The effect of eight weeks of aerobic training and Anethum herbal supplementation on lipid risk factors for cardiovascular disease in inactive obese men

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Abstract

Introduction: Studies show that the effects of different types of physical activity vary in various intensities and periods on body composition, lipid profile, and liver enzymes in men and women with varying levels of age, fitness, and health. Anethum herbal supplement can reduce cholesterol and triglycerides and help prevent and treat atherosclerosis. The effects of Anethum in interaction with exercise on blood lipids, body composition, and liver enzymes are unclear.

Material & Methods: 28 healthy and inactive male obese volunteers (age 20-30 years old) were randomly divided into four groups: Training, Anethum, Training+Anethum, and Control group. Independent variables included performing eight weeks of aerobic training and taking 650 mg of Anethum tablets for eight weeks, three times a day after meals. Dependent variables included lipid profile factors, body composition, and serum levels of liver enzymes. The intensity of aerobic training was set at 50 - 75% Vo_{2max} using the HRR method to observe the principle of increasing overload. The main stage of training consisted of 45 minutes of aerobic activities. Paired samples t-test, one-way ANOVA, and Tukey's post hoc test were used to determine the within-groups and between-groups differences, respectively, at a significance level of 5%.

Results: Performing eight weeks of aerobic training combined with Anethum herbal supplementation reduces LDL_c, TC, TG, BMI, WHR, ALT, ALP, and AST in the fasting state of inactive obese men($P<0.05$). These variables' reduction rate was more significant in all intervention groups than in the control group. However, the groups did not observe significant differences ($P>0.05$).

Conclusions: Therefore, to lose weight, blood lipids, and liver enzymes, intend to reduce the risk of cardiovascular disease, probably, performing aerobic exercises along with taking Antom tablets has a greater effect in reducing lipid risk factors for cardiovascular disease.

Key Words: Aerobic training, Anethum, Atherosclerosis, Liver enzymes, Blood lipids, Body composition.

1. Introduction

More than one billion people worldwide are obese or overweight, and cardiovascular disease has been identified as the leading cause of death in humans. The prevalence of weight gain worldwide has tripled in the last decades, and this increase has occurred in all age, gender, racial, and ethnic groups. Significant weight gain and obesity associated with impaired blood lipids can be considerable predisposing factors for diabetes, metabolic syndrome, coronary artery disease, and hypertension. The results of the Framingham study indicate that obesity and hyperlipidemia disorders are still significant risk factors for cardiovascular disease (1).

Recent meta-analyses of prospective studies and several multivariate analyses have shown that weight gain and obesity associated with lipid profile disorders have a statistically significant relationship with the incidence of cardiovascular disease and are known as independent modifiable risk factors for cardiovascular disease (2). Decreased physical activity and changes in dietary patterns, as well as ensuing weight gain and obesity, seem to play a significant role in increasing the likelihood of such a risk worldwide (3). Due to the role and importance of the liver in the interaction of hormonal and metabolic properties with the use of different enzymes during rest, training, and regeneration of energy sources in the recovery stage of sports activities, many researchers have always considered the study of liver function in athletes. High intensity of sports activities and the resulting fatigue increase the pressure on the body and raise the permeability of cell membranes, followed by an increase in serum levels of intracellular enzymes. The liver plays a more significant role in endurance activity than any other activity; therefore, the risk of liver cell membrane damage in long-term activity and endurance training is high (4). The liver regulates many physiological phenomena and is essential in fat metabolism. By acting on free fatty acids in the blood, it makes, stores, and extracts fats and lipoproteins; any disruption in its function also causes physiological and anatomical disorders and various diseases. On the other hand, with weight gain, obesity, and an increase in serum lipids, liver cells begin to accumulate fat droplets (mainly triglycerides). Consecutive fat storage in liver cells causes damage to liver cells and changes in the concentration profiles of liver enzymes such as aspartate aminotransferase, alanine aminotransferase, and alkaline phosphatase. These enzymes enter the bloodstream due to liver cell damage, and increasing the concentration of these enzymes has been introduced as markers of liver cell damage, liver status markers, and the most critical indicators of liver health function (5).

The body stores large amounts of fat as triglycerides in adipose tissue and muscle fibers. During moderate-intensity exercise, lipolysis of triglycerides in adipose tissue increases two to three times. Triglycerides are released as free fatty acids into the bloodstream and travel to active muscles to produce energy. In addition, exercise stimulates intramuscular triglyceride lipolysis, which is directly oxidized by mitochondria as fatty acids (6).

The results of previous studies show favorable changes and positive and beneficial effects of different types of physical activity. Exercise varies in various intensities and periods on body composition, lipid profile, and liver enzymes in men and women with varying levels of age, fitness, and health (7-9).

