asthma. There is substantial evidence that innate immune responses may play a key role in asthma pathogenesis [1].

The nature of the association between obesity and asthma is unclear. Several mechanisms have been proposed, suggesting that obesity is linked to asthma via mechanical and anatomical or inflammatory causes [2]. Adipokines are likely to be important in the development and progression of asthma in obese individuals, due their effects on immunity. Leptin levels are increased in

subjects with asthma with this effect being independent of obesity. Leptin levels are also increased in subjects with impaired lung function [3].

The immune system protects the host from the entry of infectious organisms and in case there is access, restrains the invasion eradicating the invading microorganisms to prevent clinical infections. There are two main host defense mechanisms: innate and adaptive. The innate or antigen-nonspecific immunity consists of physical barriers, the complement system, phagocytes, interferon and other humoral factors. The complement system is an important mediator of inflammation. It consists of a group of about 20 distinct plasma proteins that react with one another to make non-specific immune mechanisms serve as first defense line against many microorganisms and retard the establishment of overt infection [4].

There is a strong link between obesity and innate immunity. Obesity related adaptive immune function is

mediated though adiponectin is the inhibition of B cell lymphopoiesis. Also, a positive correlation was seen between body mass index (BMI) and total WBC, neutrophils and lymphocytes [5,6].

Leptin, the protein product of the obese gene, is strongly involved in the relationships between adipose tissues and immune system. The relationship between adipose tissue and immune system is believed to be related to the secretion of numerous adipokines among them leptin of which the amount is correlated to fat mass [7,8].

Regular exercise increases resistance to infections such as common cold. The positive effect of exercise on other diseases has been proved and there is increasing evidence that physical activity, as a lifestyle, offers protection against malignancy [9,10].

The aim of this study was to compare changes in leptin and selected innate immune system response after mild and moderate intensity aerobic exercise training in obese asthmatic subjects.

MATERIALS AND METHODS

Subjects: Forty obese asthmatic males with total body obesity (body mass index (BMI) 30- 35 Kg/m², free from respiratory, kidney, liver, metabolic and neurological disorders. Subjects were not smokers and not receiving drugs. Their age ranged from 25 to 43 years. The subjects were included into 2 equal groups; group received moderate intensity aerobic exercise training. The second group (B) received moderate intensity aerobic exercise training. Informed consent was obtained from all participants. All participants were free to withdraw from the study at any time. If any adverse effects had occurred, the experiment would have been stopped, with this being announced to the Human Subjects Review Board. However, no adverse effects occurred and so the data of all the participants were available for analysis.

Methods

Evaluated Parameters

Chemical Analysis: Blood sample after fasting for 12 hours was taken from each women in clean tubes containing few mg of K₂EDTA, centrifuged and plasma was separated and stored frozen at -20° used for estimation of plasma leptin level by immunoradimetric assay (IRMA), Commercial Kites to measure the level of serum protein of the complement system (includes C3 and C4 serum protein).

Evaluation of Anthropometric Parameters: All measurements were performed at pretreatment and after two months at the end of the study. The participants were measured whilst wearing their undergarments and hospital gowns. Height was measured with a digital stadiometer to the nearest 0.1 cm (JENIX DS 102, Dongsang, South Korea). Body weight was measured on a calibrated balance scale to the nearest 0.1 kg (HC4211, Cas Korea, South Korea) and BMI was calculated as Body weight/Height².

The Aerobic Exercise Training Program: The aerobic treadmill-based training program (Track master 400E, gas fitness system, England) was at 60% to 75% of the maximum heart rate (HRmax) achieved in a reference ST performed according to a modified Bruce protocol for group (A) who received moderate intensity aerobic exercise training, where group (B) received mild intensity aerobic exercise training at 50 % to 60% of the maximum heart rate (HRmax). This rate was defined as the training heart rate (THR). After an initial, 5-minute warm-up phase performed on the treadmill at a low load, each endurance training session lasted 30 minutes and ended with 5-minute recovery and relaxation phase. All patients performed three sessions / week (i.e. a total of 36 sessions per patient over a 3-month period).

