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The Effect of Aerobic Training with Green Coffee on Body Composition and Lipid Profile in Overweight Women

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Abstract

Introduction: Consumption of green coffee may play a protective role against various diseases in modern societies, such as obesity. The aim of this study was to investigate the effect of eight weeks of aerobic training with green coffee on body composition and lipid profile in overweight women.

Methods: In this semi-experimental study, 30 overweight housewives were selected voluntarily and randomly divided into experimental (aerobic training-green coffee, 15 people) and control (aerobic training, 15 people) groups. Experimental (aerobic training-green coffee) and control (aerobic training) groups participated in the aerobic training program for 8 weeks, 3 sessions per week, 60 minutes each session with intensity of 70-80% of maximum heart rate. The subjects of the green coffee group daily consumed 90 mg of green coffee for 8 weeks. Data were analyzed with covariance analysis at $p \leq 0.05$.

Results: Eight weeks of aerobic training and green coffee consumption had no significant effect on waist to hip ratio, body fat percentage, BMI, body mass, TG and HDL in overweight women ($P>0.05$). However, eight weeks of aerobic training and green coffee consumption significantly decreased cholesterol ($P=0.001$) and LDL ($P=0.01$) in overweight women.

Conclusion: According to the findings of study, eight weeks of aerobic training and green coffee consumption caused a significant decrease in cholesterol and LDL in overweight women. Therefore, it can be said that probably aerobic exercise and green coffee consumption can reduce the harmful lipids in overweight individuals.

Keywords: Training, Green Coffee, Body Composition, Lipid Profile, Obesity

Introduction

The prevalence of obesity and overweight has significantly increased in all societies and is likely to continue in the future (1). General health concerns are important because obesity plays a negative impact on health. The risk of developing diabetes type 2, cardiovascular diseases, types of cancer, and even mortality is directly related to the degree of obesity (2, 3). The prevalence of obesity, especially abdominal obesity, is higher in women than in men. The women with high body mass index and high lipid profile are more likely to be at the risk of infertility, polycystic syndrome, high blood lipids and cancer (4, 5). Due to the high level of overweight and obesity associated with the development of cardiovascular diseases, the changes in lifestyle such as exercise and change in dietary habits are suggested. Evidence suggests that exercise is one of the most significant methods to improve lifestyle and its beneficial effects on cardiovascular disease are well documented (6). Therefore, physical activity may decrease the cardiovascular risk factors and mortality by reducing inflammatory indices, coagulation indices, body fat, and obesity (7). However, the effect of physical activity on the lipid

profile varies depending on the severity, duration, and type of exercise. Clinical and epidemiological studies have recently shown that photochemicals are one of the richest bioactive compounds in plants, which reduce the risk of cardiovascular disease, cerebrovascular events, and the incidence of certain types of cancer and oxidative stress (8). Green coffee extract contains a high concentration of chlorogenic acids which is known for health effects on lipid and glucose metabolism (9), reducing lipid intake in the intestine, and reducing the lipid metabolism in the liver (10). Coffee beans have a complex matrix with some substances which can interact with the human body, for example, the development of antioxidant activities and stimulation of the nervous system. Drinking coffee reduces serious social illnesses such as diabetes type 2, Alzheimer's, Parkinson's, and liver cancer (11, 12). Green coffee polyphenols cause a wide range of effects including the effects on weight loss, better glucose homeostasis, lipid metabolism, lower blood pressure, and better nerve-related illness (13). Physical inactivity has become a major cause of increased lipid accumulation in the body. This relationship has led to a higher incidence of cardiovascular events and mortality among the people with a low level of physical activity, as well as with other chronic noncommunicable diseases (14). Therefore, considering the direct relationship between lipids and myocardial infarction, regulating blood lipids is an important factor in health. Undoubtedly, the habit of proper exercise is significant in this regard. On the other hand, using various medicinal plants has traditionally been widely used in treating many illnesses as well as improving sport functions. Green coffee is one of the medicinal plants which reduces body fat by increasing metabolism due to the high amount of chloroform acid. Green coffee extract is known as an important weight loss diet for weight loss (13). However, no study has addressed the effects of aerobic exercises and green coffee supplement on lipid profile and body composition in overweight individuals. Thus, the present study aimed at investigating the effect of eight weeks aerobic training with green coffee on body composition and lipid profile in overweight women.

