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The comparison effect of aerobic and resistance training on regional and abdominal fat reduction and some of the heart risk factors among 30 to 45 years old healthy females

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ABSTRACT

Background: Data have firmly established that abdominal obesity and especially increased levels of visceral fat are more highly associated with metabolic and cardiovascular diseases risk. Besides, exercise training is known as a best means to reduce the risks of such diseases.

Purpose: The aim of this study was to compare the effect of aerobic and resistance training on regional fat reduction, abdominal and some of the heart risk factors among 30 to 45 years old healthy females.

Methods: 20 inactive healthy female, with a mean age of 37.56±0.48 yrs, height 164.66± 1.05 cm, and a body mass index of 26.68±0.84 (kg/m^2), participated in the study in two trials [aerobic training-(n=10) and resistance training-(n=10)] in a counterbalanced, randomized design. The protocol included resistance training with 40% -60% 1RM and aerobic training program with 65-85% of individual maximum heart rate, 3 day/week for 8 weeks. Blood samples for measuring of lipoproteins concentrations plus abdominal, sacroiliac and thigh fat were measured by caliper, BMI and peripheral of abdomen from all subjects 24 hours before starting the program and after the last session of the program. Differences between post- test and pre- test were evaluated using a Student′s t-test for paired samples. A P-value < 0.05 was considered to be statistically significant.

Results: Data analysis revealed significant differences in levels of plasma lipoproteins concentrations and a significant decrease in abdominal, sacroiliac and thigh fat of both groups when following exercise training but these changes were not dramatic when two groups were compared.

Conclusion: Although physical activity is associated with reduction in abdominal and visceral fat, there is insufficient evidence to determine a dose-response relationship. Hence, further studies need to be done to understand how much physical activity would be efficacious for the management of obesity.

Key Words: Aerobic training, Resistance training, Regional fat, total body fat, lipoproteins

INTRODUCTION

A new life style with lacking of physical education can lead to obesity, which cause a serious health problem [11]. Upon available data, where fat is distributed may be more important to health than the total amount of body fat. Therefore, accumulation of fat in abdominal organs is closely associated with diabetes, cardiovascular diseases and other metabolic diseases [2]. In females, abdominal fat increases with age and dramatically after menopause and the most important reason of accumulation of visceral fat in youth female is usually the lack of physical activity and new diet pattern according to the change in lifestyle [4]. Both clinical data and studies in animal models studies have shown that more active individuals have lower regional fat and one's risk for cardiovascular disease after adjusting for total body fat. This suggests physical activity may be related to a larger decrease in fat stored in abdominal region [3,9].

Several aerobic exercise-training studies suggest that intra-abdominal adipose tissues (IAAT) are reduced in both men and women after aerobic training [3]. It also reduces cardiovascular disease risk, increases peak oxygen consumption lower resting and submaximal heart rate, increase stroke volume and cardiac output, enhance oxygen extraction, lower resting and exercise blood pressure, lower glycosylated hemoglobin, improve glucose tolerance and insulin sensitivity, and cause weight loss [9]. Roberts and et al (2002) reported that combination of diet and daily walking resulted in decreased blood pressure, increased urine nitric oxide metabolite excretion, a fall in lipid profile (decreased triglycerides, total cholesterol, and increased high-density lipoprotein [HDL] and decreased fasting insulin, but they further reported that decreased body mass index (BMI) was not related to the abovementioned variables [7]. However, resistance training improves muscular strength and endurance, enhances flexibility, changes body composition specially decreases fat-free mass, and decreases risk factors for cardiovascular disease, but few studies have reported changes in IAAT after resistance-exercise training (RT) [3].Treuth and et al (1995) demonstrated moderate resistance training reduces abdominal obesity
And body fat.
Base on documents any modes of exercise have been known to elicit alterations in whole body lean and fat mass but less is known concerning regional variation in women in response to training. Moreover, even less research has been performed to evaluate the effects of aerobic versus resistance training. Accordingly, the objective of this project was to compare the effect of aerobic and resistance training on regional fat reduction, abdominal and some of the heart risk factors in healthy females.

METHODS

1. Subjects

The study subjects were 20 inactive-healthy women 30- to 45-year-old, height 164.66± 1.05 cm, weight 65.12±2.86 and body mass index(BMI) of 29.68±0.84 kg/m^2 voluntarily participated then randomly assigned into the aerobic exercise group[AG](n=10) and resistance group[RG] (n=10).
They were informed about the aims and procedures of the investigation protocol, as well as the possible risks and benefits before they gave their written consent. The AG was prescribed to perform aerobic training program with 65-85% of individual maximum heart rate and RG resistance

training with 40% -60% 1RM, 3 day/week for 8 weeks. Upon initiation of the study and after 8 weeks, the height, body weight and abdominal, iliac crest and thigh subcutaneous fat thickness and abdominal circumference (midway between the lower rib margin and the iliac crest) of the subjects were measured sequential by Slingide caliper and non-elastic meter. For the biochemical tests, venous blood was collected after fasting for longer than 10 hours and the serum was separated by centrifugation. Cholesterol, triglyceride, HDL-cholesterol, and LDL-cholesterol were analyzed by an automated biochemical.

