Journal of Sports Education
http://dergipark.gov.tr/seder
e-ISSN 2602-4756 Special Issue (1), 01-08 (2018) Original Article

Effect of L-Carnitine Supplementation on Weight Loss and Body Composition of Taekwondo Players

Ahmet MOR[1], Kadir BAYNAZ[1], Gökhan İPEKOĞLU[1], Cansel ARSLANOĞLU[1], Kürşat ACAR[1], Halil İbrahim ÇAKIR[2], Erkal ARSLANOĞLU[1]

Article Info
Received: 28.09.2018
Accepted: 09.10.2018
Online Published: 20.10.2018

Keywords
L-Carnitine, Taekwondo, Weight Loss, Body Composition.

Abstract

In this study, it was aimed to investigate the effect of L-carnitine supplements on weight loss and body composition of taekwondo players. Sixteen voluntary male athletes, aged 18-28, were participated in this study. Athletes were divided into two groups as experiment (supplement) (n=8) and placebo (n=8). First of all, the body of the athletes was analyzed using the body composition analyzer. After these analyzes were made, for 7 days, the experimental group used carnitine and the placebo group used wheat bran. After 7 days of nutrient supplementation, the analyzes performed at the beginning of the study were repeated. The body fat percentage of the placebo group was found to be significantly lower than the post-training values ($p<0.05$) and the change in fat mass values was not statistically significant ($p>0.05$). When the intra-group pre- and post-test body composition values of the L-carnitine group were compared, the post-test averages of skeletal muscle weight, total body water and metabolic rate increased statistically significantly compared to the pre-test averages ($p<0.05$) and there was a statistically significant decrease in the body fat mass and percentage ($p<0.05$). There was no significant difference in body weight and BMI ($p>0.05$). L-carnitine and placebo groups showed no significant difference in body composition according to Independent Sample T test results ($p>0.05$). It was seen that pre-training L-carnitine consumption helped the athletes to maintain optimal body weight and increased fat oxidation during exercise by activating fat metabolism and positively affected fat mass reduction.

[1]Sinop University, Faculty of Sports Sciences, Sinop / Turkey (Correspondence author: gokhanipekoglu@sinop.edu.tr)
[2]Recep Tayyip Erdogan University, School of Physical Education and Sports, Rize / Turkey

Introduction

One of the important factors that an athlete needs to achieve high performance is nutrition. Since olden days, there have been different views on the sporting person's diet. Because it is accepted by almost every society that nutrition is a very important contributor to the success of an athlete (Şen et al., 2003). Regular and balanced diet is important for an athlete for many reasons. In addition to the increase in sportive performance, weight loss and excessive weight gain prevention and restoration of energy resources during the recovery period can be achieved by balanced nutrition, which affects the sportsman directly or indirectly (Sarıoğlu et al., 2012). Nutritional supplements which are called ergogenic supplements, are known to have positive effects on sportive performance and it is sometimes considered necessary to take additional nutrients to optimally benefit from the training program. However, many athletes believe that ergogenic is the key to success in sports (Pehlivan, 2012).

Despite many years of research, the sports nutrition area continues to grow rapidly. The supplements have become an integral part of the daily routines of the elite athletes (Close et al., 2016). It is known that nutritional supplements improve performance and accelerate recovery after exercise (Karlic and Lohinger,

2004). One of the most popular categories of nutritional supplements is fat burners. Some of the reasons for the popularity of these supplements are their effects on general health improvements, performance improvements, weight loss, or a combination of these factors. Fat burning is used to describe nutritional supplements that are claimed to increase fat metabolism or energy expenditure, decrease fat absorption, increase weight loss, increase fat oxidation during exercise, or cause long term adaptations that support fat metabolism. Often these supplements contain a number of components, each of which has a different mechanism of action (Jeukendrup and Randell, 2011). Many weight loss nutritional supplements are said to work by increasing energy consumption, modulating carbohydrate or fat metabolism, increasing fullness or inhibiting the absorption of fat or carbohydrates (Eckerson 2015).

