



Moderate Versus High Intensity Exercise Training on Leptin and Selected Immune System Response in Obese Subjects

Shehab Mahmoud Abd El- Kader

Cairo University, Faculty of Physical Therapy, Department of Physical Therapy for Cardiopulmonary Disorders and Geriatrics, Egypt.

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ABSTRACT

Aim: 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 immune system response after moderate and intense aerobic exercise training in obese subjects.

Method: Forty obese male subjects, their age ranged between 35 to 55 years old. The subjects were included into 2 equal groups; the first group (A) received moderate intensity aerobic exercise training. The second group (B) received high intensity aerobic exercise training for 3 months.

Result: There was a 6.7% and 9.2% reduction in mean values of body mass index (BMI) and Leptin respectively and 4.8% increase in mean values of immunoglobulin G (IgG) in group (A). While , there was a 3.4% and 3.7% reduction in mean values of BMI and Leptin respectively and 2.3% increase in mean values of IgG in group (B) . The mean values of BMI and Leptin were decreased and IgG was increased significantly in group (A) and group (B).Also; there was a significant difference between both groups after treatment.

Conclusion: Moderate intensity aerobic exercise training on treadmill is appropriate to improve BMI, leptin and IgG in obese male patients.

Key words: Aerobic exercise, immune system, leptin, obesity

Correspondence: Dr. Shehab Mahmoud Abd El- Kader

Faculty of Applied Medical Sciences, Department of Physical Therapy, King Abdulaziz University, P.O. Box 80324, Jeddah, 21589, Saudi Arabia.

E-mail: drshehab@live.com

Obez Bireylerde Orta Düzeyde ve Ağır Egzersizin Leptin ve Seçilmiş İmmün Sistem Üzerine Etkileri

Amaç: Obezitenin immün sistemi baskılamak suretiyle immün sistem üzerinde olumsuz sonuçları bulunmaktadır. Bu nedenle obez bireylerde infeksiyon ve bazı kanser türlerinin insidansında artış saptanmaktadır. Bu çalışmanın amacı obez bireylerde orta düzeyde ve yoğun egzersiz sonrası seçilmiş immün sistem ve leptin üzerine etkilerinin karşılaştırılması hedeflenmektedir.

Metod: Yaşları 35 ile 55 arasında olan kırk obez erkek hasta çalışmaya dahil edildi ve bu hastalar iki eşit gruba ayrıldı. Birinci grupta bulunan hastalar (A) orta düzeyde aerobic egzersiz yaparken, ikinci gruptaki hastalar yoğun aerobic egzersizi 3 ay boyunca yaptılar.

Bulgular: Grup A'daki hastalarda ortalama vücut kitle indeksinde (VKI) ve leptin seviyesinde sırasıyla %3.7 ve %9.2 azalma saptanırken ortalama immünglobulin G (Ig G) düzeylerinde %4.8 oranında bir artış tespit edildi. Buna karşılık grup B'deki hastalarda ortalama vücut kitle indeksinde ve leptin seviyesinde sırasıyla %3.4 ve %3.7 azalma saptanırken ortalama immünglobulin G (Ig G) düzeylerinde %2.3 oranında bir artış tespit edildi. Grup A ve B'deki hastalarda ortalama VKI ve leptin düzeyleri azalırken, IgG düzeyleri anlamlı oranda artış gösterdi.

Sonuç: Bununla birlikte her iki grup arasında tedavi sonrasında anlamlı fark saptandı.

Anahtar kelimeler: Aerobik egzersiz, immün sistem, leptin, obezite

INTRODUCTION

Obesity is a common problem not only in industrialized countries but also in developing nations representing now as much as 35% of all adult obesity. Impaired immune function linked to obesity, the mechanisms responsible for the increased risk of infection and altered immunity in obese persons are unknown, but they may be linked to the negative effects of hyperglycemia, hyperinsulinemia, and hyperlipidemia on the function of certain immune cells (1).

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 (2). 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 (3- 4).

Leptin, the protein product of the obese gene, is strongly involved in the relationships between adipose tissues and immune system. The relationship between adipose tis-

sue 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 (5-6). 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 (7- 8).