Anethum herbal supplement is one of the specialized pharmaceutical supplements in the group of cardiovascular drugs that reduces cholesterol and triglycerides in the body and helps prevent and treat atherosclerosis. In Iran, Anethum is widely used for weight loss and blood lipids. Piri et al. (2010) suggested that Anethum herbal supplementation in healthy rats with a high-fat diet decreased total triglyceride levels and increased high-density lipoprotein levels (10). The study

of blood lipids based on the effect of pyrethrum drug showed a significant difference between the serum lipids of experimental and control groups after receiving Anethum(10). Hosseini et al. (2018) and Oshaghi et al. (2016) concluded that Anethum herbal supplement can improve the indicators of liver damage and lipid profile (11, 12).
There have been no broad studies to determine the extent and mechanism of the effect of this supplement in interaction with exercise on changes in blood lipids, body composition, and liver enzymes as lipid risk factors for cardiovascular disease. Given the lack of reliable findings on the effect of Anethum herbal supplement on the body composition, lipid profile, and liver enzymes of obese people as well as the lack of clear information on the interaction between physical activity and consumption of Anethum herbal supplement on body composition, lipid profile, and liver enzymes as lipid risk factors for cardiovascular disease, this study seeks to answer the question whether performing eight weeks of aerobic training and taking Anethum herbal supplement has an effect on lipid risk factors for cardiovascular disease in inactive obese men.

2. Materials and Methods

The present quasi-experimental and applied research was performed in four groups, with a control group in the pre-test and post-test stages. The study aimed to determine the effect of performing eight weeks of aerobic training and taking Anethum herbal supplements on lipid risk factors for cardiovascular diseases, including elements of body composition, lipid profile, and liver enzymes in obese, inactive men (Table 1).

Subjects

The statistical population of this study included all 20-30-year-old healthy male obese volunteers (body mass index higher than 30 kg / m^2) living in Khorramdareh city of Zanjan province in summer 2019. Based on the answers to the lifestyle, health, disease risk, and physical activity questionnaires, these individuals lacked any physical or clinical symptoms of cardiovascular diseases, diabetes, hypertension, metabolic syndrome, and fatty liver. They were considered inactive in terms of physical activity, so they had no history of participating in any regular and coherent sports activities six months before the start of the study. The sample size comprised 28 subjects. The subjects were randomly divided into four groups: Aerobic Training (T), Anethum supplement (A), Aerobic Training, Anethum supplement (T+A), and Control (C). An available volunteer sampling method was used to select the samples. All participants completed and signed the consent form.To eliminate and reduce the effects of interfering variables of physical activity and diet, all subjects were asked to refrain from participating in any physical activity, exercise, and sports activities outside of the training time and make no changes in their diet. In addition, they were asked to refrain from taking any food and medicine supplements and following any diet.

Exercise Training

The exercise program is presented in Table No. 1.The intensity of aerobic training was set and controlled in the range of 50 to 75% Vo_{2max} using the reserve heart rate method. The training duration was 70 minutes, three sessions a week, and each training session consisted of three parts: warm-up, main stage, and cool down. Stretching, flexing, and jogging for 15 minutes

were used to warm up. The main set of training consisted of 45 minutes of aerobic activities. Aerobic activities were performed from simple to advance during the training weeks. The intensity of training in the first week due to the beginning of the subjects started from 50% of the reserve heart rate. To observe the principle of increasing overload, training intensity increased every week until the eighth week reached 75% of the reserve heart rate. Also, ground movements such as sitting forward, sides, Swedish swimming, and stretching exercises were used for all body parts to improve the subjects' physical fitness level. The cooling phase also included ten minutes of stretching and softening.
The training time was the same in all sessions, but the intensity was incremental. The leading aerobic training included coordinated arm and leg movements presented as blocks. Each block consisted of 32 moves. In the first week, 4-stroke activities were used, and in the second week, 16-stroke blocks were used, which included four 4-stroke movements appropriate for beginners. In the third and fourth weeks, the movements became more complicated and remained at 16 strokes. In the fifth and sixth weeks, to increase the intensity of the training, using a combination of blocks from the previous weeks, a 32-stroke block was designed, and the same blocks were used until the end of the training period.

Table 1. Research design

Day -2	Group	Training Variables	Week								Day +1
Pre-test measurement of research variables	Aerobic (N=7 70 min)		One	Two	Three	Four	Five	Six	Seven	Eight	Post-test measurement of research variables
		Intensity (Percentage of HRR)	50	55	60	60	65	70	70	75	
		Duration (Min)	45	45	45	45	45	45	45	45	
	Anethum (N=7)	Taking a 650 mg tablet three times a day for eight weeks									
	Aerobic (70 min) & Anethum (N=7)	Performing aerobic training and taking a 650 mg tablet three times a day for eight weeks									
	Control (N=7)	----------									

Supplement

With the doctor's prescription, the research samples used Antom tablets (650 mg, Darok Pharmaceutical Co.) for 8 weeks, three times a day after meals.