2. Statistical Analysis

All values are reported as Means ±SE. Differences between exercise-induced changes in lipoproteins concentrations plus abdominal, sacroiliac and thigh fat, BMI and peripheral of abdomen before and after exercise protocol were analyzed using a Student`s t-test for paired samples. A P-value < 0.05 was considered to be statistically significant. Analysis was performed using SPSS version 18.0.

Results

Mean ± standard deviation(SD) of variables including HDL-cholesterol, LDL-cholesterol, TG and TC levels and abdominal, sacroiliac and thigh fat, BMI and peripheral of abdomen(Body composition) for each subject of AG group (Post-test and Pre-test) are shown in table.1.and for each subject of RG group (Post-test and Pre-test) in table.2. and table.3. reveals the comparison of measurements between two groups after 8 weeks training.

1. The changes in physical measurements and body composition

The BMI of the AG after 8 weeks of aerobic exercise training was significantly decreased from 26.97 kg/m2 to 25.58 kg/m2 ($P = 0.022$), and Peripheral of abdomen was also significantly decreased ($P = 0.047$)(Table 1). Such changes were detected in the RG. The BMI and Peripheral of abdomen of the RG after 8 weeks of resistance exercise training also changed dramatically in respect($P = 0.031$) and ($P = 0.007$) (Table 2).

After 8 weeks of aerobic exercise, the AG showed significant reduction abdominal fat, Sacroiliac fat and thigh fat $P = 0.038$, $P = 0.018$, and $P = 0.009$ respectively (Table 1). Those variables were also changed in RG significantly $P = 0.046$, $P = 0.035$, and $P = 0.039$ respectively (Table 2).

2. Changes in lipid profile

During the whole period of trainings all subjects significantly improved in Cholesterol, triglyceride, HDL-cholesterol, and LDL-cholesterol(Table.1 and 2) in which AG changes were as follow: HDL-c ($P = 0.010$), LDL-c ($P = 0.001$), TG ($P = 0.041$) and TC ($P = 0.011$) and RG changes included: HDL-c ($P = 0.004$), LDL-c ($P = 0.011$), TG ($P = 0.001$) and TC ($P = 0.021$).

3. The comparisons among AG and RG variables

An outlook toward the results manifested abdominal circumference, lipid profiles, BMI and abdominal fat area significantly

decreased in both groups (Table.3). However changes in Sacroiliac and thigh fat was seen in each group but they were not significant statistically while results was compared between AG and RG groups (Table.3). Abdominal circumference had a greater decrease in RG in comparison with AG whereas aerobic training (AG) caused a more reduction in abdominal fat in comparison with resistance training(Table.3).

DISCUSSION AND CONCLUSION

The study compared effect of aerobic and resistance training on regional fat reduction, abdominal and some of the heart risk factors in 30 to 45 years old healthy females. Our results revealed aerobic training could reduce abdominal, sacroiliac and thigh fat rate. More evidences have shown these results. Indeed, the more aerobic exercise activity the more ability to in situ lipolytic sensitivity in subcutaneous, abdominal adipose tissue. What is considerable it is Results of this study that also demonstrate, resistance training used in this project has caused significant changes in subjects. Several studies have confirmed the results of the present study [3,4]. The reasonable influence of resistance training on subcutaneous fat it is more likely because of the form of resistance training that was used in the present study. We used Circuit weight training and this mode is often used to improve body composition, muscle strength, endurance and cardiovascular fitness, and it improves cardiovascular fitness (similar to endurance training) more than any other form of resistance training. It should also be noted that resistance training can reduce intramuscular lipids in skeletal muscle presumably by activating lipolysis. Like lipolysis in subcutaneous adipose tissue, catecholamines can activate lipolysis in the intramuscular lipid stores. Hence, exercise and Mobilization of Body Fat During resistance training, fatty acids are freed from their storage sites to be used for energy. Several studies suggest that human growth hormone may be responsible for this increased fatty acid mobilization. Growth hormone levels increase sharply with exercise and remain elevated for up to several hours in the recovery period. Other research has suggested that, with exercise, the adipose tissue is more sensitive to either the sympathetic nervous system or the increasing levels of circulating catecholamines. Either situation would increase lipid mobilization. Thus, we cannot state with certainty which factors are of greatest importance in mediating this response. Future studies measuring lipolysis in the interstitial space of skeletal muscle may provide answers [6].

The present study did not include a diet modification component, whereas effect on weight was observed. Indeed, the literature suggests that exercise alone has sufficient effects on body weight in subjects [10]. However, aerobic training does appear to mobilize abdominal, sacroiliac and thigh fat is improved with training when training plus diet is compared with diet alone [7,10]. But resistance training to mobilization of

adipose tissue has been attributed to a number of possible factors, including lipoprotein lipase activity, local blood flow, receptor agonist-to-antagonist ratio, sympathetic nervous stimulation, tissue morphology, and lipolytic responsiveness to endocrine stimuli [1]. Both aerobic and resistance training groups in present study had improved abdominal, sacroiliac and thigh fat and subsequently BMI in our study. But according our results abdominal circumference had more reduction after resistance training program. Previous literature supports our data [6,8] following a resistance training compared with aerobic exercise. Although no attempt was made in this study to determine what caused the increase metabolic rate or change in fat metabolism, a more rise in catecholamines after resistance training likely contributed to the increased lipolysis and subsequently more reduction in abdominal circumference in comparison with aerobic training.

