American Journal of Sports Science and Medicine, 2013, Vol. 1, No. 4, 59-62
Available online at http://pubs.sciepub.com/ajssm/1/4/2
© Science and Education Publishing
DOI:10.12691/ajssm-1-4-2

Effects of Acute Consumption of L-Carnitine Tartrate (LCLT) Following an Exhaustive Aerobic Exercise on Serum Lipoproteins Levels in Iranian Elite Wrestlers

Mostafa Dehghani[1,*], Saeid Shakerian[2], Mohammad Kazem Gharib Nasseri[3], Massood Nikbakht[2], Sedigheh Heidari Nejad[4]

[1]Department of Physiology, Physical Education and Sports Science Faculty, Shahid Chamran University, Ahvaz, Iran
[2]Department of Physiology, Physical Education Faculty, Shahid Chamran University, Ahvaz, Iran
[3]Physiology Research Center, Jondishapoor Medical Sciences University, Ahvaz, Iran
[4]Department of Sports Management, Physical Education Faculty, Shahid Chamran University, Ahvaz, Iran
*Corresponding author: dehghani.m66@gmail.com

Received September 25, 2013; Revised October 12, 2013; Accepted October 31, 2013

Abstract **Background and Objective**: In this study, the effect of LCLT supplementation was investigated on serum levels of high-density lipoprotein, low-density lipoprotein, and very low-density lipoprotein following an exhaustive aerobic exercise in elite wrestlers. **Materials and Methods**: Twenty healthy elite male wrestlers with a mean age of 22.05 ± 2.6 years, mean weight of 77.10 ± 11.65 kg, mean height of 1.79 ± 0.06 cm, and mean body mass index of 23.79 ± 2.45 kg/m^2 were participated in this single-blind clinical trial. The subjects were selectively divided into two groups of supplement and placebo. Ninety minutes before performing Conconi protocol, the supplement group received 3 g of LCLT dissolved in 200 ml water plus 6 drops of lemon juice and the placebo group received 200 ml water plus 6 drops of lemon juice. Blood samples were collected 90 min before exercise, immediately after exercise, and 30 min after exercise from brachial vein and their serum lipoprotein concentrations were measured. The obtained data were analyzed by SPSS-16. **Result**: The findings showed that acute consumption of 3 g LCLT tartrate in the experimental group, compared with the placebo group, had a significant positive correlation with increment of high-density lipoprotein and decrement of low-density lipoprotein following an exhaustive aerobic activity, while no significant change was observed in very low-density lipoprotein. **Conclusion:** The findings of the present investigation indicate that supplementation instant LCLT effect significant change was observed in HDL, LDL and VLDL and concentrations.

Keywords: *L-carnitine tartrate, high-density lipoprotein, low-density lipoprotein, very low-density lipoprotein, exhaustive aerobic activity*

Cite This Article: Mostafa Dehghani, Saeid Shakerian, Mohammad Kazem Gharib Nasseri, Massood Nikbakht, and Sedigheh Heidari Nejad, "Effects of Acute Consumption of L-Carnitine Tartrate (LCLT) Following an Exhaustive Aerobic Exercise on Serum Lipoproteins Levels in Iranian Elite Wrestlers." *American Journal of Sports Science and Medicine* 1, no. 4 (2013): 59-62. doi: 10.12691/ajssm-1-4-2.

1. Introduction

Nutrition is one of the most important topics of medical sciences and experts believe that observing nutrition principles may have a key role in health promotion and disease prevention in all periods of life [1]. Most athletes are familiar with dietary supplements which are used for improving athletic performance [2]; such as LCLT (3-hydroxy-4-N-trimethylammonio butanoate) with a molecular weight of 161 g/mol which was extracted from meat for the first time and is involved in the transport of fatty acids into mitochondria [3]. LCLT deficiency leads to impaired fats metabolism [4]. On the other hand, physical activity results in reduced LCLT in muscles [5]. Despite abundant reserves of triglycerides in the body, liver and muscle glycogen stores are limited, thus their depletion is expectable during exercise especially during prolonged endurance activities [6,7]. Several studies have been performed about the effects of LCLT on fatty acids consumption. In this context, some have indicated that supplementation with LCLT increases fat oxidation [8], decreases carbohydrate oxidation [9], improves exercise [10], and reduces the recovery time [11]; while, some studies have reported no effect on carbohydrate oxidation [12], no change in maximal oxygen consumption (VO_{2max}) [13], and no change in heart rate, oxygen consumption, and blood lactate concentration [14].