Measurements

The dependent variables included serum concentration of lipid profile factors (high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, triglyceride, and total cholesterol), body composition (body mass index, waist-to-hip ratio, subcutaneous body fat percentage), and serum levels of liver enzymes (aspartate aminotransferase, alanine aminotransferase, and alkaline phosphatase) were considered as lipid risk factors for cardiovascular disease.

Anthropometric measurements

Two days before the start of the training protocol and supplementation, the variables of height (plastic calibrated tape measure with an accuracy of 0.1 cm), weight (Tefal BR, and a digital scale, France with an accuracy of 0.1 kg), waist circumference (plastic calibrated tape measure with an accuracy of 0.1 cm), hip circumference (plastic calibrated tape with a precision of 0.1 cm), and body fat percentage (Sihann caliper, made in China, and Jackson, and Pollock three-point method for subcutaneous fat layer of chest, abdomen, and thigh) were measured according to st, standard instructions.

Biochemical analyses

After 9 - 12 hours of fasting, resting morning blood samples (5 ml) were taken at the same time from the left brachial vein before and after eight weeks of intervention. Blood samples were centrifuged for 5 minutes at 3000 rpm, and serum samples were stored at -80° C until the relevant tests were conducted. Twenty-four hours after the last training session, the research variables were measured in similar conditions. Serum fats and liver enzyme concentrations were measured photometrically with a fully automatic Dirni autoanalyzer (China), and a kit made by BIONIK Co.(Tehran, Iran) with a one milligram per deciliter sensitivity.

Statistical analysis

The Shapiro-Wilk and Levene's tests determined variances' normal distribution and homogeneity. A paired samples t-test was used to determine the within-group differences between the pre-test and post-test, and a one-way analysis of variance and Tukey's post hoc test were used to determine the differences between groups at a significance level of 5%.

3. Results

The results of one-way analysis of variance showed that differences in the descriptive variables of age [P = 0.168, $F_{(3,24)}$ = 1.783], weight [P = 0.124, $F_{(3,24)}$ = 2.054], TC [P = 0.534, $F_{(3,24)}$ = 0.742], TG [P = 0.559, $F_{(3,24)}$ = 0.699], LDL_c [P = 0. 676, $F_{(3,24)}$ = 0.513 F], HDL_c [P = 0.198, F $_{(3,24)}$ = 1.636], BMI [P = 0.137, $F_{(3,24)}$ =1.962], WHR [P = 0.154, $F_{(3,24)}$ = 1.859], ALT [P = 0.33, $F_{(3,24)}$ = 1.183], ASP [P = 0.22, $F_{(3,24)}$ = 1.54], ALP [P = 0.29, $F_{(3,24)}$ = 1.282], and %BF [P = 0. 559, $F_{(3,24)}$ = 0.699] were not significant in the fasting state in the pre-test stage among the research groups. Therefore, all groups were homogeneous and identical in the given variables. The results of the Shapiro-Wilk test showed that the variables had a normal distribution. The results of Levene's test to examine the homogeneity of variances also showed the equality of variances of the research variables. Table 2 presents the results of the within-group comparison of the group variables.

