Original Article

Comparison of the Effects of Diet with and without Physical Activity on Serum Lipid Profile of Obese Women

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ABSTRACT

Background and Objectives: The unfavorable lipid profile in obese individuals is associated with high incidence of various diseases including cardiovascular disease, hypertension, etc. Dieting for weight loss and physical activity are among the most important factors affecting the serum lipid profile. The aim of this study was to compare the effect of diet with and without physical activity on body mass index and serum lipid profile of obese women.

Methods: This clinical trial was performed in 2011 on 39 obese women referred to a weight loss and nutrition counseling center. Subjects were randomly divided into an active group (diet and exercise) and inactive group (diet without exercise). Blood sampling was done before the intervention and two months after the intervention. Data was analyzed using SPSS-16 and t-test.

Results: Mean level of triglyceride reduced significantly in both groups. Mean level of cholesterol and low-density lipoprotein decreased significantly only in the active group. The Mean level of high-density lipoprotein in the two groups had no significant difference.

Conclusion: The results indicate that dieting for weight loss along with short-term physical activity improves serum levels of cholesterol and low-density lipoprotein, but does not affect serum HDL level.

Keywords: Diet, Exercise, Triglyceride, Cholesterol, LDL, HDL.

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INTRODUCTION

Obesity is one of the leading causes of early death, and is associated with increased risk of several diseases such as type II diabetes, hypertension, cardiovascular disease (CVD) and cancer (1). Obesity and its related diseases are rapidly expanding as a global epidemic. Over 500 million people in the world are overweight or obese (2). In 2008, more than 1.4 billion adults aged ≥20 years were overweight, of which more than 200 million men and nearly 300 million women were obese. In 2008, 35% of adults aged ≥ 20 years were overweight and 11% were obese. In addition, 65% of the world's population are either overweight or obese. In 2011, more than 40 million children under-five years of age were overweight (3). Obesity is a multifactorial disease that results from genetic, metabolic and environmental factors. Appetite control and satiety, energy consumption, and metabolism play important roles in the development of obesity (4). Obesity is strongly associated with increased incidence of metabolic syndrome, type I diabetes, non-alcoholic fatty liver disease, and CVD (5). The term "lipid profile" refers to levels of blood lipids. The most common lipids in the blood are low-density lipoprotein (LDL), high-density lipoprotein cholesterol (HDL-C), cholesterol and triglyceride (TG). High levels of cholesterol and LDL indicate excess fat in the blood, which in turn increases the risk of CVD (6). Dyslipidemia is one of the major complications of obesity, which is associated with a high incidence of coronary artery disease and vascular disease. Many studies have shown that weight loss with diet or exercise reduces TG levels and increases HDL-C levels. In addition, a low-fat diet causes favorable changes in the plasma lipoprotein concentrations (7). Australia's Physical Activity and Sedentary Behavior Guidelines recommend that at least 30 minutes of physical activity at moderate intensity every day is essential for health and well-being of adults (8). Prospective studies have proven the close association of lipoprotein profile with CVD and mortality. Epidemiological evidence shows that physically active individuals have a 30-50% lower risk of developing type II diabetes or CVD compared to sedentary people. In addition, habitual physical activity can reduce the risk of coronary artery disease (8). The aim of this study was to investigate the effect of calorie-restricted diet with or without physical activity on body mass index (BMI) and lipid profile of obese individuals.

MATERIAL AND METHODS

This clinical trial was performed on women referred to a weight loss and nutrition counseling center in Gorgan, Ian. After completing the general information and physical activity questionnaires, 50 women were enrolled in the study. Inclusion criteria included having good general health status, age between 18-55 years, BMI of 25-35, lack of exercise activity, not using specific diets or supplements, not taking hypoglycemic and lipid-lowering drugs, and absence of any apparent clinical signs of diabetes and hypertension. The participants were equally divided and randomly assigned into an active group (regular exercise three days per week by walking for 1 hour) and inactive group (no exercise). Based on gender, anthropometric measurements (height, weight and age), wrist circumference and waist–hip ratio, appropriate calorie-restricted diets with 55% carbohydrate, 15% protein and 30% fat were prepared for both groups. After receiving approval from the Ethics Committee of Golestan University of Medical Sciences and obtaining oral consent, subjects were referred to a private laboratory for sampling. For this purpose, 5 ml of fasting blood sample was taken to measure blood glucose and lipid profile before the study. After nutrition education and counseling, appropriate diets for weight loss were given to each subject. The participants were asked to come to the clinic every two weeks for weight control. During each visit, counselors reminded the participants to comply with the treatment protocol. After a 2-month follow-up, 5 ml of fasting blood sample was taken for testing (TG, total cholesterol, LDL, HDL) from 39 subjects (of 100) who visited the clinic. Participants were advised to fast for 12-14 hours before the test. Serum was separated from blood sample, and analyzed for level of HDL, LDL, TG and cholesterol using Pars Azmoon kit. After verifying the accuracy of the data, the pre- and post-intervention data were analyzed using SPSS software (version 16) and t-test. P-values less than 0.05 were considered as statistically significant.

RESULTS

Of 39 participants who completed the study, 20 were in the inactive group and 19 were in the physical activity group. The mean age, height, and weight of subjects before the start of the study are presented in Table 1. After two months of intervention, the mean weight decreased by 9.68% (from 87.27 to 78.82 Kg) in the active group and by 9.2% (from 81.47 to 73.97 Kg) in the inactive group ($P<0.05$). Comparison of the pre- and post-intervention results showed that the mean BMI decreased by 8.8% (from 34.64 to 31.57 Kg/m2) in the active group and by 9% (from 31.87 to 28.91 Kg/m2) in the inactive group ($P<0.05$). As shown in Table 2, the mean level of TG in both groups decreased significantly. The mean level of cholesterol and LDL decreased significantly in the active group, but did not change significantly in the inactive group. Moreover, mean level of HDL in the two groups did have any significant difference.