Methods

The method of this study was quasi-experimental and one-blind clinical trial was conducted as pre-test and post-test. The population included overweight non-active housewives referring to sports clubs in Qazvin in 2017. The age range of the subjects in this study was 25 to 35 years who were selected from volunteers of sports clubs in Qazvin. All of them were healthy non-athlete women. None of the subjects had a history of chronic disease such as cardiovascular disease, diabetes, various cancers, kidney and digestive disorders, or any kind of injury or problem preventing them from involving in physical activities. In order to select the statistical sample, the disease record questionnaire was distributed in sports clubs in Qazvin and were asked to participate voluntarily in this study if they wanted. The invitation provided an explanation of the research method and training program. Accordingly, 32 subjects were eligible for this study. Therefore, using Morgan's table, 30 subjects were invited to participate in the briefing and randomly divided into two experimental (training + green coffee, 15 subjects) and control (training; 15 subjects) group. After grouping the subjects, the first venipuncture (one day before training and green coffee consumption) was performed. At the beginning of the session, the subjects' height was measured by using the Seca stadiometer, made in Germany without shoes while the legs clenched and the buttocks, shoulders, and back were in contact with the stadiometer. Measuring the weight was conducted with lightweight, without shoes and with a digital scale of the Seca, made in Germany. Subsequently, the subjects' body composition was calculated using a 220-in-

body device, Model 240, made in Japan. One day after the venipuncture at the first stage and measurement of physical and physiological indices in both groups, the subjects participated in aerobic exercise for eight weeks for three days per week. The experimental group received green tea for eight weeks. In addition, one day after the venipuncture at the first stage and measurement of physical and physiological indices, the experimental group received a teaspoon of green coffee equivalent to 90 mg of solution in 250 ml every day at 20 minutes before breakfast and 20 minutes before lunch (15). After completing the last session in both groups, the second venipuncture was performed before breakfast. In addition, the physical and physiological indices of the subjects were measured. In order to conduct an aerobic training program, the subjects in the experimental and control participated in an aerobic training program of eight weeks, three sessions per week, 60 minutes each session, with intensity of 70-80% of the maximum heart rate after measuring the anthropometric characteristics. The aerobic training program included 10 minutes of stretch and warm up, 10 minutes of slow or average-speed jogging, 25 minutes of aerobic movements including V-STEP, MAMBO, EASY-WALK, GRAB-ONE motions and so on with hand movements, 15 minutes of sit-up, and finally the cool down. A full supervision was performed on the exercise movements, aerobic blocks, and learning both control and experimental groups during the whole training (16). In order to evaluate the biochemical variables, venipuncture was performed after 12-14 hours of fasting before and after eight weeks (24 hours after the last exercise session). At each stage, 10 ml of blood was taken from the antitumor vein of the left hand of subjects at a rest and sitting position. Blood samples were stored at -80 ° C after centrifugation and serum separation until the tests were conducted. In order to prevent the effect of circadian rhythm, venipuncture was performed at a specific time of day (8.5 to 9.5) in the morning. The kits of Teknikan Company and enzymatic method (calorimetry) were used to measure the lipid indices (TG, TC, LDL, HDL). The Kolmogorov-Smirnov test was used to ensure the normal distribution of variables. After determining the normal distribution of data, ANCOVA was used to compare physiological and biochemical variables. All calculations were performed using SPSS software version 22. The significance level of tests was considered to be $P < 0.05$.

Results

Table 1 shows the mean and standard deviation of the subjects' personal characteristics. The results of ANCOVA for studying the effect of green coffee consumption on the waist to hip ratio of overweight women after eight weeks of aerobic training indicated no significant difference between two groups of green coffee and control group (P=0.44). In addition, body fat percentage in overweight women after eight weeks of aerobic training showed no significant difference between the two groups of green coffee and control (P=0.991). Body mass index (BMI) of overweight women after eight weeks of aerobic training showed no significant difference between the green coffee and control groups (P=0.65). The lean body mass indices of overweight women after eight weeks of aerobic training indicated no significant difference between the green coffee and control groups (Table 2). The results indicated that the cholesterol levels of overweight women after eight weeks of aerobic training reported a significant difference between the green coffee and control groups (P=0.001). The TG values of overweight women after eight weeks of aerobic training showed no significant difference between the green coffee and control groups (P=0.41). Further, the LDL values of overweight women after eight weeks of aerobic training showed a significant

difference between the green coffee and control groups (P=0.01). Finally, the HDL values of overweight women after eight weeks of aerobic training showed no significant difference between the green coffee and control groups (P =0.10) (Table 2).