The difference between pre-test and post-test means of HDL_c was statistically significant in the aerobic training, and Anethum ($P = 0.003$, $t_{(6)} = 3.995$), aerobic training ($P = 0.006$, $t_{(6)} = 3.526$), Anethum ($P = 0.001$, $t_{(6)} = 4.749$), and control ($P = 0.025$, $t_{(6)} = 6.676$) groups. These changes caused increases in the aerobic training and Anethum (12.73%), aerobic training (18.88%), and Anethum (12.55%) groups and decreases in the control (9.60%) group. The results of the Pearson correlation coefficient between the pre-test and post-test values of HDL_c were significant in the aerobic training, and Anethum ($P = 0.002$, $r_{(7)} = 0.848$), aerobic training ($P = 0.013$, $r_{(7)} = 7.745$), and Anethum ($P \leq 0.001$, $r_{(7)} = 7.9.3$) groups. Besides, aerobic training combined with Anethum herbal supplementation, aerobic exercise alone, and Anethum alone effectively increased HDL_c in inactive obese men, and the change process was regular.
The difference between pre-test and post-test means of LDL_c was statistically significant in the aerobic training, and Anethum ($P = 0.003$, $t_{(6)} = 3.995$), aerobic training ($P = 0.008$, $t_{(6)} = 3.405$), and Anethum ($P = 0.001$, $t_{(6)} = 5.240$) groups. This difference was insignificant in the control group ($P = 0.001$, $t_{(6)} = 2.201$). These changes caused decreases in the aerobic training and Anethum (12.57%), aerobic training (9.17%), and Anethum (13.56%), and increases in the control group (9.65%). The results of the Pearson correlation coefficient between pre-test and post-test values of LDL_c were significant in the aerobic training, and Anethum ($P = 0.007$, $r_{(7)} = 0.955$), aerobic training ($P \leq 0.001$, $r_{(7)} = 0.971$), and Anethum ($P \leq 0.001$, $r_{(7)} = 0.955$) groups. Aerobic training, Anethum herbal supplementation, aerobic exercise alone, and Anethum alone effectively reduced LDL_c in inactive obese men, and the change process was regular.
The difference between pre-test and post-test means of serum TC was statistically significant in the aerobic training, and Anethum herbal supplementation ($P = 0.08$, $t_{(6)} = 3.373$), aerobic training ($P = 0.031$, $t_{(6)} = 2.558$), Anethum ($P = 0.009$, $t_{(6)} = 3.293$), and control ($P = 0.015$, $t_{(6)} = 3.006$) groups. These changes caused decreases in the aerobic training and Anethum (10.54%), aerobic training (8.07%), and Anethum (14.70%) groups and increases in the control group (12.70%). The results of Pearson correlation coefficient between pre-test and post-test values of serum TC in the aerobic training, and Anethum ($P = 0.015$, $r_{(7)} = 0.738$), aerobic exercise ($P = 0.001$, $r_{(7)} = 0.870$), and Anethum ($P = 0.44$, $r_{(7)} = 0.646$) groups were significant. Aerobic training, Anethum, aerobic training alone, and Anethum alone effectively reduced TC in inactive obese men, and the change process was regular.
The difference between pre-test and post-test means of serum TG was statistically significant in the aerobic training, and Anethum ($P = 0.003$, $t_{(6)} = 3.973$), aerobic training ($P = 0.038$, $t_{(6)} = 2.422$), and Anethum ($P = 0.003$, $t_{(6)} = 3.986$) groups. This difference was insignificant in the control group ($P = 0.499$, $t_{(6)} = 0.704$). These changes caused decreases in aerobic training and Anethum (18.07%), aerobic exercise (15.02%), and Anethum (14.42%) while causing increases in the control group (4.90%). The results of the Pearson correlation coefficient between pre-test and post-test values of serum TG were significant in the aerobic training, and Anethum ($P = 0.003$, $r_{(7)} = 0.828$), and Anethum ($P = 0.005$, $r_{(7)}= 0.804$) groups. In contrast, the correlation coefficient was insignificant in the aerobic training group ($P = 0.093$, $r_{(7)} = 0.558$). Aerobic training, Anethum herbal supplementation, and Anethum alone were effective in lowering the serum TG of inactive obese men, and the trend was regular while performing aerobic training alone was effective in reducing the serum TG of idle obese men, but the change process was irregular.

The difference between pre-test and post-test means of BMI was statistically significant in the aerobic training, and Anethum ($P = 0.001$, $t_{(6)} = 4.548$), aerobic training ($P = 0.013$, $t_{(6)} = 3.084$), and Anethum ($P = 0.023$, $t_{(6)} = 2.743$) groups. This difference was insignificant in the control group ($P = 0.084$, $t_{(6)} = 1.941$). These changes caused decreases in the aerobic training and Anethum (4.15%), aerobic training (1.00% r), and Anethum (1.20%) groups and caused increases in the control group (4.00%). The results of the Pearson correlation coefficient between pre-test and post-test values of BMI were significant in the aerobic training, and Anethum ($P = 0.002$, $r_{(7)} = 0.853$), aerobic training ($P \leq 0.001$, $r_{(7)} = 0.986$), and Anethum ($P \leq 0.003$, $r_{(7)} = 0.975$) groups. Aerobic training and Anethum herbal supplementation, aerobic training alone, and Anethum alone effectively reduced the BMI of inactive obese men, and the trend of changes was regular.

The difference between pre-test and post-test means of waist-to-hip ratio was significant in the aerobic training, and Anethum ($P \leq 0.001$, $t_{(6)} = 6.596$), aerobic exercise ($P = 0.005$, $t_{(6)} = 3.720$), Anethum ($P = 0.001$, $t_{(6)} = 5.287$), and control ($P = 0.023$, $t_{(6)} = 2.739$) groups. These changes caused decreases in the aerobic training and Anethum (3.50%), aerobic training (3.35%), and Anethum (2.15%) groups and caused increases in the control group (2.85%). The results of the Pearson correlation coefficient between pre-test and post-test values of waist-to-hip ratio were significant in the aerobic training, and Anethum ($P \leq 0.001$, $r_{(7)} = 0.936$), aerobic exercise ($P = 0.003$, $r_{(7)} = 0.746$), and Anethum ($P \leq 0.001$, $r_{(7)} = 0.956$) groups. Aerobic training and Anethum, aerobic training alone, and Anethum alone effectively reduced the waist-to-hip ratio of inactive obese men, and the trend of changes was regular.