Research evidences show that the findings about acute effects of LCLT supplement on metabolic factors and athletic performance in athlete and non-athlete population are often disparate and inconsistent, such that some reports show the beneficial impacts of this supplementation on endurance performance and others not. Therefore, the aim of the present study was to evaluate the effects of acute

consumption of 3 g LCLT on lipid metabolism in elite wrestlers performing exhaustive aerobic exercise, in order to provide new results along with other research findings.

2. Materials and Methods

The statistical population of this single-blind clinical trial consisted of elite wrestlers of Ahvaz. Following determination of sample size, 20 male wrestlers with full consent were selected as samples and signed the consent form. To measure their anthropometric variables, they were examined a few days before the test and the data on height, weight, and body mass index were determined. They were then specifically divided into two equal groups of supplement and placebo. The supplement group received 3 g of LCLT dissolved in 200 ml water plus 6 drops of lemon juice and the placebo group received 200 ml water plus 6 drops of lemon juice. The sample size was determined based on the findings of some studies on the effects of LCLT and sample size estimation for comparing the two groups, with a type I error at 5%. The confidence level for estimating sample size in this study was 95%. The subjects (Ahvaz elite wrestlers) hold national, Asian, and world championships, and they do not have any metabolic disease such as diabetes, asthma, or cardiovascular disease. Both experimental and control groups were prohibited to exercise 48 hours before the test. They were also asked to avoid consumption of coffee and dairy products at least a day before the test, to put themselves in normal conditions for the test, and to be fasting 12 to 14 hours before the test. LCLT tartrate (68.2% LCLT, 31.8% L-tartrate) was obtained as gift from the Shahr Darou Company.

Test performance: The supplement and placebo were consumed by the subjects 90 minutes before the exercise. Five milliliter blood sample was obtained from them at the test morning, after 15 min rest. To obtain serum, blood samples were centrifuged for 10 min at 2000 RPM. Serum high-density lipoprotein (HDL), low density lipoprotein (LDL), and very low-density lipoprotein (VLDL) were measured using standard kits (Bionic, Iran) with a sensitivity of 1 mg/dL (first stage). The exercise protocol; Conconi test (15), was performed 90 min after receiving the supplement and placebo as follows; after a warm-up, the participants start to run on a treadmill (Hp/cusmos-Germany) with an initial speed of 8 km/h which raised 0.5 km/h every 200 m and continued until the subject exhausted. Immediately after the test, the traveled distance was recorded and the second blood was sampled (second stage). The third blood sample was taken 30 min after the exercise (third stage) as mentioned earlier. Biochemical and physiological variables were compared in SPSS-16 using ANOVA inferential analysis (MANOVA). To evaluate normal distribution of original variables and to study homogeneity of variance, the parametric Kolmogorov-Smirnov test and the Leaven test were used, respectively. The significance level of mean difference was considered $p < 0.05$.

3. Results

A- The initial investigation showed that LCLT consumption had no side effects on the subjects, such as stomach ache or diarrhea which often occur following the consumption of some supplements. The participants were able to successfully complete the test protocol. Table 1 depicts the anthropometric characteristics of the two study groups in this exercise trial. As the results show, both groups were homogeneous in terms of anthropometric parameters and there are no significant differences in any of the characteristics.

Table 1. Anthropometric characteristics of subjects (mean ± SD)

Characteristics/Group	Experimental	Control
Age (years)	22.6 ± 1.42	21 ± 3.4
Height (m)	1.8 ± 1.06	1.79 ± 0.4
Weight (kg)	77.5 ± 10.62	76.7 ± 13.17
BMI (kg/m^2)	23.87 ± 1.83	23.71 ± 3.06

B- Effect of LCLT on serum HDL

As in Figure 1, HDL levels shows no significant difference before and after exhaustive exercise in the experimental and control groups, while serum HDL was higher in the experimental group than the control group after resting ($p < 0.035$).

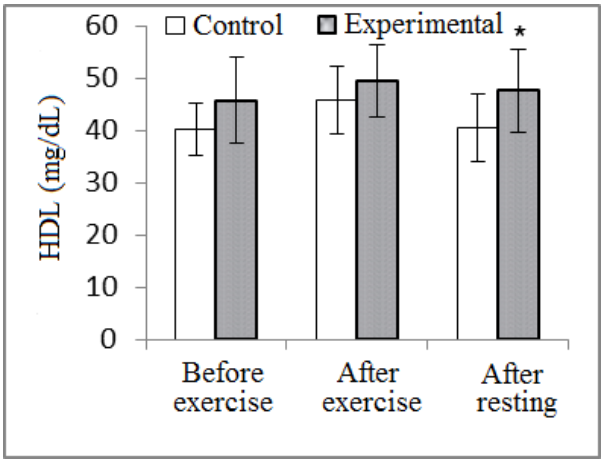

Figure 1. Effect of LCLT on serum HDL, 90 min before and immediately after exhaustive activity and 30 min after resting in control and experimental groups (10 persons per group). * Significant difference at $p < 0.05$

