The effect of aerobic activity and L-carnitine supplementation on blood lipids

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Summary

Introduction: An increase in body fat percentage and blood lipids would threaten the health of the current generation. Several factors can affect the blood lipid profile, among which age, heredity, physical activity, and the consumption of bodybuilding supplements can be mentioned. The main goal of this research was to investigate the effect of a period of aerobic activity (6 weeks) along with L-carnitine supplementation on lipids (triglycerides and cholesterol) and lipoproteins in the blood serum of non-athletic boys in the county of Selseleh.

Material and methods: In this research, a checklist and note-taking were used to collect information from the field research method and to obtain primary data for analysis and hypothesis testing. The statistical population in this study included 30 non-athletes who were selected by available sampling and randomly divided into 3 groups of 10: the first group (aerobic activity), the second group (L-carnitine-supplement consumption), and the third group (aerobic activity-L-carnitine-supplement consumption).

Results: For the statistical analysis of data in this study, a semi-experimental, pre-test-post-test method was used. According to the obtained results, it was found that aerobic activities alone can reduce blood serum lipids and lipoproteins, and taking L-carnitine supplement can reduce blood serum lipids, but it did not have a positive effect on reducing lipoproteins.

Conclusions: According to the results, aerobic activity is the most effective approach for the reduction of blood serum lipids and lipoproteins rather than the 2 other approaches.

Key words: blood lipids, L-carnitine supplement, aerobic activities, non-athletic boys.

Introduction

Nowadays, with the development and industrialization of societies, attention to personal health and well-being (especially in middle-aged people) has increased, because the increase in body fat percentage and blood fats threatens the health of the current generation. Among the most common components of blood fat that are related to health, we can mention total cholesterol, cholesterol with low-density lipoprotein, cholesterol with high-density lipoprotein, and triglycerides. Many factors affect the percentage of body fat and blood lipid profile, including age, heredity, excess weight, smoking, physical activity, blood pressure, gender, stress, lifestyle, diet, etc. [1]. Habitual eating of processed foods, abundance of low-value foods such as chips, crisps, and soft drinks and their extensive advertising, as well as a sedentary lifestyle, have had a significant effect on overweight and obesity, which is the cause of many different diseases such as diabetes, cancer, and hypertension [1]. One of the most effective ways to prevent the complications of overweight is to control nutrition (reduce calorie intake) and increase calorie consumption with aerobic exercise. Today, the beneficial role of aerobic exercise in reducing body fat and serum lipid profile is well known [2]. On the other hand, people who do not have the opportunity to attend sports activities and those who do not see a change in their body fat percentage despite performing aerobic exercises, or who have excessive expectations to reduce their body fat, should consider using fat burning supplements, and the use of these materials is increasing day by day. Among these supplements is L-carnitine. L-carnitine is the active form of carnitine in the body, which can be prescribed and consumed as a dietary supplement. Currently, the use of carnitine, due to its direct role in lipolysis, easy access, and low cost and side effects, as well as its permissibility, has become very common among those who are looking for weight loss. According to some reports, the consumption of L-carnitine has caused changes in sugar and lipid pa-

rameters in human models, but other studies have not reported a significant effect [3–6]. In the following, some of the research conducted in this regard are mentioned. In a study by Ramezanpour *et al*. it was stated that L-carnitine consumption causes a significant decrease in fasting blood sugar but does not cause a significant change in the serum lipid profile of diabetic men [7]. In another study by Haghighi *et al*., the effect of aerobic exercise with L-carnitine supplementation was investigated. The results of their study showed that taking L-carnitine supplements significantly reduces body fat, but it has no significant effect on serum triglycerides, total cholesterol, low-density lipoprotein (LDL), and high-density lipoprotein HDL [8]. Izadi *et al*. concluded in their research that 21-day consumption of L-carnitine L-tartrate along with aerobic exercise does not affect fat metabolism [9]. Zarghami Khamene *et al*. found that consuming L-carnitine in the basic state leads to a decrease in heart rate ($p = 0.001$) and an increase in blood pressure indicators ($p = 0.024$), while the range of index changes after exercise in all groups had a significant increase ($p \geq 0.05$). Therefore, it can be concluded that the consumption of medium and high amounts of L-carnitine on cardiac indices like activity-induced vascularity has the same effect [10]. Roger *et al*., in a study titled L-carnitine supplement during recovery after exercise, stated that due to its central role in fatty acid oxidation and energy metabolism, L-carnitine as an ergogenic aid increased the exercise capacity in a healthy population of athletes [11]. Despite the relatively numerous studies that have been done, there are still conflicting results about the effects of L-carnitine on the level of serum sugar and blood lipids. The present study was conducted with the aim of investigating the effect of 6 weeks of aerobic activity along with L-carnitine supplementation on blood serum lipids and lipoproteins of non-athletic boys of Selseleh.