It is more likely individuals with abdominal obesity will develop cardiovascular diseases 10.8 times more than that for normal individuals [8,9]. Based on our results lipid profiles including triglycerides, total cholesterol, high-density lipoprotein [HDL] and low-density lipoprotein [LDL] decreased after both aerobic and resistance training. Some researches imply aerobic exercise more than resistance training has been shown to decrease lipid profiles. Furthermore, they reported that aerobic exercise such as walking was more effective than weightlifting [5]. Nevertheless, resistance training improves muscular strength and endurance, enhances flexibility, alters body composition (particularly decreases fat-free mass), and decreases risk factors for cardiovascular disease [4,5] The research concerning the effect of resistance training is not as clear and recent studies are controversial. Studies that do show a positive result, typically involve higher volumes emphasizing multi segment exercises. Hurley et al. (1987) reported a 13% increase in HDL cholesterol following 16 weeks of heavy strength training. Wallace et al. (1989), and Johnson et al. (1982) both reported positive changes in lipid profiles, but only during the highest volumes of training. Goldberg et al. (1984) showed that a program emphasizing high volume with short rest periods increased HDL while decreasing LDL and serum triglycerides. Conversely, Kokkinos et al. (1987, 1991), Kohl et al. (1992), and Smutok et al. (1993) all reported that strength training did not significantly alter serum lipid profiles. Thus, the conflicting results between studies could be attributed to differences in the amount and mode of intensity and duration of training [11].

The effects of resistance/aerobic training on regional and abdominal fat reduction and some of the cardiovascular risk factors is some deal known. More recently, resistance training has been shown to be beneficial in improving many factors associated with good health. These factors include increased function and prevention of falls, decreased lipid profiles, improved glucose tolerance and insulin sensitivity, increased lean body mass, increased basal metabolic rate (weight

control), body fat percent and at last improved quality of life. However, long-term epidemiological studies are necessary to confirm these findings. It appears that most of foregoing findings can be attained in resistance training programs that include 8–10 exercises that are performed 2–3 days per week, using 1 set of 8–15 repetitions to fatigue.

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Table.1. *AG Groups' Pre- and Post-Experiment Measurements, Body Composition, HDL-cholesterol, LDL-cholesterol, TG and TC levels*

Aerobic training group	Pre-Test Mean ± SD	Post-Test Mean ± SD	P-value
Abdominal fat(mm)	31.39	24.38	0.038*
Sacroiliac fat(mm)	16.14	13.23	0.018*
thigh fat(mm)	30.58	23.94	0.009*
Peripheral of abdomen(cm)	86.31	80.24	0.047*
BMI(kg/m^2)	26.97	25.58	0.022*
HDL-cholesterol(mg/l)	47.64	53.92	0.010*
LDL-cholesterol(mg/l)	135.56	108.58	0.001*
Triglyceride(TG)(mg/l)	126.32	112.04	0.041*
Cholesterol(TC)(mg/l)	219.65	207.48	0.011*

*Note: *Significant improvement, $p < 0.05$.*

Table.2. *RG Groups' Pre- and Post-Experiment Measurements, Body Composition, HDL-cholesterol, LDL-cholesterol, TG and TC levels*

Aerobic training group	Pre-Test Mean ± SD	Post-Test Mean ± SD	P-value
Abdominal fat(mm)	27.62	23.58	0.046*
Sacroiliac fat(mm)	13.24	12.42	0.035*
thigh fat(mm)	28.37	23.18	0.039*
Peripheral of abdomen(cm)	83.48	78.98	0.007*
BMI(kg/m^2)	26.97	25.18	0.031*
HDL-cholesterol(mg/l)	46.61	54.56	0.004*
LDL-cholesterol(mg/l)	134.32	107.38	0.011*
Triglyceride(TG)(mg/l)	127.87	111.28	0.001*
Cholesterol(TC)(mg/l)	218.27	206.54	0.021*

*Note: *Significant improvement, $p < 0.05$*

Table.3. *The comparison between RG and AG Groups' Post-Experiment Measurements, Body Composition, HDL-cholesterol, LDL-cholesterol, TG and TC levels*

Aerobic& Resistance training group	T_{obs}	df	P-value
Abdominal fat(mm)	12.431	19	0.001*
Sacroiliac fat(mm)	6.495	19	0.108
thigh fat(mm)	9.22	19	0.175
Peripheral of abdomen(cm)	7.007	19	0.009*
BMI(kg/m^2)	1.024	19	0.231*
HDL-cholesterol(mg/l)	46.61	19	0.013*
LDL-cholesterol(mg/l)	8.728	19	0.008*
Triglyceride(TG)(mg/l)	6.099	19	0.002*
Cholesterol(TC)(mg/l)	8.671	19	0.001*

*Note: *Significant improvement, $p < 0.05$*