Table 1- Anthropometric characteristics of subjects (data are shown as mean ± SD)

Group / Variable	Active group (diet-exercise)	Inactive group (diet)
Age (years)	32.36±8.97	19.50± 9.17
Height (cm)	158.05± 4.09	159.85± 4.93
Wight (Kg)	87.27± 14.09	81.48± 11.11

Table 2- Mean ± SD of changes in serum lipids before and after the intervention in the two study groups

Variable / Group	Stage	Mean ±SD					
		Wight	TG	Cholesterol	LDL	HDL	BMI
Active group (diet-exercise)	Pre-intervention	87.27± 14.09	140.42±89.00	178.26±30.20	102.42±16.26	42.47±7.67	34.64±5.67
	Post-intervention	78.82±13.66	87.71±32.38	173.31± 24.26	103.28±19.66	43.64±1.30	31.57±5.61
	P-value	0.000	0.000	0.000	0.006	0.478	0.000
Inactive group (diet)	Pre-intervention	81.48± 11.11	119.00± 50.31	180.60±23.00	100.50±16.83	37.60±7.93	31.87±3.96
	Post-intervention	73.97±11.87	79.85± 35.25	172.30±32.37	101.08±24.08	44.34±3.48	28.91±4.17
	P-value	0.000	0.001	0.231	0.902	0.434	0.000

DISCUSSION

In this study, there was a significant reduction in the BMI value and TG level after the intervention. The mean level of cholesterol and LDL decreased significantly in the active group, but did not change significantly in the inactive group. Mean level of HDL in the two groups did have any significant difference.

In study of Aadahl et al. in Denmark during 1999-2006, men and women who had long-term physical activity (5 years) had lower serum levels of LDL, cholesterol and TG, but plasma HDL levels only increased in men (11). In study of Rush et al. on immigrant Indians aged >50 years, 5 months of dietary modification and enhanced physical activity increased HDL and decreased LDL-C/HDL-C ratio in both men and women. The difference between the results of the present study and the mentioned study on HDL levels could be due to the longer duration of Rush et al. study and the positive impact of increased physical activity on HDL level (12). A study in Spain evaluated lipid profile of 96 obese individuals (59 women and 61 men aged 18-50 years, BMI= 30- 34.9 Kg/m^2) at the beginning of

exercise and after 24 weeks of exercise. Their results showed significant reductions in LDL, TG and cholesterol levels, while HDL level remained unchanged (8). These results are consistent with the findings of our study.

Study of Klempel et al. in 2013, randomly divided 35 obese women (39.9> BMI> 30) into two groups of calorie and fat-restricted diet (25% fat, 60% carbohydrate, 15% protein) and calorie-restricted high-fat diet (45% fat, 40% carbohydrate, 15% protein). After 10 weeks of intervention, plasma cholesterol, TG and LDL levels decreased, but plasma HDL remained unchanged in both groups. Although these results are similar to our findings in terms of reduction in plasma TG and lack of change in plasma HDL levels, plasma cholesterol and LDL did not decrease significantly in the present study (6).

In study of Yashido et al., 16 weeks of aerobic exercise (3 times a week, 60 minutes/day) in 25 patients with dyslipidemia decreased LDL and BMI, but did not change HDL and TG levels. The difference between these findings and results of our study could be related to use of diet along with exercise (13).

In 2012, Morencos et al. investigated the serum lipid profile of 66 participants after 22 weeks of exercise along with calorie-restricted diet. Consistent with the present study, they reported that LDL and cholesterol levels decrease after the intervention (14). The results of the present study also showed that the impact of short-term exercise with diet do not have a significant difference with that of diet alone. In 2009, a study in Urmia on 30 healthy middle-aged inactive men reported that 30 minutes of aerobic exercise at 65% maximum heart rate on a treadmill, significantly increases concentrations of TG, cholesterol and VLDL immediately after the exercise compared to a control group. Blood lipids of subjects had no significant difference in the recovery stage. The levels of cholesterol, VLDL and LDL significantly increased immediately after exercise recovery compared to the controls ($P < 0.05$). Their results showed that moderate intensity aerobic exercise increases the concentration of blood lipids for metabolism, and provides favorable conditions for reducing CVD risk factors (15).

In study of Eatemady-Boroujeni et al., 45 patients with type II diabetes were randomly divided into three groups of aerobic exercise, resistance training and control. Experimental groups performed 45-70 minutes of aerobic exercise and resistance training every day for 8 weeks (three sessions per week) under the supervision of a trainer. They reported that aerobic exercise significantly improves total cholesterol and HDL levels, and resistance training significantly increases HDL levels (16). TrussardiFayh et al. investigated the effects of diet with and without exercise on obese individuals. After a 5% weight loss in both groups, the levels of cholesterol and TG significantly reduced in both groups, while HDL and LDL levels remained unchanged. In the present study, the diet alone affected weight, BMI and TG level, but the combination of diet and exercise changed cholesterol and LDL levels in addition to the aforementioned effects (17).

A limitation of this study was the lack of proper control on regular family meals. However, our investigations indicated that the advised 30% fat intake was maintained in the daily diet. Another limitation is the difference in basal metabolic rate and function of the endocrine glands in each individual that affect metabolism.

CONCLUSION

Based on the results of our study, it can be concluded that good compliance with diet alone can lead to weight loss even in the absence of physical activity. Diet with short-term physical activity improves serum cholesterol and LDL levels but does not affect HDL levels.

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