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

MATERIALS AND METHODS

Subjects

Forty obese male patients with body mass index (BMI) ranged from 30 to 35 Kg/m², non smokers, free from respiratory, kidney, liver, metabolic and neurological disorders. Their age ranged from 35 to 55 years. The subjects were included into 2 equal groups; the first group (A) received moderate intensity aerobic exercise training. The second group (B) received high intensity aerobic exercise training. All patients performed three sessions / week (i.e. a total of 36 sessions per patient over a 3-month period). 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.

Table 1. Mean value and significance of BMI, IgG and leptin in group A before and after treatment

	Before	After	t-value	p-value
BMI, Kg/m ²	35.65±5.87	33.23±5.34	5.51	p<0.05
Leptin, ng/ml	38.83±6.54	35.24±5.46	5.48	p<0.05
IgG, mg/dl	0.64±0.18	0.95±0.13	4.97	p<0.05

BMI = Body Mass Index, gG = Immunoglobulin G

Methods

Chemical analysis

Blood sample after fasting for 12 hours was taken from each patient in clean tubes containing few mg of K₂EDTA, centrifuged and plasma was separated and stored frozen at -20° used for estimation of immunoglobulin G (IgG) and leptin.

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 (HR_{max}) 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 high intensity aerobic exercise training at 75 % to 85% of the maximum heart rate (HR_{max}) (9). 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 BMI, IgG and leptin were obtained before and after three months in both groups and compared using paired "t" test. Independent "t" test was used for the comparison between the two groups (p<0.05).

RESULTS

There was a 6.7% and 9.2% reduction in mean values of body mass index (BMI) and Leptin respectively and 4.8% increase in mean values of IgG in group (A). While , there was a 3.4% and 3.7% reduction in mean values of BMI and Leptin respectively and 2.3% increase in mean values of IgG in group (B) . The mean values of BMI and Leptin were decreased and IgG was increased significantly in group (A) and group (B) (Table 1 and 2). Also; there was a significant difference between both groups after treatment (Table 3). So, moderate intensity aerobic exercise training on treadmill is appropriate to improve BMI, leptin and IgG in obese male patients.

DISCUSSION

This study was designed to compare changes in leptin and selected immune system response after moderate and high intensity aerobic exercise training in obese subjects. Results of this study indicated that moderate intensity aerobic exercise training on treadmill is appropriate to improve BMI, leptin and IgG in obese male patients. Also, results of this study confirmed and agreed with many previous studies.

High intensity exercise training for 6 well trained men who ran on a treadmill for 27 minutes: 10 minutes at 60% of VO₂max, 10 minutes at 75% of VO₂max, 5 minutes at 90% of VO₂max and 2 minutes at 100% of VO₂max for one month elicited an increase in serum leptin levels in

Table 2. Mean value and significance of BMI, IgG and leptin in group B before and after treatment

	Before	After	t-value	p-value
BMI, Kg/m ²	36.43±6.47	35.18±5.52	2.62	p<0.05
Leptin, ng/ml	39.15±5.86	37.95±5.77	2.57	p<0.05
IgG, mg/dl	0.63±0.19	0.78±0.12	2.45	p<0.05

BMI = Body Mass Index, gG = Immunoglobulin G

Table 2. Mean value and significance of BMI, IgG and leptin in group A and B after treatment.

	Group (A)	Group (B)	t-value	p-value
BMI, Kg/m ²	33.23 ± 5.34	35.18 ± 5.52	2.86	p<0.05
Leptin, ng/ml	35.24 ± 5.46	37.95 ± 5.77	2.74	p<0.05
IgG, mg/dl	0.95 ± 0.13	0.78 ± 0.12	2.51	p<0.05

BMI = Body Mass Index, gG = Immunoglobulin G

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 (10). 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 (11). 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 (12).

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 (13). Immune system is enhanced during moderate and severe exercise, and only intense long-duration exercise is followed by impairment of the immune system. The latter includes suppressed concentration of lymphocytes, suppressed natural killer cell activity, lymphocyte proliferation and secretory IgA in saliva (14).

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 (15).

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(16).

Moderate exercise improves, whereas intense or prolonged exercise suppresses immune functioning (17). Also, Moderate training enhances many aspects of immune function, exhaustive exercise may impair immune responses increasing athlete's susceptibility to infection and, possibly, to autoimmune diseases and cancer (18).

In conclusion, moderate intensity aerobic exercise training on treadmill is appropriate to improve BMI, leptin and IgG in obese male patients.

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