The difference between pre-test and post-test means of %BF was statistically significant in the aerobic training, and Anethum ($P = 0.006$, $t_{(6)} = 3.586$), aerobic training ($P = 0.009$, $t_{(6)} = 3.286$), Anethum ($P = 0.004$, $t_{(6)} = 3.767$), and control ($P = 0.003$, $t_{(6)} = 4.070$) groups. These changes caused decreases in the aerobic training and Anethum (7.22%), aerobic training (8.07%), and Anethum (6.88%) groups and caused increases in the control group (6.50%). The results of the Pearson correlation coefficient between pre-test and post-test values of %BF were significant in the aerobic training ($P = 0.032$, $r_{(7)} = 0.677$) and Anethum ($P \leq 0.001$, $r_{(7)} = 0.933$) groups. This correlation was insignificant in the aerobic training and Anethum ($P =0.098$, $r_{(7)} = 0.552$). Both aerobic exercise alone and Anethum alone were effective in reducing the %BF of inactive obese men, and the process of change was regular; on the other hand, performing aerobic training and Anethum herbal supplementation was effective in reducing the %BF of inactive obese men, the trend was irregular.

The difference between pre-test and post-test means of serum ALT in the aerobic training and Anethum group was not statistically significant ($P = 0.098$, $t_{(6)} = 1.84$). Difference between pre-test and post-test means of serum ALT in the aerobic training ($P = 0.030$, $t_{(6)} = 2.57$), Anethum ($P = 0.032$, $t_{(6)} = 2.54$), and control ($P = 0.024$, $t_{(6)} = 2.71$) groups was statistically significant. These changes caused decreases in the aerobic training and Anethum (14.44%), aerobic training (17.54%), and Anethum (18.94%), and increases in the control group (23.60%). The results of the Pearson correlation coefficient between pre-test and post-test values of serum ALT in aerobic training and Anethum were insignificant ($P =0.54$, $r_{(7)} = 0.220$). The results of the Pearson correlation coefficient between pre-test and post-test values of serum ALT in aerobic training ($P =0.002$, $r_{(7)} = 0.856$) and Anethum ($P =0.002$, $r_{(7)} = 0.840$) groups were significant. Aerobic training and Anethum alone effectively reduced serum ALT in inactive obese men, and the changes were regular. On the other hand, while performing aerobic exercise, Anethum not only did not affect altering and reducing serum ALT, but the trend of changes in this group was also irregular.

The difference between pre-test and post-test means of serum AST was statistically significant in the aerobic training, and Anethum (P 0≤0.001, $t_{(6)}$ = 6.91), aerobic exercise (P = 0.002, $t_{(6)}$ = 4.21), Anethum (P = 0.007, $t_{(6)}$ = 3.44), and control groups (P = 0.023, $t_{(6)}$ = 2.72). These changes caused decreases in the aerobic training and Anethum (18.10%), aerobic training (19.31%), and Anethum (20.80%) groups and increases in the control group (16.58%). The results of Pearson coefficient between pretest and post-test values of serum AST in the aerobic training and Anethum (P =0.22, $r_{(7)}$ = 0.706), aerobic training (P =0.006, $r_{(7)}$ = 0.797), and Anethum (P =0.04, $r_{(7)}$ = 0.815) groups were significant. Aerobic training, Anethum herbal supplementation, aerobic exercise alone, and Anethum alone effectively reduced serum AST in inactive obese men, and changes were also regular.

The difference between pre-test and post-test means of serum ALP in the aerobic training, and Anethum (P = 0.95, $t_{(6)}$ = 0.06), aerobic training (P = 0.82, $t_{(6)}$ = 0.22), Anethum (P = 0.76, $t_{(6)}$ = 0.3), and control (P = 0.41, $t_{(6)}$ = 0.85) groups was not statistically significant. These changes caused increases in the aerobic training and Anethum (0.37%), aerobic training (0.52%), Anethum (1.90%), and control (4.73%) groups. The results of Pearson correlation coefficient between pre-test and post-test values of serum ALP variable in the aerobic training, and Anethum (P = 0.12, $r_{(7)}$ = 0.516), and Anethum (P = 0.07, $r_{(7)}$ = 0.590) groups were not significant. The results of the Pearson correlation coefficient between pre-test and post-test values of serum ALP variable in aerobic training (P = 0.032, $r_{(7)}$ = 0.677) were significant. Performing an aerobic exercise with Anethum herbal supplementation, aerobic activity alone, and Anethum alone was ineffective in changing the serum ALP of inactive obese men, and the process of changes was irregular; on the other hand, while performing aerobic training alone, the trend was regular.