L-carnitine (a bioactive form of carnitine) is a popular and preferred product among athletes as a potential ergogenic aid due to its role in converting fat to energy (Colombani et al., 1996; Karlic and Lohinger, 2004; Kim et al., 2015). L-Carnitine is a natural compound synthesized in mammals from the essential amino acids lysine and methionine, or taken by diet (Kreamer et al., 2008). L-Carnitine is of primary importance for the transport of long chain fatty acids into the mitochondria of liver, heart and skeleton muscle (Center et al., 2000). Carnitine is primarily stored in the skeleton muscle and is also present in the plasma (Kreamer et al., 2008). More than 95% of the body's total carnitine storage is found in the skeletal muscle, and plays an important role in crucial metabolic events such as ATP production and transport of long chain fatty acids from cytoplasm to mitochondria where the β-oxidation occurs (Deniz, 1999; Kim et al., 2015; Stephens et al., 2007). L-carnitine, known to enhance physical performance, is a vitamin-like compound required for β-oxidation and transport of long-chain fatty acids through the inner mitochondrial membrane (Broad et al., 2011; Owen et al., 2001; Pandareesh et al., 2013). L-carnitine, which plays a central role in lipid catabolism and energy production, plays a key role in muscle fuel metabolism during exercise, as well as having a vital importance in regulating muscle fuel metabolism (Greig et al., 1987; Kim et al., 2015; Stephens et al., 2007). All these, along with its need during high exercise performance, indicate that L-carnitine consumption increases fat oxidation during long exercise, protects glycogen deposits and delays the onset of fatigue (Brass and Hiatt, 1998; Kreamer and Volek, 2008; Stephens et al., 2007).

In this study, it was aimed to investigate the effect of L-carnitine supplements on weight loss and body composition of taekwondo players.

Materials and Methods

Research Group

Sixteen voluntary male athletes, aged 18-28 and lengths of 175.58±6.80, were participated in this study. Athletes were divided into two groups as experiment (supplement) (n=8) and placebo (n=8). Athletes are required to be healthy, free from chronic or acute illness, and free from any disability caused by an injury. The study was conducted with a single taekwondo team in terms of the reliability of the study because of the effects of different training programs and all Taekwondo players were selected from individuals who applied the same training program together. The Ethics

Committee of Sinop University Human Research has decided that this study does not have ethical inconvenience and has approved the study conduction of the study (No: 57428665-619-E.10599).

Study Design

First of all, the body of the athletes was analyzed using the Inbody 120 Bioimpedance Body Composition Analyzer. After these analyzes were made, for 7 days, the experimental group used carnitine and the placebo group used wheat bran. After 7 days of nutrient supplementation, the analyzes performed at the beginning of the study were repeated. That is, the same analysis protocol was applied on every athlete who participated in the study twice (before supplementation and after 7 days of supplementation). Analysis were done on both experimental and control groups on the same physical conditions.

Supplementation

After 1 day of the analysis, the research group of 16 patients randomly assigned two groups, namely carnitine (n=8) and placebo (n=8) groups. The study was conducted as a single blind procedure. L-carnitine supplements were given to the experimental group according to the daily use and dosage, and placebo (wheat bran) was given to the placebo group in equal amounts to the food supplements provided and they were used under the supervision of the investigator for 7 days. The supplementation was given as 1000 milligrams (mg), 30 minutes before the training, as a single daily dose. Sportsmen were not informed about the substance given to them, and only the researchers knew which substances the groups received. Thus, the psychological effects that may occur on the athletes have been eliminated and the study has been conducted in more reliable conditions. The necessary explanations have been given about the nutrition of the athletes and they were asked to continue their daily life patterns and training programs. The sportsmen were also warned not to use alcohol and stimulants during the study, and to take care of their nutrition and resting. After 1 day of 7 day supplementation, body analyzes were repeated.

Statistical Analyses

The research data obtained were given in the form of the arithmetic mean and standard deviation. After looking at the normality distribution with the Shapiro-Wilk test, differences between the pre- and post-tests within the groups were analyzed using the "Paired sample T test" and between the groups by "Independent sample T test" at $p < 0.05$ significance level. SPSS v.22 package program was used for statistical analysis and comparison of the results obtained in the study.