Table 1. Distribution of L-carnitine supplement consumption

Consumption	Frequency	Percentage
Never	8	26.7
Sometimes (for a period of time)	15	50
Continuous (for a period of time)	7	23.3
Total	30	100

Table 2. Age distribution of the statistical sample

Age range	Frequency	Percentage
Under 20-years-old	8	26.7
20–22-years-old	9	30
23–25-years-old	6	20
25–27-years-old	7	21.9
Total	30	100

Material and methods

The current research was semi-experimental (pretest and post-test) and was practical in terms of its purpose and nature because it focused on the development of applied knowledge in a specific field. The statistical population in this research consisted of 30 non-athletes who were selected by available sampling method and were randomly divided into 3 groups of 10 people: the exercise group (aerobic activity), the supplement group (L-carnitine supplement consumption), and the exercise-supplement group (aerobic activity with L-carnitine supplement consumption). The participants were homogeneous in terms of age, height, weight. They had general good health did not suffer from blood diseases, infections, or allergic conditions, and did not use drugs or tobacco. One day before the start of the study, all participants became familiar with the process of tests and the training schedule. Before conducting the research, consent forms were filled in by all the participants after being familiarized with the process of experiments and training programs. Also, the participants were asked to refrain from taking drugs or supplements, smoking, and any other factors that would affect the study.

Demographic information

In this section, the characteristics of age and education of 30 statistical samples were examined. The history of L-carnitine supplement consumption was non-athlete boys in the present study, so gender analysis was not done and all statistical samples comprised boys. Table 1 shows the L-carnitine intake information of the participants.

As can be seen in the above table, 26.7% of the participants had never used, 50% of them had sometimes used, and 23.3% had continuously used L-carnitine supplement for a period of time before participating in the research.

The age range of 30% of the statistical sample was between 20 and 22 years, while 20% of them were between 23 and 25 years old, 26.7% of them were under 20 years old, and 23.3% of the statistical sample were between 25 and 27 years old (Table 2).

46.6% of the statistical sample had attained a bachelor's degree, this figure was 23.3% for people with a master's degree, 16.6% of the studied sample had a post-

Table 3. Frequency distribution of the statistical sample based on the level of education

Level of education	Frequency	Percentage
Diploma	4	13.3
Post-diploma	5	16.6
Bachelor	14	46.6
Master	7	23.3
Total	30	100

diploma education, and 13.3% of the people had diploma education (Table 3).

Exercise protocol

High-intensity interval training was used for the exercises. Aerobic exercises were held in a 6-week period, during which 3 sessions of high-intensity aerobic exercise were performed for 45 minutes each week. The exercises were divided into 3 groups of 12-minute exercises with a 3-minute rest in between. It should be noted that 5 minutes as a warm-up and 5 minutes after the exercise as a cool-down were also performed.

Results

The result of the sample t test on the pre-test scores of the indicators in Table 4 shows that the 3 groups were homogeneous in the indicators of weight, body fat, and VO_2 max, and there was no significant difference between them ($p \geq 0.05$).

Table 5 shows the pre-test and post-test values of the dependent variables of the 3 studied groups in the pre-test and post-test situations. The results of the sample t test on the pre-test scores show that the 3 groups in the studied variables did not have a significance difference ($p \geq 0.05$).

According to the results in Table 4, it can be seen that the level of blood serum lipids, which includes triglycerides and total cholesterol, decreased in the training group. According to these results, triglyceride in the exercise group decreased 127.2–120.1 mg/dl and total cholesterol decreased 169.2–164 mg/dl. The reduction of blood serum lipids in the supplement group was lower than the training group; the triglycerides decreased 183.1–181.4 mg/dl and the total cholesterol decreased 199.8–196.7. The changes in blood serum lipids in the exercise-supplement group also reduced; the triglycerides decreased 165.6–157.9 mg/dl and the amount of total cholesterol decreased 177.1–171.6 mg/dl. According to the results in Table 2, it can be seen that blood serum lipoproteins, which included LDL and HDL, decreased in the exercise group but increased in the supplement group. Thus, the amount of LDL in the exercise group decreased 104.4–101.8 mg/dl, and the amount of HDL decreased 37.3–35 mg/dl. Blood serum lipoprotein levels were increased in the supplement group, in contrast to the training group. The amount of LDL increased 129.7–132.8 mg/dl, which shows that this group was at the highest risk from the cardiovascular perspective, and the amount of HDL increased 38.1–39.9 mg/dl. The changes in blood serum lipoproteins in the exercise-supplement group were not found to be very effective with exercise and supplement consumption; the maximum changes in LDL and HDL values were 0.5 mg/dl.

