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INFLUENCE OF AEROBIC EXERCISE AND RESISTANCE TRAINING IN MANAGEMENT OF OBESE FEMALES

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ABSTRACT

Background/aim: *Metabolic complication of obesity is rising not only in developed countries but also in non developing countries. In fact, Obesity can be presented as (new world syndrome) the greatest health problem in the modern industrial world.. The aim of this study was to investigate the influence of Aerobic Exercise and Resistance Training in Management of obese females.*

Material and methods: *Forty-five obese females participated in this study. Obese females were allocated randomly into three groups; group A, B, and C, fifteen obese females in each group. Group A received aerobic exercise only, group B received resistance exercise only, and group C received combined (aerobic and resistance) exercise. The study lasted for four weeks, Fasting lipid profile was measured before and at the end of the study for the three groups.*

Results*: statistical analysis revealed that there was significant improvement in fasting lipid profile in the three groups with a greatest improvement to group c.*

Conclusion*: Aerobic, resistance and combined training are effective methods for treating dyslipidemia in obese females.*

KEY WORDS: Metabolic complications, Aerobic exercise, resistance training, Fasting lipid profile.

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INTRODUCTION

Obesity is a complex multifaceted disease that is influenced by genetic, epigenetic, environmental, and behavioral factors. It results from long-term imbalance between energy intake and energy expenditure, favoring positive energy balance. When energy intake chronically exceeds energy expenditure, the resulting imbalance causes expansion of lipid storage and favors adipogenesis (1).

Obesity has turned into a worldwide epidemic. In the last decades the number of obese patients has increased considerably. It is especially alarming that in recent years the increase was most pronounced in children and that it occurs both in developed, but perhaps even more, in developing countries (2).

The typical dyslipidemia of obesity consists of increased triglycerides (TG) and FFA, decreased HDL-C with HDL dysfunction and normal or slightly increased LDL-C with increased small dense LDL. The concentrations of plasma apolipoprotein (apo) B are also often increased, partly due to the hepatic overproduction of apo B containing lipoproteins (3).

Treatment of obesity-associated dyslipidemia should be focused on lifestyle changes including weight loss, physical exercise and a healthy diet. Lifestyle changes synergistically improve insulin resistance and dyslipidemia. Physical exercise without diet restriction or weight loss has evidenced improvements in blood lipids profiles and to decrease fat mass (4, 5).

Exercise training has specifically been reported to induce changes in blood lipids and lipoproteins in other non obese populations, including reductions in total cholesterol (TC), low-density lipoprotein-cholesterol(LDL-C) and triacylg-lycerols, and increased high-density lipoprotein-cholesterol (HDL-C) (6).

Metabolic complication of obesity is rising not only in developed countries but also in developing countries.In fact, obesity can be presented as (new world syndrome) the greatest health problem in the modern industrial world. The prevalence of this complication is increasing in all age groups in the world. Significant changes that occur from adolescence to middle age affect health and can increase the tendency to the disease. Severe obesity is associated with increased mortality (7, 8).

Obesity reduces vascular compliance and work with the stiffness and hardness and increased resistance to blood vessels in the long term and by factors such as additional energy absorption, low used energy, low level of basal metabolism, reduce fat oxidation, and sympathetic activity. The researchers reported that obesity and decreased levels of High-density lipoprotein (HDL) and increased Low-density lipoprotein (LDL) levels and triacylglycerol are the factors related to heart disease (9, 10).

Regular exercise may cause a gradual reduction of triglycerides (TG), total cholesterol (TC), LDL, Body Mass Index (BMI), body mass, body fat and increased HDL, body mass, and Basal Metabolic Rate (BMR). A low-calorie diet improves the lipid profile, which if combined with exercise, is targeted at improving body composition. People who associated diet with physical activity achieve better results in reducing body fat, particularly visceral fat than in other areas affected by activities (11).

The short- and long-term effects of aerobic exercise and resistance training in normolipidaemic subjects and hyperlipidaemic patients. The ESC concluded that it has not yet been established how much exercise is required in order to improve the lipid profile and reduce cardiovascular risk. The lack of evidence for training programmes that optimally improve cardiovascular risk, drawing particular attention to the effects of aerobic exercise, resistance training or both on cardiovascular risk factors(12, 13).

MATERIALS AND METHODS

Forty five obese females, aging from 25 to 50 years, lipid profile was evaluated before and after treatment sessions. These women were randomly allocated into three groups: Group A:Fifteen obese females performed aerobic exercise only. Group B: Fifteen women performed resistance exercise only. Group C: Fifteen females performed combined exercise (aerobic and resistance training). Fasting lipid profile was measured before and at the end of the study for the three groups. Written informed consent was obtained from each patient. Age, weight, height, and body mass index of the patients were recorded. The study was designed as a prospective randomised clinical trial.