Table 3 presents the results of the intergroup comparison of variables in the post-test. Differences in HDL_c [P = 0.513, $F_{(3, 24)}$ = 1.42], LDL_c [P = 0.74, $F_{(3, 24)}$ = 0.605], TC [P = 0.083, $F_{(3, 24)}$ = 2.40], TG [P = 0.175, $F_{(3, 24)}$ = 2.13], BMI [P = 0.137, $F_{(3, 24)}$ =1.962), WHR [P = 0.694, $F_{(3, 24)}$ = 0.486], ALT [P = 0.211, $F_{(3, 24)}$ = 2.36], ASP [P = 0.17, $F_{(3, 24)}$ = 2.10], and ALP [P = 0.92, $F_{(3, 24)}$ = 0.80] of obese men in the post-test was not statistically significant. However, the difference in the percentage of %BF of inactive obese men in the post-test was statistically substantial [P = 0.001, $F_{(3, 24)}$ = 6.555]. The differences between aerobic training and Anethum and control groups [P = 0.003], aerobic training and control groups [P = 0.012], and Anethum and control groups [P = 0.003] were significant.

Table 2. The results of paired samples t-test to compare the pre-and post-test of variables.

Variables	Groups	Pre-test		Post-test		Mean differences	df	t	P
		Mean	SD	Mean	SD				
HDL_c (mg/dl)	aerobic+Anethum	42.40	6.38	47.80	8.02	+5.40	6	3.995	0.003
	aerobic	39.20	7.13	46.60	9.93	+7.40	6	3.526	0.006
	Anethum	47.00	10.32	52.90	10.59	+5.90	6	4.749	0.001
	control	46.90	12.32	42.40	8.68	-4.50	6	2.676	0.025

LDL_c (mg/dl)	aerobic+Anethum	87.50	13.45	76.50	12.66	-11.00	6	4.068	0.003
	aerobic	97.00	34.43	88.10	32.59	-8.90	6	3.405	0.008
	Anethum	92.90	25.48	80.30	23.50	-12.60	6	5.240	0.001
	control	84.90	16.72	93.10	26.43	+8.20	6	2.201	0.055
TC (mg/dl)	aerobic+Anethum	153.70	21.89	137.50	19.69	-16.20	6	3.373	0.008
	aerobic	142.50	23.82	131.00	28.77	-11.50	6	2.558	0.031
	Anethum	157.20	27.24	134.10	25.29	-23.10	6	3.293	0.009
	control	146.40	25.10	165.00	29.37	+18.60	6	3.006	0.015
TG (mg/dl)	aerobic+Anethum	153.80	34.36	126.00	39.32	-27.80	6	3.973	0.003
	aerobic	149.80	28.06	127.30	33.59	-22.50	6	2.422	0.038
	Anethum	136.60	24.82	116.90	25.06	-19.70	6	3.986	0.003
	control	150.70	27.07	158.10	26.89	+7.40	6	0.704	0.499
BMI (kg/m^2)	aerobic+Anethum	28.14	1.54	26.97	1.41	-1.17	6	4.548	0.001
	aerobic	28.33	1.72	28.04	1.65	-0.028	6	3.084	0.013
	Anethum	26.65	1.66	26.33	1.60	-0.32	6	2.743	0.023
	control	26.49	1.80	27.56	1.86	+1.06	6	1.941	0.084
W/H	aerobic+Anethum	0.800	0.37	0.772	0.33	-0.028	6	6.596	≤0.001
	aerobic	0.804	0.31	0.777	0.34	-0.027	6	3.720	0.005
	Anethum	0.791	0.29	0.774	0.32	-0.017	6	5.287	0.001
	control	0.770	0.40	0.792	0.57	+0.022	6	2.739	0.023
%BF	aerobic+Anethum	27.70	1.94	25.70	1.76	-2.00	6	3.586	0.006
	aerobic	28.50	2.67	26.20	2.82	-2.30	6	3.286	0.009
	Anethum	27.60	3.20	25.70	1.88	-1.90	6	3.767	0.004
	control	17.70	3.02	29.50	2.41	+1.80	6	4.070	0.003
ALT (Unit/liter)	aerobic+Anethum	18.00	4.34	15.40	2.31	-2.60	6	1.84	0.098
	aerobic	22.80	9.05	18.80	6.23	-4.00	6	2.57	0.030
	Anethum	19.00	7.51	15.40	4.45	-3.60	6	2.54	0.032
	control	17.80	5.07	22.00	7.02	+4.20	6	2.71	0.024
AST (Unit/liter)	aerobic+Anethum	19.90	1.44	16.30	2.31	-3.60	6	6.91	≤0.001
	aerobic	23.30	5.51	18.80	4.93	-4.50	6	4.21	0.002
	Anethum	22.60	6.22	17.90	2.68	-4.70	6	3.44	0.007
	control	19.90	3.31	23.20	3.48	+3.30	6	2.72	0.023
ALP (Unit/liter)	aerobic+Anethum	132.70	28.20	133.20	21.46	+0.50	6	0.06	0.95
	aerobic	152.70	25.46	153.50	24.07	+0.80	6	0.22	0.82
	Anethum	152.70	32.65	155.60	34.05	+2.90	6	0.30	0.76
	control	137.20	29.52	143.70	36.78	+6.50	6	0.85	0.41

Table 3. The results of one-way analysis of variance to compare the between-group in the post-test.