Table 1. Mean and standard deviation related to the subjects' personal characteristics

Group Variable		Green coffee	Control
Age (year)		30.4 ± 26.82	28.5 ± 20.53
Height (m)		160.5 ± 0.94	160.5 ± 60.46
Weight (kg)		76.9 ± 13.29	75.8 ± 04.44
Waist to hip ratio (WHR)	pretest	0.0 ± 917.05	0.0 ± 911.06
	Post-test	0.0 ± 915.05	0.0 ± 903.066
BMI (kg/m)	pretest	27.4 ± 73.36	28.7 ± 34.61
	Post-test	27.4 ± 59.12	28.7 ± 35.48
Body fat (percentage)	pretest	37.4 ± 68.92	37.7 ± 61.55
	Post-test	37.6 ± 33.06	37.7 ± 25.94
Lean body mass (LBM)	pretest	43.7 ± 95.12	43.6 ± 55.60
	Post-test	44.09 ± 7.83	43.78 ± 6.06

Table 2. ANCOVA results for the changes in body composition and lipid profiles

Variable	Group	Pretest	Post-test	Modified Mean	The results of ANCOVA
Waist to hip ratio (CM^2)	Green coffee	0.917 ± 0.05	0.915 ± 0.05	0.913	$F_{1,27}$= 0.593, sig = 0.448, Eta = 0.022
	Control	0.911 ± 0.06	0.903 ± 0.06	0.906	
BMI (kg/m)	Green coffee	27.73 ± 4.36	27.59 ± 4.12	27.878	$F_{1,27}$= 0.210, sig = 0.651, Eta = 0.008
	Control	28.34 ± 7.61	28.35 ± 7.48	28.056	
Body fat (percentage)	Green coffee	37.68 ± 4.92	37.33 ± 6.06	37.294	$F_{1,27}$= 0.001, sig = 0.991, Eta = 0.001
	Control	37.61 ± 7.55	37.25 ± 7.94	37.286	
Lean body mass (kg)	Green coffee	43.95 ± 7.12	44.09 ± 7.83	27.878	$F_{1,27}$= 0.016, sig = 0.900, Eta = 0.001
	Control	43.55 ± 6.60	43.78 ± 6.06	28.056	
Cholesterol (mg/dL)	Green coffee	167.40 ± 27.56	160.73 ± 17.59	176.556	$F_{1,27}$=15.793, sig = 0.000,* Eta = 0.369
	Control	183.40 ± 45.78	161.60 ± 35.88	152.444	
TG (mg/dL)	Green coffee	122.73 ± 36.6	111.93 ± 42.37	104.469	F1,27=0.688, sig = 0.414, Eta = 0.025
	Control	103.53 ± 51.63	44.09 ± 7.83	96.597	
LDL (mg/dL)	Green coffee	90.23 ± 20.41	86.53 ± 13.57	94.051	$F_{1,27}$= 6.732, sig = 0.015,* Eta = 0.200
	Control	95.93 ± 28.52	86.67 ± 22.33	82.849	
HDL (mg/dL)	Green coffee	42.33 ± 5.57	46.43 ± 7.71	48.454	$F_{1,27}$= 2.825, sig = 0.104, Eta = 0.095
	Control	46.87 ± 8.59	46.93 ± 9.06	44.913	