Group A (aerobic exercise): According to maximum heart rate they received aerobic training at mild to moderate intensity at 65- 80% of predicted maximum heart rate (predicted maximum heart rate= 220 – age), duration about 40 minutes consisted of warm up phase consisted of slow walking on treadmill for 5- 10 minutes, training phase for 20-30 minutes on intervals increased gradually till reaching 30 minutes at the end of the forth weak, cooling down phase in the form of slow walking on treadmill for 5 minutes. This exercise training was done 3 days/ week for four weeks (14, 15 ,16)

Group B (resistance exercises): According to the one repetition maximum (1-RM) which is defined as the maximum amount of weight that can be displaced in a single repetition for each muscles group for each patient participated in resistive training.

They received 30-min of resistance exercise in the form of (four sets of 8–12 repetitions at 10-RM for leg press, leg curl, bench press and rear deltoid row, with each set completed in approximately 30-sec with 1-min rest) with the 10-RM level determined during the initial session (17).

Starting workload levels for each piece of equipment will be tested by participants and if more than 10 repetitions will be achieved, the weight will increase and after a short rest participants tried again. Likewise, if less than 8 repetitions were achieved, the weight was decreased and after a short rest participants tried again.

Group C (combined exercises):This is a combination of 15-min aerobic exercise (walking by using treadmill) and 15-min of resistance exercise (two sets of each exercise in the form of leg press, leg curl, leg extension, bench press and rear deltoid) (17).

Statistical Analysis

A statistical package program was used to evaluate the data obtained from the study. Descriptive statistical methods (mean, and standard deviation) were used in the evaluation of research data as well as the Kolmogorov–Smirnov distribution test for examining normal distribution. In comparing quantitative data, the ANOVA test was used in intergroup comparison of parameters. The Paired samples t-test was used for intragroup comparisons. The results were calculated at the 95% confidence interval, P < 0.05 significance level and P < 0.01 advanced significance level.

Results

No study participant left the research project for any reason. No side effects or complications were observed during the treatment. Baseline characteristics of the patients are shown in Table 1. Group A: Their mean ± SD age, weight, height, and BMIwere31.13 ± 4.25years, 85.09 ± 6.29kg, 161.13 ± 3.64cm, and 32.26 ± 1.53kg/m². Group B: Their mean ± SD age, weight, height, and BMI were 32.53± 5.09 years, 82.95± 4.92kg, 162.8± 3.48cm, and 31.33± 1.39kg/m². Group C: Their mean ± SD age, weight, height, and BMI were 32.6 ± 6.17 years, 83.64 ± 5.03kg, 161.8 ± 2.59cm, and 31.8 ± 1.47kg/m².

Comparing the general characteristics of the subjects of the three groups revealed that there was no significance difference between groups in the mean age, weight, height, and BMI (p > 0.05).

There was a significant difference between the three groups in the mean value of TC post treatment (p = 0.0001), as shown in Table 2.

There was no significant difference between the three groups in the mean value of triglycerides post treatment (p = 0.15), as shown in Table 3.

There was a significant difference between the three groups in the mean value of LDL post treatment (p = 0.0001), as shown in Table 4.

There was a significant difference between the three groups in the mean value of HDL post treatment (p = 0.001), as shown in Table 5.

Table 1. Baseline characteristics of the patients.

	Group A (n = 15)	Group B (n = 15)	Group C (n = 15)	p
Age (years)	31.13 ± 4.25	32.53± 5.09	32.6 ± 6.17	0.68
Weight (kg)	85.09 ± 6.29	82.95± 4.92	83.64 ± 5.03	0.55
Height (cm)	161.13 ± 3.64	162.8± 3.48	161.8 ± 2.59	0.38
BMI (kg/m²)	32.26 ± 1.53	31.33± 1.39	31.8 ± 1.47	0.23

Data are presented as mean ± SD or number of patients.

Table 2. *TC* (mg/dl)

TC (mg/dl)	Group A (n = 15)	Group B (n = 15)	Group C (n = 15)	p
Baseline	205.86± 10.92	201.6± 13.46	199.13± 12.54	0.32
At the end of the treatment	200.8 ± 11.18	191.53 ± 9.24	182.93 ± 10.68	0.0001

Data are presented as mean ± SD or number of patients. **P < 0.01.

Table 3.Ttriglycerides(mg/dl)

Triglycerides (mg/dl)	Group A (n = 15)	Group B (n = 15)	Group C (n = 15)	p
Baseline	129.2± 9.75	132.46± 10.2	133± 6.39	0.45
At the end of the treatment	122.53 ± 8.97	121.93 ± 8.55	117.06 ± 7.14	0.15

Table 4. *LDL*(mg/dl)

LDL mg/dl(mg/dl)	Group A (n = 15)	Group B (n = 15)	Group C (n = 15)	p
Baseline	114.8± 10.43	111.53± 6.65	109.86± 17.13	0.53
At the end of the treatment	108.86 ± 10.19	87.66 ± 10.54	88.4 ± 14.28	0.0001

Table 5. HDL(mg/dl)