Statistical Analysis: The mean values of C3, C4, BMI and Leptin obtained before and after three months in both groups were compared using paired "t" test. Independent "t" test was used for the comparison between the two groups (P<0.05).

RESULTS

The mean values of C3, C4, BMI and Leptin were significantly decreased in group (A) received moderate intensity aerobic exercise training and group (B) received mild intensity aerobic exercise training (Table 1 & 2 and figure 1&2). Also, there were significant differences between mean levels of the investigated parameters in group (A) and group (B) after treatment (Table 3 and Figure 3). These results mean that moderate intensity aerobic exercise intensity is appropriate to improve innate immune system response in asthmatic obese patients.

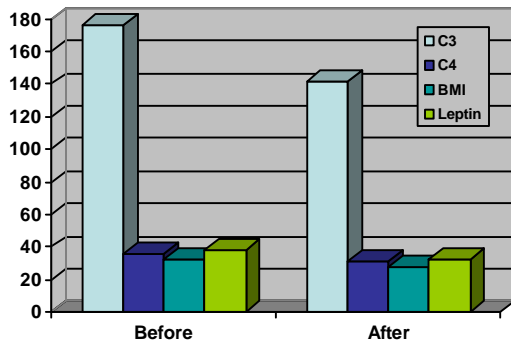


Fig. 1: Mean value and significance of C3, C4, BMI and Leptin in group (A) before and after treatment

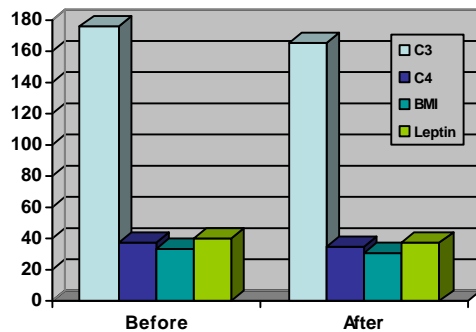


Fig. 2: Mean value and significance of C3, C4, BMI and Leptin in group (B) before and after treatment.

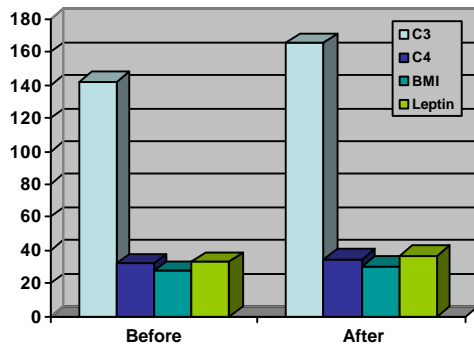


Fig. 3: Mean value and significance of C3, C4, BMI and Leptin in group (A) and (B) after treatment.

DISCUSSION

The aim of this study was to detect changes in leptin and selected innate immune system response after mild and moderate intensity aerobic exercise training in obese asthmatic subjects. The mean values of C3, C4, BMI and Leptin were significantly decreased in group (A) and group (B). Also; there was a significant difference between both groups after treatment. Results of this study confirmed and agreed with many previous studies.

Table 1: Mean value and significance of C3, C4 , BMI and Leptin in group (A) before and after treatment

	Mean \pm SD		T-value	Significance
	Before	After		
C3(mg/dl)	176.24 \pm 9.11	141.98 \pm 8.62	- 8.33	P <0.05
C4(mg/dl)	35.76 \pm 5.62	31.76 \pm 6.18	-6.14	P <0.05
BMI (kg /m ²)	32.28 \pm 3.12	27.41 \pm 2.73	- 9.28	P <0.05
Leptin Ng/ml	38.25 \pm 6.65	32.71 \pm 5.42	8.432	P <0.05

BMI= Body Mass index

Table 2: Mean value and significance of C3, C4, BMI and Leptin in group (B) before and after treatment

	Mean \pm SD		T-value	Significance
	Before	After		
C3(mg/dl)	178.65 \pm 8.81	165.34 \pm 9.23	6.45	P <0.05
C4(mg/dl)	36.67 \pm 5.72	34.41 \pm 5.26	3.18	P <0.05
BMI (kg /m ²)	33.28 \pm 4.71	30.25 \pm 4.88	4.86	P <0.05
Leptin Ng/ml	39.65 \pm 7.94	36.81 \pm 7.45	5.62	P <0.05

BMI= Body Mass index

Table 3: Mean value and significance of C3, C4, BMI and Leptin in group (A) and group (B) after treatment.