Results

When the pre- and post-test body composition values of the placebo group were compared, body weight, skeletal muscle weight, total body water, body mass index (BMI) and metabolic rate showed a statistically significant increase with respect to pre-test averages ($p<0.05$). The body fat percentage of the placebo group was found to be significantly lower than the post-training values ($p<0.05$) and the change in fat mass values was not statistically significant ($p>0.05$) (Table 1).

When the intra-group pre- and post-test body composition values of the L-carnitine group were compared, the post-test averages of skeletal muscle weight, total body water and metabolic rate increased statistically significantly compared to the pre-test averages ($p<0.05$) and there was a statistically significant decrease in the body fat mass and percentage ($p<0.05$). There was no significant difference in body weight and BMI ($p>0.05$) (Table 1).

L-carnitine and placebo groups showed no significant difference in body composition according to Independent Sample T test results ($p>0.05$).

Table 1. Comparison of pre and post test body composition of groups

Values	Groups	n	Pre	Post	p
Body Weight (Kg)	L-Carnitine	8	66.01±5.42	66.53±5.71	0.17
	Placebo	8	71.08±11.06	71.85±11.33	**0.01***
Skeletal Muscle Weight (Kg)	L-Carnitine	8	32.15±2.83	33.08±3.28	**0.02***
	Placebo	8	34.78±5.74	35.51±5.74	**0.00***
Fat Mass (Kg)	L-Carnitine	8	9.23±1.97	8.23±1.95	**0.03***
	Placebo	8	10.06±3.41	9.68±3.26	0.11
Total Body Water (L)	L-Carnitine	8	41.60±3.42	42.68±3.94	**0.02***
	Placebo	8	44.70±7.12	45.55±7.07	**0.00***
Body Fat Percentage (%)	L-Carnitine	8	13.93±2.52	8.23±1.95	**0.00***
	Placebo	8	14.10±4.57	9.68±3.26	**0.00***
Body Mass Index (Kg/m^2)	L-Carnitine	8	21.63±1.59	21.78±1.69	0.25
	Placebo	8	22.71±1.99	22.96±1.98	**0.01***
Metabolic Rate	L-Carnitine	8	1596±100.68	1629±116.79	**0.02***
	Placebo	8	1687±210.64	1712±210.32	**0.00***

*There is a statistically significant difference when compared to pretest ($p<0.05$).

Discussion

In recent years, L-Carnitine, an essential adjunct to mitochondrial oxidation of long chain fatty acids, has been widely marketed as a useful nutritional supplement in healthy food products for the management of obesity (Villani et al., 2000). L-Carnitine is a natural substance required for energy metabolism in mammals. It is produced by the body and is mainly found in products of animal origin (Wutzke and Lorenz, 2004). L-Carnitine is a vitamin B-like compound found naturally in humans and other mammals. The basic function is to facilitate the transport of long chain fatty acids to mitochondria for energy production via β-oxidation. Thus, in L-carnitine deficiencies, the

mitochondrial progression and oxidation of long-chain fatty acids may be disrupted (Owen et al., 1996).

There are many different studies on L-carnitine supplementation in the literature. In these studies where different methods of supplementation are used, cardiovascular and metabolic responses (Broad et al., 2011), aerobic and anaerobic exercise performance (Smith et al., 2018), recovery (Volek et al., 2002), maximal physical exercise (Vecchiet et al., 1990), physical performance and energy metabolism (Colombani et al., 1996) and body composition (Wutzke and Lorenz, 2004) have been associated with the use of L-carnitine.

In some studies, Wall et al. (2004) looked at body mass and body mass indexes of carnitine and control groups who were exercising during a 24-week survey. Although there was no significant difference between the two groups, there was no significant difference regarding the body mass index between the groups, but there was a significant difference in body mass values in the control group. Colombani et al. (1996) have not found any effect of L-carnitine use on the metabolism in their study with athletes. In other findings, researchers also could not found that carnitine consumption had an effect on physical performance and recovery. Wutzke and Lorenz (2004) conducted body composition analyzes of subjects in their studies with L-carnitine supplementation for 10 days. In their conclusions, they found no effect of L-carnitine consumption on body mass, total body water, and body weight, but there was an increase in fat oxidation. Aoki et al. (2004), performed a study on rats where rats followed a swimming training for 1 hour daily for 6 weeks, and they divided the subjects into four groups as; control, sedentary supplement, training and training-carnitine. The researchers concluded that the loss of fat mass was due to the training workout rather than carnitine. Seim et al. (2002) found that the use of L-carnitine significantly increased fatty acid oxidation. In the study that is presented, as a result of 7-day L-carnitine supplementation, both groups showed an increase in body weight, but a significant difference was found only in the placebo group. Skeletal muscle weight, total body water and metabolic rate were increased at a statistically significant level in both groups. In the obtained data, the percentage of body fat decreased in both groups, but the body mass index increased in both groups, showing a significant difference only in the placebo group. In our study, although the fat weight decreased in both groups, the only significant difference was found in the carnitine group.

