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Research Article

The Effect of an Aerobic Training Course with Curcumin Supplementation on Serum Lipid Profile in Obese Male Rats

Somayeh Sadeghnia[1], Abbas Fattahi Bafghi[2]*, Narges shishebori 3

1. Department of Physical Education and Sport Sciences, Yazd Branch, Islamic Azad University, Yazd, Iran
2-Department of Physical Education and Sport Sciences, Yazd Branch, Islamic Azad University, Yazd, Iran
3-Department of Physical Education and Sport Sciences, Yazd Branch, Islamic Azad University, Yazd, Iran.

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Abstract

Background: Today, research has shown that the combination of physical activity and supplements can have more beneficial effects on diseases, so the purpose of this study is to investigate the effect of a period of aerobic training combined with consumption Curcumin supplement is based on serum lipid profile of obese rats.

Materials and Methods: In a semi-experimental and applied study, 32 obese male rats of 6 months with Wistar breed with a weighted average of 332/28 Grams and standard deviation of 9 after 7 days of acquaintance with the laboratory environment were randomly divided into 4 groups of 8 (control, training, supplement and training-supplement). The training-supplementation and training groups underwent aerobic training for 6 weeks and 4 sessions in each week, according to the training protocol.

Supplement and training- Supplements Groups also for 6 weeks and 4 meals every week, one hour before the start of training, 50 mg of curcumin per kilogram of body weight was gavage. 24 hours after the last training session, while fasting for 12 hours, all subjects were anesthetized with ketamine and xylazine solution and blood was taken from the posterior orbital sinus of the rats. The collected blood samples were immediately transferred to the laboratory to measure the variables. In order to analyze the data at the descriptive level, mean and standard deviation tests were used, and at the inferential level, the Shapiro-Wilk test was used to check the normality of the data, and the two-way ANOVA test was used to check the interaction effect of the groups. data analysis It was done with using spss software version 26 and at a significance level ($P \leq 0.05$).

Results: The results of the research showed that a course of aerobic training and curcumin supplementation had a significant effect on TG and HDL of obese rats. It was also observed that a course of aerobic training and curcumin supplementation had no significant effect on TC and LDL of obese rats.

Conclusion: The results showed that aerobic training and curcumin supplementation can be used simultaneously to improve the lipid profile of obese people, especially in HDL and TG indices.

***Corresponding author:** Abbas Fattahi Bafghi
Address: Department of Physical Education and Sport Sciences, Yazd Branch, Islamic Azad University, Yazd, Iran
Email: abbasfattahi_60@yahoo.com **Tell**: +983531872506
A F: 0000-0003-0519-3262

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1. Introduction

Globally, the prevalence of overweight and obesity is increasing. The World Health Organization estimates that more than 2 billion people worldwide are overweight, of which 344 million are obese. Obesity affects the functioning of various body systems and reduces life expectancy (1). Inactivity and lack of physical activity is one of the most important causes of dyslipidemia or fat disorders and can be associated with obesity and overweight and increases the risk of cardiovascular diseases. More than two-thirds of the deaths that occur in the world are related to cardiovascular diseases caused by high body mass index, which is considered as an index of obesity (2).

The consequences of obesity include cardiovascular diseases, type 2 diabetes, blood pressure and increased blood lipids. The main cause of obesity is the increase in energy intake compared to energy consumption. Therefore, establishing a balance between the calories consumed and the energy received is the most important strategy for obesity prevention and treatment (3). The increase in abdominal obesity is accompanied by increased disturbances in glucose and insulin homeostasis, as well as changes in the amount of lipids and lipoproteins in the blood, especially the increase in triglycerides, low-density lipoprotein (LDL) and decrease in high-density lipoprotein (HDL). Fat peroxidation probably plays an important role in the occurrence of cardiovascular diseases and diabetes (4).

According to studies, sports trainings can have a great contribution in preventing obesity and reducing fat and diseases related to lifestyle. Doing sports by reducing the size of WAT can also improve fat metabolism (5).

Considering the higher energy consumption associated with acute aerobic training compared to other forms of sports activity this type of activity may be more preferable for achieving a negative energy balance.

During aerobic training, the level of hormones such as insulin decreases, which is considered an effective factor on appetite (6).

From a clinical point of view, it has been proven that physical activity as a primary intervention is cost-effective and in many cases it prevents additional health costs related to many chronic diseases (7).

Research shows that aerobic training improves lipid profiles, decreases LDL, triglycerides, blood glucose, decreases body weight, body fat percentage, and increases HDL in inactive and obese men and women. Reducing body fat in these people leads to increasing antioxidant capacity, reducing oxidative stress and reducing muscle damage indicators (8).

Today, along with training, the use of various diets and supplements to improve lipid profile indicators is known, and in the past few years, the interest in investigating the role of food compounds for the control and management of various diseases has increased. In recent years, due to their cost-effectiveness and lack of side effects, they have received much attention as a therapeutic approach along with physical activities (9).