Table 4. Physiological indicators of the groups

Parameters	Groups	Measurement time		*p*-value
		Pre-test	Post test	
Weight [kg]	Exercise group	80.3 ±16.3	80.5 ±16.1	0.89
	L-carnitine-supplement group	82.7 ±9.6	82.6 ±9.9	
	p (pre-test)	0.83		
Weight [kg]	L-carnitine-supplement group	82.7 ±9.6	82.6 ±9.9	0.76
	Exercise-L-carnitine-supplement group	81.5 ±7.8	81.7 ±7.4	
	p (pre-test)	0.78		
Body fat (%)	Exercise group	25.2 ±5.7	21.4 ±6.1	0.64
	L-carnitine-supplement group	24.5 ±3.8	26.3 ±5.4	
	p (pre-test)	0.74		
Body fat (%)	L-carnitine-supplement group	24.5 ±3.8	26.3 ±5.4	0.48
	Exercise-L-carnitine-supplement group	24.9 ±6.2	23.8 ±5.9	
	p (pre-test)	0.53		
VO_2 max [ml/kg/min]	Exercise group	37.1 ±4.8	42.4 ±3.3	0.51
	L-carnitine-supplement group	38.2 ±3.9	38.6 ±2.2	
	p (pre-test)	0.44		
VO_2 max [ml/kg/min]	L-carnitine-supplement group	38.2 ±3.9	38.6 ±2.2	0.56
	Exercise-L-carnitine-supplement group	37.6 ±5	38.3 ±4.3	
	p (pre-test)	0.47		

Table 5. Pre-test and post-test values of the exercise group, L-carnitine-supplement group, and exercise-L-carnitine-supplement group

Parameters		Exercise group		L-carnitine-supplement group		Exercise-L-carnitine-supplement group	
		Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Blood serum lipids [mg/dl]	Triglyceride	67.4 ±127.2	120.1 ±56.5	183.1 ±69.7	181.4 ±68.3	165.6 ±54.7	157.9 ±59.3
	Cholesterol	20.4 ±169.2	164 ±22.8	199.8 ±38.8	196.7 ±41.5	177.1 ±63.2	171.6 ±65.8
Blood serum lipoproteins [mg/dl]	LDL	104.4 ±24.6	101.8 ±27	129.7 ±34.6	132.8 ±36.2	107.3 ±29.7	107.8 ±28.5
	HDL	37.3 ±6.2	35 ±6.8	38.1 ±5.7	39.9 ±6.2	38.7 ±6.7	39.2 ±7.1

HDL – high-density lipoprotein, LDL – low-density lipoprotein

Conclusions

The results of investigating the effect of a period of aerobic activity (6 weeks) along with L-carnitine supplementation on blood lipids of non-athletic boys in Selseleh showed that aerobic activities alone can reduce blood serum lipids, including triglycerides and cholesterol, and also that aerobic activities can reduce blood serum lipoproteins (it should be mentioned that the effect of physical exercise on plasma lipid parameters is short-lived and lasts up to about 48 hours) including LDL and HDL in the exercise group. Based on the results, body fat percentage decreased in the exercise group, the L-carnitine-supplement group, and the exercise-L-carnitine-supplement group by about 3.8%, 1.8%, and 1.1%, respectively. This means that 6 weeks of aerobic activity was more effective in the exercise group than in the 2 other groups. Based on the results, the greatest increase in maximal oxygen consumption (VO_2 max) was seen in the exercise group (increase of 5.3 ml/kg/min), and the lowest increase was seen in the L-carnitine-supplement group (about 0.4 ml/kg/min). The greatest change in weight was not significant in the 3 groups (about 0.2 kg). This part of our research was in line with a study by Villani *et al*., which showed that aerobic exercise alone leads to a decrease in fat percentage and weight loss, provided that the exercise is carried out for more than one year and with a high volume (800 minutes per week) or with an intensity of more than 80% of maximum heart rate [12]. Lofgren *et al*. showed that taking L-carnitine supplements along with aerobic exercise and eating a high-protein diet reduced body weight, body mass index, fat percentage, and waist-to-hip ratio [13]. According to the results, L-carnitine supplementation was effective on blood serum lipids, and it reduced triglyceride and cholesterol levels, but L-carnitine supplementation was not effective on blood serum lipoproteins, and we saw an increase in LDL and HDL levels compared to the pre-test. According to the obtained results, blood serum lipids decreased in the exercise-supplement group, but no significant changes were observed in blood serum lipoproteins due to aerobic activities and supplement consumption. This part of the results was in line with the results of Haghighi *et al*. [8] and Salimi Avansar [14], who both found that aerobic activity in an exercise-L-carnitine-supplement group significantly reduced body fat percentage but had no significant effect ($p > 0.05$) on triglycerides, total cholesterol, LDL, and HDL. The limitations of the present study included the low number of repetitions in this study, which increases the probability of the results being random. It is necessary to conduct this study with different repetitions and considering different supplements, to increase the degree of confidence in the results. Also, each supplement has its own prerequisites and conditions, which should be considered as control variables in the research, and their effect should be investigated to increase the accuracy of the research. It is suggested that in future research, factors affecting blood serum lipids and lipoproteins should be investigated using hierarchical methods. In this way, it is possible to examine the position of the variables considered in this research, including aerobic exercise and L-carnitine supplementation among the factors affecting blood serum lipids and lipoproteins, and a comprehensive, all-round program with the aim of improving the effect on blood serum lipids and lipoproteins and reducing the complications related to the use of L-carnitine supplements should be available to managers and sports planners, athletes, and other young people in cities and provinces.

Authors declare no conflict of interest.

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