This research reveals the effects of L-carnitine use on the body composition of the athletes. When the changes in the data were examined and compared with the placebo group, it was seen that pre-training L-carnitine consumption helped the athletes to maintain optimal body weight and increased fat oxidation during exercise by activating fat metabolism and positively affected fat mass reduction.

References

Aoki, M. S., Almeida, A. L. R. A., Navarro, F., Costa-Rosa, L. F. B. P., & Bacurau, R. F. P. (2004). Carnitine supplementation fails to maximize fat mass loss induced by endurance training in rats. *Annals of nutrition and metabolism*, *48*(2), 90-94.

Brass, E. P., & Hiatt, W. R. (1998). The role of carnitine and carnitine supplementation during exercise in man and in individuals with special needs. *Journal of the American College of Nutrition*, *17*(3), 207-215.

Broad, E. M., Maughan, R. J., & Galloway, S. D. (2011). Effects of exercise intensity and altered substrate availability on cardiovascular and metabolic responses to exercise after oral carnitine supplementation in athletes. *International journal of sport nutrition and exercise metabolism*, *21*(5), 385-397.

Center, S. A., Harte, J., Watrous, D., Reynolds, A., Watson, T. D. G., Markwell, P. J., ... & Erb, H. N. (2000). The clinical and metabolic effects of rapid weight loss in obese pet cats and the influence of supplemental oral L-carnitine. *Journal of veterinary internal medicine*, *14*(6), 598-608.

Close, G. L., Hamilton, D. L., Philp, A., Burke, L. M., & Morton, J. P. (2016). New strategies in sport nutrition to increase exercise performance. *Free Radical Biology and Medicine*, *98*, 144-158.

Colombani, P., Wenk, C., Kunz, I., Krähenbühl, S., Kuhnt, M., Arnold, M., ... & Langhans, W. (1996). Effects of L-carnitine supplementation on physical performance and energy metabolism of endurance-trained athletes: a double-blind crossover field study. *European journal of applied physiology and occupational physiology*, *73*(5), 434-439.

Deniz, G. (1999). Karnitin: Sentez, Metabolizma, Fonksiyon Ve İskemik Kalpte Terapötik Önemi. *Turkiye Klinikleri Journal of Medical Sciences*, *19*(1), 55-62.

Eckerson, J. M. (2015). Weight loss nutritional supplements. In *Nutritional Supplements in Sports and Exercise* (pp. 159-185). Springer, Cham.

Greig, C. F. K. M., Finch, K. M., Jones, D. A., Cooper, M., Sargeant, A. J., & Forte, C. A. (1987). The effect of oral supplementation with L-carnitine on maximum and submaximum exercise capacity. *European journal of applied physiology and occupational physiology*, *56*(4), 457-460.

Jeukendrup, A. E., & Randell, R. (2011). Fat burners: nutrition supplements that increase fat metabolism. *Obesity reviews*, *12*(10), 841-851.

Karlic, H., & Lohninger, A. (2004). Supplementation of L-carnitine in athletes: does it make sense?. *Nutrition*, *20*(7-8), 709-715.

Kim, J. H., Pan, J. H., Lee, E. S., & Kim, Y. J. (2015). L-Carnitine enhances exercise endurance capacity by promoting muscle oxidative metabolism in mice. *Biochemical and biophysical research communications*, *464*(2), 568-573.

Kraemer, W. J., Volek, J. S., & Dunn-Lewis, C. (2008). L-carnitine supplementation: influence upon physiological function. *Current sports medicine reports*, *7*(4), 218-223.