* Significant difference at P≤0.05 level

Discussion

The present study aimed at investigating the effect of eight weeks aerobic training with green coffee on body composition and lipid profile in overweight women. The findings of this study showed that eight weeks of aerobic training and green coffee consumption had no significant effect on waist to hip ratio, body fat percentage, BMI, body mass, TG and HDL in overweight women. In addition to glycemic control and increased insulin sensitivity, exercise can improve cardiovascular risk factors such as visceral fat, lipid profiles, arterial tension and endothelial function (17). As a result, the exercise intensity can affect HDL levels so that HDL levels can be significantly increased after high intensity exercises, compared to low intensity exercises (18). Since the body weight, its changes, and body composition affect lipoproteins (19), significant changes should occur in fat percentage, weight, and body composition in order to have a favorable effect on lipoproteins. As mentioned, if exercise changes the body composition and fat percentage, it can affect the lipoproteins although the useful change of lipoproteins was observed without weight loss (19). A study indicated that lipid profile correlates with body fat changes. However, in the present study, the percentage of subjects' fat after training showed no significant change and it seems that the reason for these contradictions is different exercise patterns (20). In addition, the changes in lipid profile may be associated with other mechanisms such as changes in concentrations of plasma hormones, lipoprotein lipase, and other factors. On the other hand, the level of health and base level of individuals affects the percentage of blood lipid in response to exercise. In fact, the normal level of base fat may be regarded as the reason. For example, high HDL is less effective than exercise (21). The results of this study as no change in lean body mass of overweight women after eight weeks of aerobic training and green coffee consumption were consistent with the study of Saket *et al.* (2017) indicating that six weeks of combined exercise and consumption of green coffee at 250 mg / day had no significant effect on the lean body mass of overweight women (22). Coffee is one of the most popular beverages in the world and its beneficial effects on human health have been the subject of many studies (10, 23, 24). Green coffee is known as one of the rich sources of chlorogenic acid (25, 26). Most effects of green coffee on weight loss are related to chlorogenic acid which is an important intermediate for biological synthesis (27). In this regard, some clinical studies were conducted to evaluate the commercial efficacy and safety of green coffee in reducing body weight and body mass in overweight adults (28-31). The results of a clinical study of 30 overweight individuals showed that the consumption of coffee-rich chlorogenic acid for 12 weeks resulted in a significant decrease in body mass index and body fat, compared to the control group (15). In a randomized, double-blind, placebo-controlled trial, Vinson examined high doses of green coffee (1050 mg) and a low dose of green coffee (700 mg) or placebo in 16 overweight adults over a six-week period and two-week washout period. The results showed a significant reduction in body weight, body mass index, and body fat percentage (31). Furthermore, the usage dose of green coffee in this study was low while more doses are required for the effectiveness of green coffee on lipid profiles. Therefore, future research should address this issue. In addition, the results of this study indicated that eight weeks of aerobic training as well as the combination of aerobic training and green coffee consumption caused a significant decrease in cholesterol and LDL in overweight women. The level of blood cholesterol is influenced by the balance between intestinal cholesterol and cholesterol from food intake. In the present study, nutrition and stress were not controlled. In the present study, only cholesterol and LDL levels were significantly decreased in overweight women perhaps due

to pressure and duration of exercise. The mechanism of the effect of these types of exercises for improving the lipid profile is related to the enzyme processes involved in lipid metabolism. In this regard, an increase in lipoprotein lipase activity was reported (32). Although one of the limitations of the present research was the lack of measuring these enzymes, Sogiora *et al.* stated that regular exercise with increased lipoprotein lipase enzyme activity and lipid peroxidase cholesterol acetyltransferase (LOC) decrease the total cholesterol and LDL (33) On the other hand, the findings indicated that the beneficial effects of exercise on different types of lipoproteins are strongly correlated with high intensity of exercise, so that the amount and intensity of exercise, along with the use of supplements, leads to a higher percentage of recovery (34). The blood cholesterol level regulation system is located in the endoplasmic membrane which is important for maintaining the cholesterol homeostasis. In fact, this regulation system responds to the intracellular cholesterol levels, so that the gene expression increases with the reduction of intracellular cholesterol levels. Increasing the LDL-R expression removes more plasma cholesterol and increases the clearance of LDL- C (35). In addition, some studies showed that green coffee enhances energy metabolism and reduces lipogenesis by decreasing the SREBP-1c (regulatory protein binding protein) and related molecules leading to the inhibition of body fat accumulation (10). According to some scientific theories, the natural ingredients in green coffee prevent weight gain and fat accumulation by inhibiting fat absorption and increasing fat metabolism in the liver (36). Using the coffee polyphenol as supplement can be effective in weight loss and reduction of abdominal fat and liver accumulation by controlling the penetration of macrophages into fatty tissues (37). In general, the biological mechanism that may improve the lipid profile, along with physical activity is not well-known. Some researchers believed that changes in LDL can be related to the increase in LPL and the reduction of Apolipoprotein B hepatic lipase due to exercise (21). Perhaps, if the exercise period was associated with green coffee consumption for more than eight weeks, it could allow more comparability of enzymes and hormones, and provide further change in the lipid profile. In addition, dietary control, and mental and emotional states of subjects were regarded as the limitations of the study.

Conclusion

In general, the results of this study indicated that eight weeks of aerobic training and green coffee consumption caused a significant decrease in cholesterol and LDL in overweight women. Therefore, according to the findings of this research, aerobic training and green coffee consumption can reduce the harmful lipids in overweight individuals. Due to the meagerness of studies conducted in this regard, the effect of aerobic training with green coffee consumption on the improvement of lipid profiles in overweight individuals requires more studies.

Ethical issues

Not applicable.

Authors' contributions

All authors equally contributed to the writing and revision of this paper.

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