Variables	Source of variations	Sum of squares	df	Mean of the sum of squares	F value	P	Result
HDL_c (mg/dl)	Between-group	560.475	3	186.825	1.42	0.513	Non-significant
	Within-group	3157.300	24	131.55			
	Total	3717.775	27	-------			
LDL_c (mg/dl)	Between-group	1685.600	3	561.867	0.605	0.74	Non-significant
	Within-group	22268.400	24	927.85			
	Total	23954.000	27	-------			
TC (mg/dl)	Between-group	7326.200	3	2442.067	2.40	0.83	Non-significant
	Within-group	24465.400	24	1019.391			
	Total	31791.600	27	-------			
TG (mg/dl)	Between-group	9672.875	3	3224.292	2.13	0.175	Non-significant
	Within-group	26233.900	24	1006.497			
	Total	45906.775	27	-------			

BMI (kg/m^2)	Between-group	16.488	3	5.49	1.962	0.137	Non-significant
	Within-group	67.224	24	2.801			
	Total	83.712	27	-------			
W/H	Between-group	0.002	3	0.001	0.462	0.694	Non-significant
	Within-group	0.048	24	0.002			
	Total	0.05	27	-------			
%BF	Between-group	100.675	3	23.558	6.555	0.001	Significant
	Within-group	122.856	24	5.119			
	Total	223.531	27	-------			
ALT (Unit/liter)	Between-group	301.20	3	100.40	2.36	0.211	Non-significant
	Within-group	1020.40	24	42.52			
	Total	1321.60	27	-------			
AST (Unit/liter)	Between-group	261.70	3	87.233	2.10	0.170	Non-significant
	Within-group	996.96	24	41.54			
	Total	1258.66	27	-------			
ALP (Unit/liter)	Between-group	3165.40	3	1055.133	0.80	0.92	Non-significant
	Within-group	31976.60	24	1332.36			
	Total	35142.00	27	-------			

4. Discussion

Performing eight weeks of aerobic training combined with Anethum herbal supplementation significantly reduces low-density lipoprotein serum cholesterol, total serum cholesterol, serum triglyceride, body mass index, waist-to-hip ratio, alkaline phosphatase, alanine enzymes, and aspartate aminotransferase in the fasting state of inactive obese men. In addition, these variables' reduction rate was more significant in all intervention groups than in the control group. However, no significant differences were observed between the research groups, possibly due to the subjects' non-observance of the average daily diet, the dosage of Anethum herbal supplement, and even the variables of aerobic training.

Consistent with the findings of the present study, Kojouri et al. (2007), Bahrami Kia et al. (2009), Piri et al. (2010), Rashid Lemir et al. (2012) reported the effect of Anethum herbal supplement on weight loss, and serum lipid, and liver anzymes modulation (10, 13-15); in addition, Ossanloo et al. (2012), Eftekhari et al.(2015), Nazari et al. (2023), Falah et al. (2020), Nazari et al. (2014), Orhan et al.(2015) reported the desired changes, and positive, and beneficial effects of different types of physical activity, and exercise in different intensities, and duration on body composition factors, lipid profile, and liver enzymes in men, and women with various age ranges, and different levels of fitness, and health (2, 16-20).

Anethum comprises herbal compounds containing 83% dill seed leaves, 6% chicory root and flower extracts, 6% fumitory leaves, and 5% dried lime. Clinical trials on this product have confirmed its hypoglycemic effects. The therapeutic effect of dill may be related to the flavonoids and volatile oils present in this plant. Dill contains significant amounts of the flavonoids quercetin and isoramentin. Quercetin and isoramentin have been shown to lower total triglyceride levels. Part of this quercetin-lowering effect is due to the reduced production of ApoB-100 by the liver, which reduces the production of very low-density plasma lipoproteins, decreasing total triglycerides. The flavonoids in dill also prevent particle oxidation by activating antioxidant enzymes. Essential oils in dill, such as lemon, caron, and antofuran, also activate antioxidant enzymes such as glutathione transferase (14, 21).The compounds in Anethum increase bile secretion, and the quercetin and lactocopicrin in this product also have an inhibitory effect on lipoxygenase enzymes. Clinical and field experiments have also shown that extracting fumitory prevents the formation of gallstones and is, therefore, beneficial. The active ingredients in Anethum are volatile oils such as carvone, limonene, bitter glycoside, lactocopicrin, alkaloids, protopine, and hesperidin. Dill contains d-carvone, limonene, and alpha-phellandrene, which lower blood lipids. Chicory plant with bitter glycoside (shicoridin or sicuridine) is a heart tonic. The aerial part of the fumitory contains alkaloids benzyl isokinoline derivatives. Fumarin is effective in vascular diseases, atherosclerosis, and the treatment of hypertension; also, lime contains citric acid and has high vitamin C, blood pressure, and blood lipid-lowering effects. Each tablet also contains 2 to 4 mg of carvone (11).