Curcumin is one of the recently noticed antioxidant supplements. Curcumin is a type of polyphenol that is extracted from the root of curcuma plant and is abundantly found in turmeric (10).

Curcumin has a positive effect on lipid profile by reducing inflammation, regulating cholesterol homeostasis, reducing LDL, fat peroxidation and increasing HDL. It also has an effect on glucose homeostasis by activating glycolysis and inhibiting glyconeogenesis, and by increasing beta-oxidation and inhibiting fatty acid synthetase activity, it reduces fat storage in the body and prevents LDL absorption (11).

Laboratory and clinical studies have shown that the interaction of curcumin with multiple signaling pathways increases the expression of adiponectin in patients with metabolic syndrome and reverses insulin resistance, hyperglycemia, hyperlipidemia and other inflammatory symptoms associated with obesity and metabolic diseases (12).

Therefore, based on the background of the current research, it seems that the use of physical trainings along with the consumption of medicinal plants such as curcumin, due to the synergistic effect, can create favorable and beneficial conditions in the state of metabolic syndrome and anti-inflammatory and antioxidant responses and improve the effects of obesity, including the profile Lipid has a positive effect. Also, there is a scientific gap in the field of investigating the interactive and simultaneous effect of aerobic training and curcumin consumption on lipid profile, so the present study was conducted with the aim of investigating the effect of a course of aerobic training along with curcumin supplementation on serum lipid profile of obese male rats.

2. Materials and Methods

This research is applied and semi-experimental, which was conducted with a pre-test and post-test design. The statistical sample of this research included 40 6-month-old male rats with an average weight of 350 grams, which were placed in four groups of 10: endurance training, curcumin supplement, training supplement and control group. Rats were kept in the animal laboratory under light-controlled conditions, 12 hours of light and 12 hours of darkness (starting light at 6 in the morning and turning off at 6 in the evening), temperature 22 ± 3 centigrade and humidity about 45%, and kept for 1 week with new environment and activity on the treadmill.

In order to get familiar with the treadmill, first the rats of the experimental group worked on the treadmill for 1 week (5 sessions), for 10 to 15 minutes in each session at a speed of 6 to 10 meters per minute with a zero-degree slope, to learn about the treadmill and the running pattern. Learn about it. Then, to accurately determine the training intensity, the maximum running speed test was performed using a treadmill in an indirect way.

The training and supplementary training groups practiced 4 sessions per week according to the set protocol for eight weeks. Aerobic training protocol on a treadmill and in the first week with a speed of 15 meters per minute, starting time of 6 minutes and each session increased to a speed of 1 to 2 meters per minute and the time was increased by 2 to 4 minutes so that in the fourth week the speed It reached 25 meters per minute and the time reached 60 minutes. After the fourth week, the intensity and duration of training remained constant until the last week (13). training program. Curcumin was obtained from Sigma, Germany and was used after dilution in DMSO (dimethyl sulfoxide) solvent with a concentration of 15% (14).

All rats were anesthetized by intraperitoneal injection of a combination of ketamine (50 mg/kg) and xylazine (4 mg/kg) 48 h after the last training session. Then, blood sampling was done directly from the heart of the rats. The blood sample was slowly drained into the inner wall of the test tube containing heparin. The test tubes were placed in the wells of the centrifuge and the machine was set at 3000 rpm for 10 minutes to separate the plasma. After centrifugation, the serum was transferred to microtube 2 by sampler and stored in a freezer at -70°C.

The level of high-density lipoprotein, low-density lipoprotein, triglyceride and total cholesterol in plasma was measured photometrically using the Pars Azmoun research kit for animal samples and according to the manufacturer's instructions. For the purpose of statistical analysis at the level of descriptive statistics of the mean and standard deviation and at the level of inferential statistics after checking the normality of the data using the Shapiro-Wilk test, for the purpose of statistical analysis of the data and comparison between the groups, two-way ANOVA test and Tukey's post hoc test was used at a significance level of less than 0.05. All statistical calculations were performed using SPSS version 26 statistical software.

3. Results

The present study was conducted with the aim of investigating the effect of a course of aerobic training and curcumin supplementation on the serum lipid profile of obese male rats. The descriptive results of the research showed that the highest average weight in the supplementary training group and the lowest average weight belonged to the control group (Table 1).

Table No. 1: Average and standard deviation of weight in research

Groups	Weighted average	standard deviation
Training - supplement	336.25	7
supplement	332.5	9
Practice	334.12	9
Control	326.25	8

According to the results of the Shapiro-Wilk test and the proof of the normal distribution of the data, the two-way analysis of variance test was used to investigate the interactive effect of the research variables. The results of this research showed that all three variables of endurance training, curcumin supplement and training-supplement improved all lipid profile indicators, but only the use of endurance training and the simultaneous use of curcumin supplement significantly reduced serum triglyceride and low lipoprotein levels. There was a significant increase in high-density lipoprotein serum level of obese rats compared to the control group ($p \leq 0.05$), but despite the decrease in total cholesterol level, its values were not significant.