HDL mg/dl(mg/dl)	Group A (n = 15)	Group B (n = 15)	Group C (n = 15)	p
Baseline	43.26 ± 4.36	40.93± 4.83	40.6± 5.57	0.28
At the end of the treatment	47.06 ± 4.18	50.06 ± 5.24	55 ± 6.46	0.001

DISCUSSION

The findings of the current study were consistence with results obtained from a study conducted by Ha and So who combined 30 min of aerobic exercise at 60–80 % of the maximal heart rate reserve (maximal heart rate − heart rate at rest) [$HR_{reserve}$] with 30 min of resistance training at 12–15 repetitions maximum in 16 participants aged 20–26 years for 12 weeks. The intervention significantly reduced the participants' waist circumference, body fat percentage and blood pressure values, compared with those of non-exercising controls. The lipid profile improved in the exercising condition, with reductions in total cholesterol from 180.29 to 161 mg/dL, LDL cholesterol from 112.14 to 103.57 mg/dL and triglycerides from 97.14 to 50.43 mg/dL, although the changes did not reach statistical significance when compared with values in the controls. The authors suggested that the participants was too young to elicit the clinical and significant effects shown by previous research in predominantly elderly or middle-aged participants (18).

Our findings agreed with results obtained from a study conducted byFett et al. [*43*] who incorporated resistance training into circuit training sessions in which no specific weight was specified but a specific time duration was allocated to each exercise. Sessions lasted 60 min and were completed three times weekly for 1 month and four times weekly for the second month. Significant reductions were reported in total cholesterol (from 203 to 186 mg/dL, $p < 0.01$) and triglycerides (from 122 to 91 mg/dL, $p < 0.05$), further adding to the speculation that the volume of movement may be just as important as—or even more important than—the amount of weight lifted (19).

Our findings were consistence with results obtained from a study conducted by Kraus et al who investigated the impact of increasing the volume and intensity of aerobic exercise upon the lipid profiles of 111 sedentary overweight participants, all with mild to moderate dyslipidaemia. Participants were allocated to either 6 months in a control group or 8 months in one of three aerobic exercise groups. The three aerobic exercise groups were high-intensity/high-volume aerobic exercise (jogging for the calorific equivalent of 20 miles/week at an intensity of 65–80 % of the peak aerobic capacity (VO_{2peak}), high-intensity/low-volume aerobic exercise (jogging for the calorific equivalent of 12 miles/week at an intensity of 65–80 % VO_{2peak}) and moderate-intensity/low-volume exercise (walking for the calorific equivalent of 12 miles/week at an intensity of 40–55 % VO_{2peak}). It was reported that the high-intensity/high-volume training combination resulted in the greatest improvements in 10 of 11 lipid variables (LDL cholesterol decreased from 130.1 to 128.2 mg/dL, $p < 0.05$; HDL cholesterol increased from 44.3 to 48.6 mg/dL, $p < 0.05$; triglycerides decreased from 166.9 to 138.5 mg/dL, $p < 0.05$). These data suggest that in relation to aerobic exercise, both total energy expenditure and intensity are factors in lipid reduction (20).

Our findings were consistence with results obtained from a study conducted by Dunn et al whoinvestigated the effects of a 6-month aerobic exercise training programe, which progressed from 50 to 85 % of maximum aerobic power for 20–60 min three times weekly, and reported significant decreases in total cholesterol (−0.3 mmol/L, $p < 0.001$) and in the total:HDL cholesterol ratio (−0.3, $p < 0.001$)(21).

In contrast of our findings Banz et al reported that aerobic training of sufficient intensity and duration cause increase in high density lipoprotein level more than resistive traning (16).

In contrast of our findings Laaksonen reported thatthe effects of regular aerobic exercise on the lipid profile individuals have been variable. There was increase in the HDL / Total cholesterol ratio, without significant changes in High density lipoprotein (HDL) or total cholesterol, body mass index(BMI) or glycemic control after six weeks of ergometer cycling exercise for 60 min 4 days aweek. The relative change did not differ significantly between the training and control groups, however. In an uncontrolled study investigating the effect of three months of regular exercise in 20 type 1 DM men and women 22- 48 years old, LDL decreased by 14% and HDL increased by 10%, with concomitant weight loss and decreased percent body fat (22).

Our findings agreed with results obtained from a study conducted by Moghadasi et al who reported that during the 12 weeks intervention,the subjects were trained for 45 min per session at a heart rate corresponding to 75-80% of the maximal oxygen uptake measured at baseline. Each participant was equipped with a heart rate monitor to ensure accuracy of exercise level. After 12 weeks exercise training, BMI, body fat percent and TC decreased (23).

Our findings were consistence with results obtained from a study conducted byKodama et al who reported that aerobic exercise is believed to reduce the risk of cardiovascular disease partially through increasing serum levels of HDL- C and decreasing serum levels of TC, TG and LDL-C improving in blood level profile is related to the amount and intensity of the exercise (24)

In conclusion, aerobic, resistance and combined training are an effective modalities for treating dyslipidemia associated with obesity.

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