Owen, K. Q., Nelssen, J. L., Goodband, R. D., Tokach, M. D., & Friesen, K. G. (2001). Effect of dietary L-carnitine on growth performance and body composition in nursery and growing-finishing pigs. *Journal of animal science*, *79*(6), 1509-1515.

Owen, K. Q., Nelssen, J. L., Goodband, R. D., Weeden, T. L., & Blum, S. A. (1996). Effect of L-carnitine and soybean oil on growth performance and body composition of early-weaned pigs. *Journal of Animal Science*, *74*(7), 1612-1619.

Pandareesh, M. D., & Anand, T. (2013). Ergogenic effect of dietary L-carnitine and fat supplementation against exercise induced physical fatigue in Wistar rats. *Journal of physiology and biochemistry*, *69*(4), 799-809.

Pehlivan, A. (2012). Ergojenik Yardım-1: Vitaminler, Mineraller ve Antioksidanlar. *TFF Futbol Gelişim Bülten*, 4: 80-84.

Sarıoğlu, Ö., İmamoğlu, O., Atan, T., Türkmen, M., & Akyol, P. (2012). Beden eğitimi bölümünde okuyan farklı branşlardaki öğrencilerin beslenme alışkanlıklarının incelenmesi. *Selçuk Üniversitesi Beden Eğitimi Ve Spor Bilim Dergisi*, *14*(1), 88-94.

Seim, H., Kiess, W., & Richter, T. (2002). Effects of oral L-carnitine supplementation on in vivo long-chain fatty acid oxidation in healthy adults. *Metabolism-Clinical and Experimental*, *51*(11), 1389-1391.

Smith, W. A., Fry, A. C., Tschume, L. C., & Bloomer, R. J. (2008). Effect of glycine propionyl-L-carnitine on aerobic and anaerobic exercise performance. *International journal of sport nutrition and exercise metabolism*, *18*(1), 19-36.

Stephens, F. B., Constantin-Teodosiu, D., & Greenhaff, P. L. (2007). New insights concerning the role of carnitine in the regulation of fuel metabolism in skeletal muscle. *The Journal of physiology*, *581*(2), 431-444.

Şen, İ., Öztaşyonar, Y., & Atasever, M. (2003). Besinlerin glisemik indeksi ve sporcuların beslenmesi. *Journal of Physical Education and Sport Sciences*, *5*(2).

Vecchiet, L., Di Lisa, F., Pieralisi, G., Ripari, P., Menabo, R., Giamberardino, M. A., & Siliprandi, N. (1990). Influence of L-carnitine administration on maximal physical exercise. *European journal of applied physiology and occupational physiology*, *61*(5-6), 486-490.

Villani, R. G., Gannon, J., Self, M., & Rich, P. A. (2000). L-Carnitine supplementation combined with aerobic training does not promote weight loss in moderately obese women. *International journal of sport nutrition and exercise metabolism*, *10*(2), 199-207.

Volek, J. S., Kraemer, W. J., Rubin, M. R., Gómez, A. L., Ratamess, N. A., & Gaynor, P. (2002). L-Carnitine L-tartrate supplementation favorably affects markers of recovery from exercise stress. *American Journal of Physiology-Endocrinology and Metabolism*, *282*(2), E474-E482.

Wall, B. T., Stephens, F. B., Constantin-Teodosiu, D., Marimuthu, K., Macdonald, I. A., & Greenhaff, P. L. (2011). Chronic oral ingestion of l-carnitine and carbohydrate increases muscle carnitine content and alters muscle fuel metabolism during exercise in humans. *The Journal of physiology*, *589*(4), 963-973.

Wutzke, K. D., & Lorenz, H. (2004). The effect of l-carnitine on fat oxidation, protein turnover, and body composition in slightly overweight subjects. *Metabolism*, *53*(8), 1002-1006.

Citation of this article

Mor, A., Baynaz, K., İpekoglu, G., Arslanoglu, C., Acar, K., Cakır, H.İ. & Arslanoglu, E. (2018). Effect of L-Carnitine Supplementation on Weight Loss and Body Composition of Taekwondo Players, *Spor Eğitim Dergisi*, Special Issue 1, 01-08.