On the other hand, a combined training course had no significant effect on reducing the level of triglyceride, low-density lipoprotein, and total cholesterol and increasing the level of high-density lipoprotein. Curcumin supplementation alone had no significant effect on the lipid profiles of obese rats ($p \geq 0.05$) (Table 2).

In general, the results of the present study indicated a significant interactive effect of endurance training and curcumin supplementation on the lipid profile of obese rats, or in other words, the simultaneous use of endurance training and curcumin supplementation had a synergistic effect on the improvement of lipid profile indices in obese rats. The effect was not observed in the training and supplement groups separately.

Table No. 2: Comparison of lipid profile index values of the experimental groups with the control group

Groups	TG		TC		HDL		LDL	
	Average	p	Average	P	Average	P	Average	P
Practice	167±9	0.740	78.14±6	0.145	53.49±3	0.101	28.42±2	0.927
Curcumin	155±7	0.120	76.75±8	0.521	47.75±4	0.374	35.62±5	0.126
Training-Curcumin	141±11	0.001	75.06±5	0.060	57.37±2	0.003	32.25±8	0.000

4. Discussion

In the present study, curcumin supplementation, despite the improvement in the lipid profile, but its effect was not statistically significant, which is consistent with the research results of Amirkhani et al. (2016) and Fakhri et al. 2018) and Amirsasan et al. (2023) were inconsistent (16 and 17)

However, in the present study, the consumption of a six-week period of curcumin supplementation did not have a significant effect on improving the lipid profile, which may be due to the length of the supplementation period, the supplement dose, or the animal samples.

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On the other hand, endurance training did not have a significant effect on them despite the improvement of lipid profiles.

These results were inconsistent with the research results of Naghizadeh et al. (2023) and Abdi et al.

However, the results of the present study regarding the simultaneous use of training and supplementation showed that the combination of endurance training and curcumin supplementation in obese rats led to significant improvement in lipid profile indices, including total cholesterol, triglyceride, low-density lipoprotein, and high-density lipoprotein.

These results show that the combination of curcumin extract and endurance training has a great effect on improving the levels of triglycerides, total cholesterol, high-density lipoprotein and low-density lipoprotein in obese rats, which shows the synergy of the effects of training and curcumin supplementation and their favorable effects. on the lipid profile. Very few studies have investigated the effect of training training and consumption of curcumin extract on the lipid profile of obese rats and similar to the present study, they have reported the improvement of the lipid profile.

Amir Sasan et al. (2023) and Davali et al. (17 and 21) Research has shown that curcumin prevents the formation of free oxygen radicals and its antioxidant effects may be effective in reducing the progression and complications of inflammation and hyperlipidemia. Also, curcumin inhibits the activity of fatty acid synthase (FAS) and enhances the oxidation of β-fatty acids; As a result, it can lead to an effective reduction of fat reserves, and by using this mechanism, curcumin can regulate lipid metabolism (9).

However, it seems that sports activities have increased the ability of skeletal muscles to use lipids, which reduces the level of plasma lipids. Also, it seems that another mechanism of the effectiveness of training training on improving the lipid profile is related to the enzymatic process involved in lipid metabolism. In this regard, studies have shown that regular training is associated with increased activity of lipoprotein lipase and cholesterol lecithin enzyme. These two enzymes decrease low-density lipoprotein, triglyceride and cholesterol and increase high-density lipoprotein. On the other hand, lipoprotein lipase enzyme increases the catabolism of very low concentration lipoprotein and low density lipoprotein after training (20).

Conclusion

The simultaneous use of aerobic trainings and curcumin supplementation, which was proposed and implemented in this research, produced favorable changes in the serum lipid profiles of obese rats. Therefore, it seems that this protocol was used to reduce the adverse effects of obesity on the lipid profile of obese people, although more research is needed.

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Compliance with ethical standards

Conflict of interest None declared.

Ethical approval the research was conducted with regard to the ethical principles.

Informed consent Informed consent was obtained from all participants.

Author contributions

Conceptualization: S.S., A.F.B, N.Sh ; Methodology: S.S., A.F.B, N.Sh.; Software: S.S., A.F.B, N.Sh; Validation: S.S., A.F.B, N.Sh ; Formal analysis S.S., A.F.B, N.Sh ; Investigation: S.S., A.F.B, N.Sh ; Resources: S.S., A.F.B, N.Sh ;Data curation : S.S., A.F.B, N.Sh ; Writing - original draft: S.S., A.F.B, N.Sh ; Writing - review & editing: S.S., A.F.B, N.Sh ;Visualization S.S., A.F.B, N.Sh ; Supervision: S.S., A.F.B, N.Sh ; Project administration: S.S., A.F.B, N.Sh

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