	Mean \pm SD		T-value	Significance
	Group (A)	Group (B)		
C3(mg/dl)	141.98 \pm 8.62	165.34 \pm 9.23	4.25	P <0.05
C4(mg/dl)	31.76 \pm 6.18	34.41 \pm 5.26	3.87	P <0.05
BMI (kg /m ²)	27.41 \pm 2.73	30.25 \pm 4.88	3.71	P <0.05
Leptin Ng/ml	32.71 \pm 5.42	36.81 \pm 7.45	3.23	P <0.05

BMI= Body Mass index

Exercise has a variable effect on the immune system. The underlying reasons for this variability are multifactorial and include infectious, neuroendocrine, and metabolic factors, with nutritional status of the athlete and the training load playing a role. Environmental factors such as living quarters, travel requirements, and the type of sport (team versus individual) also contribute to infectious risk. Regarding the direct effect of exercise on the immune system, moderate exercise seems to exert a protective effect, whereas repeated bouts of strenuous exercise can result in immune dysfunction [11].

High intensity exercise training for 6 well trained men who ran on a treadmill for 27 minutes: 10 minutes at 60% of VO_{2max}, 10 minutes at 75% of VO_{2max}, 5 minutes at 90% of VO_{2max} and 2 minutes at 100% of VO_{2max} for one month elicited an increase in serum leptin levels in 4 of 6 trained

subjects and an increase in serum testosterone concentrations in all 6 well-trained males. A possible factor to explain individual differences in leptin responses may include percent body fat, but it does not appear to be related to serum testosterone changes [12].

Aerobic exercise training program for patients with type 2 diabetes consisted of walking and cycle ergometer exercise for 1 hour at least 5 times per week, with the intensity of exercise maintained at 50% of maximum oxygen uptake for 6 months reduced serum leptin levels [13].

Aerobic exercise resulted in serum leptin reduction and suppressed circadian rhythm of serum insulin when sampled immediately or 10 hours after exercise; but the resistance exercise protocol did not result in serum leptin and insulin changes [14].

A supervised exercise training program for elderly continued for six months began at a light level (50% VO₂ max) and progressed to a moderate level (60–65% VO₂ max) by the midpoint of the program. Exercise duration increased from 10 to 15 min per session at the beginning of the program to 40 continuous min by week 12 resulted in increase in some measures of immune function [15].

Moderate exercise improves immune function, whereas intense exercise of long duration suppresses the immune response. Moderate exercise decreased morbidity and mortality by 46% and 38%, respectively, whereas exhaustive exercise increased morbidity and mortality by 35% and 17%, respectively [16].

Moderate to heavy exercise workloads have contrasting influences on immune function. Moderate exercise training has been associated with favorable perturbations in immunity and a reduction in incidence of upper respiratory tract infection. However, For several hours subsequent to heavy exertion, components of both the innate (e.g., natural killer cell activity and neutrophil oxidative burst activity) and adaptive (e.g., T- and B-cell function) immune system exhibit suppressed function[17].

There is evidence that high-intensity exercise in humans can lead to an overall impairment of the cellular immune system, resulting in low concentrations of lymphocytes, suppressed natural immunity, suppressed lymphocyte proliferation, suppressed levels of secretory IgA in saliva, and an increased incidence of upper respiratory tract infections. By contrast, a regular routine of moderate exercise seems to improve immunological function and increase disease resistance, particularly in the elderly[18].

In conclusion, moderate intensity aerobic exercise training on treadmill is appropriate to improve innate immune system response asthmatic obese male patients.

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