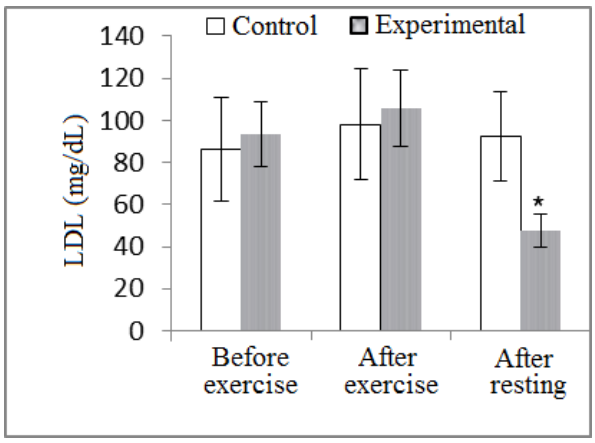

Figure 2. Effect of LCLT on serum LDL, 90 min before and immediately after exhaustive activity and 30 min after resting in control and experimental groups (10 persons per group). * Significant difference at $p < 0.05$

C- Effect of LCLT on serum LDL

As Figure 2 illustrates, the levels of LDL before and after exhaustive exercise have no significant difference in

the experimental and control groups, while serum LDL is lower in the experimental group than the control group after resting ($p < 0.018$).

D- Effect of LCLT on serum VLDL

As in Figure 3, the level of VLDL before and after exhaustive exercise and resting has no significant difference in the experimental and control groups.

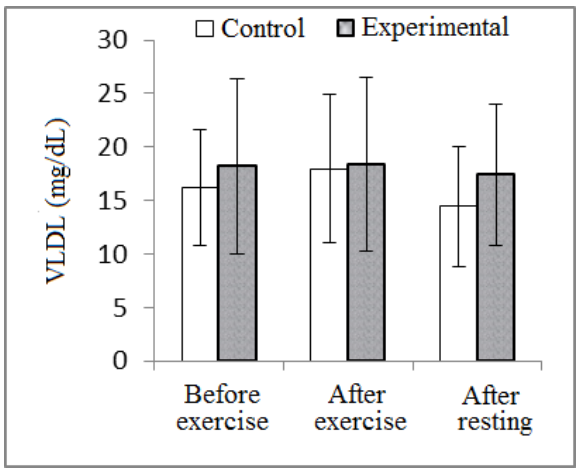

Figure 3. Effect of LCLT on serum VLDL, 90 min before and immediately after exhaustive activity and 30 min after resting in control and experimental groups (10 persons per group)

4. Discussion

To gain a competitive advantage and to achieve a higher level of health or physical performance, athletes experience various diet or artificial methods containing nutritional supplements or injectable medications [16]. Dietary supplements which improve athletic performance are familiar to most athletes [11]. The primary role of LCLT is focused on lipid metabolism however, scientific evidence confirms its role in carbohydrate metabolism as well and in fact, there is a strong correlation between muscle carnitine and Krebs cycle. Fat oxidation is triggered in rabbits following L-carnitine consumption [17]. Muscle carnitine concentration is directly proportional to muscle glycogen stores [18]. Studies show that L-carnitine improves fat metabolism and preserves glycogen [19]. Another study shows that L-carnitine increases fat oxidation and hence CO_2 elimination [20]. Other studies show ineffectiveness of L-carnitine on blood lipid levels [21]. What distinguishes the present research with these studies is the readiness of the subjects and the exercise type. Regarding the role of L-carnitine in transferring free fatty acids into mitochondria, particularly during sports, it is expected that its supplementation and thus its increase in plasma be associated with increased entry of free fatty acids into the cell's mitochondria; the main outcome of which is the preservation of liver and muscle glycogen to continue carbohydrate oxidation, particularly in the later stages of exercise and hence delayed exhaustion. These benefits have been confirmed by many scientific evidences.

5. Conclusion

Single-dose consumption of 3 g LCLT, 90 min before starting exercise can improve the performance through transporting of blood free fatty acids into mitochondria. The results of the present study showed that acute supplementation with LCLT tartrate increased HDL and decreased LDL, while not affected VLDL following an exhaustive aerobic activity. To improve fatty acid metabolism and their records, athletes of aerobic sports like wrestling (*e.g.* taekwondo and gymnastics) can be recommended to consume 3 g LCLT, 90 minutes before exercise. To analyze more confidently the results, it is suggests to measure glycogen concentration and LCLT in blood and muscle in future studies.