In Seron's (2013) research, the effect of two 12-week programs of aerobic training (three times a week) and resistance training (twice a week) on body composition was investigated. There were no significant changes in the body fat percentage of the two groups, which is inconsistent with the present study (22). However, in line with the present study, the aerobic training group's body mass index and waist circumference decreased. In contrast, in the control and resistance training groups, no significant changes were seen in these variables. Silva et al. (2014) examined the effect of aerobic sport on body composition and fat profile for 12 weeks. In their study, body fat percentage and fat mass decreased, but high-density lipoprotein and lean body mass increased. These findings suggest that regular exercise reduces the risk of cardiovascular disease (8). Jaywant (2013), in a study entitled "The Effect of Aerobic Training on Body Fat Distribution and Cardiovascular endurance in Middle-aged Women," showed that the effects of aerobic training on weight loss are significant. Still, an increase in the intensity of training to achieve Vo_{2max} can cause muscle damage (7). Orhan (2015) showed that 12 weeks of aerobic exercise significantly differed in low-density lipoprotein, high-density lipoprotein, cholesterol, triglyceride, weight, body fat percentage, body mass index, and maximal oxygen consumption in the training group (20). Bielay (2013) investigated the combined effect of aerobic and resistance training on the body composition of obese adults for 12 weeks. The results showed that combining these two types of exercise significantly affects weight loss, %BF, BMI, FBS, and TC. Eftekhari et al. (2015) suggested that the role of aerobic training in increasing lipolysis of adipose tissue is one of the reasons for lowering serum lipids and improving body composition.Exercise helps increase lipolysis and fat metabolism by acting on beta-adrenergic receptors, stimulating the central nervous system, and the secretion of epinephrine. Aerobic training reduces serum insulin concentration as a lipolysis inhibitor, increasing fat oxidation. In addition, training-induced adaptation to fat metabolism, including lowered triglycerides and increased lipoprotein lipase activity, are the main reasons for increased serum cholesterol lipoprotein and decreased serum lipoproteins, and lipids in muscle, serum, liver, and even adipose tissue (16, 23-27).

Shearman et al. (2010) showed that 12 weeks of aerobic training with an intensity of 60-50% of the heart rate reserve reduces triglycerides and does not change total cholesterol, high-density lipoprotein, and low-density lipoprotein in middle-aged men. Lack of changes in serum lipids and lipoproteins in moderate to low-intensity training can be attributed to factors such as the short duration of the training, and low-intensity exercise program, their initial concentrations, the dependence of lipoproteins on triglycerides, and lack of decreasing it, as well as lack of significant decrease in abdominal fat due to training or taking herbal supplements. The reason for the discrepancy in the results of the previous research can be the intensity and duration of the training period, age, gender, health status of the subjects, the body composition of the issues at the beginning of the research, type, and amount of the supplement, and other factors. Exercise increases the activity of the enzymes lipoprotein lipase and lecithin cholesterol acyl transferase. These two enzymes reduce low-density lipoprotein, triglyceride, and cholesterol and increase high-density lipoprotein. The enzyme lipase accelerates the transfer of lipids from chylomicrons and very low-density lipoprotein to high-density lipoprotein. Lipoprotein lipase activity is determined by lowering serum triglycerides after training. This reduction can increase the concentration of high-density lipoprotein. The present study has probably been able to stimulate these mechanisms (28). Therefore, one can hopefully reduce the amount of abdominal fat, subcutaneous fat, and serum lipids by exercising and possibly taking herbal supplements such as Anethum.

A lot of effort has been made to control, eliminate, or limit the interfering variables; however, maintaining and limiting some factors such as the subjects' lack of complete availability, environmental conditions, lifestyle, the subjects' level of motivation, nutritional conditions, the amount of activities outside the framework of the issues, and possibly taking some drugs, and supplements can result in different consequences. With this in mind, and based on the results of this study, it is suggested that different doses of Anethum herbal supplement be studied along with other types, intensities, and duration of training protocols.

5. Conclusion

It is recommended that inactive obese individuals who intend to lose weight, reduce blood lipids and liver enzymes, and plan to reduce the risk of cardiovascular disease consult their physicians, perform endurance training protocols such as aerobic training under the supervision of sports scientists, and use Anethum herbal supplement, that can reduce and modulate lipid profile risk factors for cardiovascular disease.

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