

THE EFFECT OF L-CARNITINE SUPPLEMENTATION ON 1500 m RUNNING PERFORMANCE

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SUMMARY

The purpose of this study was to determine the effects of L-Carnitine on 1500m running performance and blood lactate level. Healthy and well-trained 20 voluntary male athletes were randomly classified in two groups as the control (n=10) and study (n=10) groups. Before the treatment performance times of the athletes for running 1500 m recorded and the blood samples were obtained four minutes after the exercise. Athletes in the study group were treated with 1 x 2 g of L-Carnitine per day after the lunch for 10 days, while the control group had only fruit juice. Then performance time recording and blood taking were repeated to see the effects of L-Carnitine. The results of the control group showed no statistical significance. But in the study group both performance times and plasma lactate levels significantly reduced ($p < 0.001$). In this study, 10 days L-Carnitine supplementation has provided an ergogenic benefit on blood lactate level and 1500m running performance on well-trained athletes.

Key Words: L-Carnitine, plasma lactate level, performance, exercise.

INTRODUCTION

Carnitine, also called as vitamin B_T, plays an important role during the transport and oxidation of the long-chain fatty acids (F.A. Rodriguez, 1992). This feature brought a question to minds: whether endogenously produced carnitine is sufficient during exercise. The studies showed that its level doesn't change during low-density exercises (up to VO₂ 50%). On the other hand, during high- and maximal-density exercises plasma and skeletal muscle carnitine contents decrease significantly. So it was recommended to give exogenous L-Carnitine to keep its blood levels high during exercise (J. Decombaz, 1993, C. Marconi, 1985, N. Siliprandi et al, 1990). Two functions of the carnitine are especially important because of its effects on the performance and its ergogenic use: 1) its role at the oxidation of free fatty acids (Rodriguez F.A., 1992. C Barnett et al 1994) balancing the acetyl CoA/Coa ratio and increasing the acetyl CoA formation from piruvate (D. Constantin, et al 1991). It's assumed that L-Carnitine decreases lactate production. There are many studies conducted on effects of exercise on the carnitine content of plasma and muscle. Sliprandi and L.Vecchiet, 1990, V. Wyss, 1990 found that 2 g of L-Carnitine given one hour before the exercise decreases the plasma lactate levels and increases the performance. According to S.E.Oyono, 1988, L-Carnitine given 1 and 2 weeks helps to develop the performance scores. On the other hand, Oyono (C.J Rebouche, D.J Paulson, 1986, Colombani, 1996, S.W Trappe, 1994 and R.C Harris, 1987) could not find any additional effect of L-Carnitine on performance. So the bias on the effect of L-Carnitine on exercise is not clear yet. To our knowledge there isn't any study in the literature investigating the effects of L-Carnitine on 1500 m

running performance. Hence we aimed to give 2 g of L-Carnitine for 10 days to 1500 m running athletes.

MATERIALS AND METHODS

The study performed with 20 healthy male volunteer athletes whose 1500 m running performance time was between 4-5 minutes. After the informed consent was obtained the athletes were randomly divided into two groups as the study and the control groups. Seven days before the tests the initial information from volunteers was obtained; such as age, height, weight and physiologic parameters like resting heart rate and max VO₂. The volunteers run 1500m twice ten days apart. After each period their performance times were recorded. After the exercise at the first minute heart rates and the fourth minute blood samples (10 ml) from the antecubital vein were obtained. During the ten day interval between the performances the study group had 2 gr/day L-Carnitine L-Tartarate (%68.2 L-Carnitine, and %31.8 L-Tartarate, Lonza Ltd. Basel/ Switzerland) containing 200 ml fruit juice. The control group had only the fruit juice. While obtaining the blood samples fluoride oxalate was used as the anticoagulant to minimize the lactate concentration changes. Samples were analyzed at room temperature at dimmed light. One ml of the lactate reactive was put into each tube. Then the plasma or the standard solution was added, 10 µl from each. The tubes were incubated for ten minutes. The reactive solution was used as the blank while the absorbance values at 540 nm wave length were obtained. The results were evaluated from the calibration curve and results were given as mMol/L. Paired sample t test was used for the statistical evaluation (B. Dawson-Saunders, R.G Trapp, 1990)

RESULTS

Some physical and physiological findings of the athletes are given in Table 1 and 2.

There was no statistical significance between the physical and physiological profiles of the study and the control groups. In the control group 1500 m running time, heart rate and plasma lactate levels were not significantly different between the first and the second tests ($p > 0.05$). Whereas in the study group 1500 m running time and plasma lactate levels were significantly lower at the second test when compared to the first test ($p < 0.001$).