Acknowledgement

The authors of the paper would like to sincerely thank the Shahr Darou Company for providing L-carnitine.

References

[1] Shidfar, F. Mahan, L. Scout, S. Raymond, G. Background. Kraous food and the care process, 13th ed. Tehran: Khosravi; 2012; 254-5.

[2] Karlic H, Lohninger A, Laschan C .Downregulation of carnitine acyltransferases and organic cation transporter OCTN2 in mononuclear cells in healthy elderly and patients with myelodysplastic syndromes. *J Mol Med*; 2004; 81:435.

[3] Rebouche CJ, Chenard CA. Metabolic fate of dietary carnitine in human adults: identification and quantification of urinary and fecal metabolites. *J. Nutr* 1991; 121:539.

[4] Heinonen oj. Carnitine and physical exercise. Sport Med. 1996; 22 (2): 109-132.

[5] Zeyner A, Harmeyer J. Metablic functions of L-carnitine and its effects as feed additive in horses. Areview Arch Tiererahr. 1999 52; (2): 115-138.

[6] Robergs, R.A., Roberts S. Fundamental Principles of Exercise Physiology: For Fitness, Performance and Health. USA, McGraw Hill, 2000; pp 237-42.

[7] Maughan R, Gleeson M, Greenhaff P.L. Biochemistry of exercise & training. USA, Oxford Medical Publications, 1997; pp131-3.

[8] Ibrahim WH, Bailey N, Sunvold GD, Bruckner GG. Effects of carnitine and taurine on fatty acid metabolism and lipid accumulation in the liver of cats during weight gain and weight loss. Am J Vet Res 2003; 64(10):1265-77.

[9] Stephens FB, Constantin-Teodosiu D, Laithwaite D, Simpson EJ, Greenhaff PL. Anacute increase in skeletal muscle carnitine content alters fuel metabolism in resting human skeletal muscle. J Clin Endocrinol. Metab 2006; 91(12):5013-8.

[10] Guarnieri G, Biolo G, Vinci P, Massolino B, Barazzoni R. Advances in carnitine in chronic uremia. J Ren Nutr. 2007; 17(1):23-9.

[11] Karlic H, Lohninger A. Supplementation of L-carnitine in athletes: does it make sense? Nutrition 2004; 20(7):709-15.

[12] Abramowicz WN, Galloway SD. Effects of acute versus chronic L-carnitine L-tartrate supplementation on metabolic responses to steady state exercise in males and females. Int J Sport Nutr Exercise Metab 2005; 15(4):386-400.

[13] Ero ğ lu H, Senel O, Güzel NA. Effects of acute L-carnitine intake on metabolic and blood lactate levels of elite badminton players. Neuro Endocrinol Lett 2008; 29(2): 261-6.

[14] Stuessi C, Hofer P, Meier C, Boutellier U. L-carnitine and the recovery from exhaustive endurance exercise: a randomised, doubleblind, placebo-controlled trial. Eur J Appl Physiol 2005; 95(5-6): 431-5.

[15] Shuaa Kazmi, M. Kimiagar, M. RastManners R. Sarreshteh,m. Taleban, F. A. Acute supplementation of L - carnitine level, blood lactic acid and anaerobic threshold distance on the treadmill to Rsydnbh. Journal of Kurdistan University of Medical Sciences. Autumn 2006; 10: 43-52.

[16] Ghandchi, z. Mahan, L. Scout, S. Raymond, G . Nutrition in Exercise and Sport. Kraous food and the care process, 13th ed. Tehran: Khosravi; 2012: 13: 194-254.

[17] Bacurau R.F.P. Navarro, F. Bassit R.A. Does exercise training interfere with effects of L-carnitine supplementation? *Nutrition* 2003; 19 (4): 337-41.

[18] Horleys. L-carnitine. A division of naturalac nutrition. Level 2. [cited on 2003]. Available from: htpp://horlrys. com.

[19] Stephens, F.B. Constantin-Teodosiu D, Greenhaff PL. New insights concerning the role of carnitine in the regulation of fuel metabolism in skeletal muscle. J Physiol 2007; 581 (Pt 2): 431-44.

[20] Muller DM, Seim H, Kiess W, Loster H, Richter T. Effect of oral L-carnitine supplementation on in vivo long-chain fatty acid oxidation in healthy adult. Metabolism. 2002; 51(11): 1389-91.

[21] Colombani P, Wenk C, Kunz I. Effects of L-carnitine supplementation on physical performance and energy metabolism of endurance-trained athletes: a double-blind crossover field study. Eur J Appl Physiol Occup Physiol. 1996; 73: 434-439.