DISCUSSION

Fatty acid metabolism is very important during exercise. Carnitine, whether taken from diet or endogenously synthesized by liver or kidneys, increases the physiologic performances of skeletal and cardiac muscles. To our knowledge up to now there is no study conducted to search the effects of L-Carnitine on 1500 m running performance. Vecchiet et al. showed that 2 g of L-carnitine given to athletes one hour prior to the exercise increases the maximal oxygen intake and the energy they spend. So their performance increases significantly (V. Wyss, 1990). Marconi et al showed that 4 g/day L-Carnitine given for two weeks improved max. VO_2 (S.E.Oyono, 1988, V.Wyss et al 1990) gave 3 g/day L-Carnitine at different intervals for seven days and athletes' power and total energy levels increased. Respiratory quotient significantly reduced in a study of Gorostia et al (C. Greig et al 1987) In our study, we found a significant improvement in the performances of the study group. So the results are consistent with these studies reporting the beneficial effect of L-Carnitine intake.

On the other hand, there are controversial studies. For seven days 2 g/day L-Carnitine with supramaximally intense and short-length swimming by Trappe et al (24), 4 g/day L-Carnitine for two weeks with maximally and supramaximally intense biking by Barnett et al, 2g/day L-Carnitine taken two hours prior to 20 km running had no effect on the performance. Also Oyono et al 1988, and (R.C Harris et al, 1987) found no effect of L-Carnitine on supramaximally intense exercises. All of them had agreed that L-Carnitine might have a positive effect on the sportive performance but the intensity of exercise in their studies may be too much to see this effect. Today to define the intensity of the exercise lactate threshold of the athlete is used (M.J.Chwalbinska, 1989,E.M.Gorostiaga, 1989). Blood lactate levels increase at exercises of high intensity or above (K.P.George, 1988(G.M.E Janssen et al 1989). During exercise, carnitine provides economical expenditure of carbohydrate by increasing the use of free fatty acids (F. Brouns, 1998, Y.Feng, 2001).It also increases conversion of piruvate by piruvate decarboxilase to acetyl CoA by increasing the use of free coenzyme A (Co A). So

the lactate production by muscles decreases due to the increased conversion of lactate to piruvate (A. Hildebrand, 2000). L-Carnitine given 60 minutes prior to the exercise has shown to decrease the plasma lactate levels significantly by Vecchiet (V. Wyss, 1990). Whereas L. Vecchiet et al, 1990 and C. Barnett, 1994, couldn't see any decrease in lactate levels following high and supramaximally intense swimming exercise. In our study, we observed the decrease in the lactate levels with consumption of L-Carnitine in the study group ($p < 0.001$). The lactate levels that we measured were similar to the levels S.V.Trappe 1994, and A. Hildebrand 2000,observed, but they were higher than the values given in some studies (C Barnett et al 1994, K.P.George, 1988, V. Wyss, 1990). It might be because of the differences in the intensity and duration of the exercise. There might be also an influence of the laboratory methods used to measure plasma lactate levels (P.A Bishop 1992, K. Sahlin,1990).As a result, we found an ergogenic effect of L-Carnitine consumption on 1500 m running performance.

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Table 1. Some physical and physiological findings of the athletes.

Groups	Age (Year)	Active Sport	Weight	Height (cm)	Resting Pulse	Max.VO ₂
	X± SD	Life (year) X± SD	(kg) X± SD	X± SD	(beat/min) X± SD	(ml/kg/min) X± SD
Control Group (n=10)	21,6±1,6	5,3±1,2	68,9±5,6	174,6±5,6	70,4±3,3	58,7±2
Study Group (n=10)	21,2±1,4	5,5±1,4	70,4±4,4	176,6±5,8	69,6±3,7	60,2±1,8
p	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

Table 2. Comparison of the parameters at the first and the second tests.

Groups	Running Time (sec)	Pulse Rate (beat/min)	Plasma Lactate (mMol/L)
	First test — Second test	First test — Second test	First test — Second test
	X± SD	X± SD	X± SD
Control Group (n=10)	298,9±5,5 — 296±7,1	139,4±3,4 — 141,2±4,3	16,8±1,6 — 16,7±1,6
Study Group (n=10)	298,2±4,5 — 285,3±4,7*	138,7±4,3 — 139,5±3,6	18,3±1,7 — 16,1±1,2*
p	<0.001	<0.001	<0.001

*When compared to their first test results p value was found to be <0,001.