

Carnipure® Focus

Energy and Weight Management



In this edition of the Carnipure® focus, we review the main metabolic function of the Carnipure® ingredient and explore two important applications of Carnipure® supplementation: sustained energy and weight management. While seemingly unrelated applications, the underlying theme for both topics is using fat for energy via fatty acid oxidation. This fundamental metabolic function makes Carnipure® L-Carnitine an ideal ingredient to help consumers in their quest to manage their weight and have more energy.

What is Carnipure® L-Carnitine?

Carnipure® is high quality L-Carnitine manufactured by the Swiss life-science company Lonza. Products displaying the Carnipure® quality seal on the packaging show the consumer that they contain high quality L-Carnitine from Lonza.



Built on Quality. Backed by Science.™

Main Metabolic Function

The main metabolic function of the Carnipure® ingredient is to transport long-chain fatty acids into the mitochondrial matrix for beta-oxidation. Beta-oxidation is the metabolic pathway for using fat stores as an energy source. This pathway occurs in the part of the cell called the mitochondrial matrix, and Carnipure® L-Carnitine is essential for transporting the fatty acids into this space. Weight management and sustained energy are two practical applications that utilize this shuttling function. In the case of sustained energy, while glucose or other stimulants may provide a quick energy boost, converting fatty acids into ATP (adenosine triphosphate) can provide a more sustained source of energy. In the case of weight management, decreasing fat mass while preserving muscle mass is the ultimate goal. In order to decrease body fat, it must be used for energy via beta-oxidation. While weight management and sustained energy are different applications, both require using fatty acids, breaking them down, and converting them into energy in the form of ATP. Carnipure® L-Carnitine is the nutrient needed to help support this conversion of fat into metabolic energy.

Carnipure® L-Carnitine and Fatty Acid Oxidation

Carnipure® supplementation can help optimize fatty acid oxidation through increasing enzyme activity. Specifically, the Carnipure® ingredient acts on carnitine palmitoyltransferase 1 (CPT1), one of the enzymes involved in transporting fatty acids into the mitochondria. Because CPT1 is the rate limiting step for beta-oxidation, it controls how much fat can be used for energy. Several studies show that increasing CPT1's activity through Carnipure® supplementation could increase fatty acid oxidation. In one study, participants in the Carnipure® supplement group showed significantly increased CPT1 activity as compared with those in the placebo group.¹ Furthermore, a review by researchers from Johns Hopkins University School of Medicine concluded that enhanced CPT1 activity could increase energy expenditure.²

Two independent research groups, Wutzke and Müller, studied the impact of Carnipure® supplementation on fatty acid oxidation.^{3,4} Both groups used ¹³C labeled isotopes to measure fatty acid oxidation and to study metabolic changes after Carnipure® supplementation. Fatty acid oxidation can be measured through quantifying the amount of carbon dioxide in exhaled air. Participants took Carnipure® supplements for ten days and then ingested a meal with labeled ¹³C fatty acids. In both of these studies, the supplemented group showed a significant increase in ¹³CO₂ exhaled air as compared with the control group. This indicates there was a significant increase in fatty acid oxidation.

Another study, published in 2011, found that Carnipure® supplementation increased glycogen sparing during low intensity exercise.⁵ Participants ingested either a Carnipure® L-Carnitine and carbohydrate solution or a carbohydrate solution alone. The participants performed cycling exercises in order to measure work output. The study also found that work output during exercise was higher in the supplemented group than in the placebo group. This higher work output in combination with increased glycogen sparing suggests that the Carnipure® supplemented group was likely using fatty acids for fuel during the study, further implying that Carnipure® supplementation may in fact increase fatty acid oxidation.

Carnipure® L-Carnitine and Sustained Energy

Increasing fatty acid oxidation can assist those who are seeking an aid for sustained energy. Fatty acids provide a longer lasting source of energy for the body, and Carnipure® supplementation can help the body turn fat stores into this sustained energy. This section provides a review of the research pertaining to L-Carnitine and fatigue. This section also includes a discussion on combining with other ingredients to achieve sustained energy.

Regarding L-Carnitine and fatigue, several studies showed positive results. One study found that L-Carnitine supplementation decreased both physical and mental fatigue in an elderly population. Moreover, those in the L-Carnitine group experienced decreased fatigue severity and scored better on the Mini-Mental State Examination (MMSE)⁶, which measures recall and memory. A similar study also found L-Carnitine supplementation decreased fatigue in elderly participants. Specifically, those in the L-Carnitine group showed a 40 percent decrease in physical fatigue and a 45 percent decrease in mental fatigue symptoms as compared with placebo.⁷ The studies above indicate Carnipure® supplementation may help with decreasing both mental and physical fatigue.

The synergistic effects of L-Carnitine and other ingredients on increasing fatty acid oxidation is also a widely studied topic. In a study by Cha, participants took a mixture of caffeine and L-Carnitine, or were given caffeine or L-Carnitine alone. While L-Carnitine alone promoted fatty acid oxidation, the combination of caffeine and L-Carnitine provided a greater effect than L-Carnitine alone.⁸ The authors hypothesized that this synergistic effect could be due to the metabolic actions of both substances. Caffeine helps mobilize fatty acids from the fat stores, and L-Carnitine is essential for using those fatty acids for energy. Another study, which combined L-Carnitine with caffeine, arginine and soy isoflavones, found similar results.⁹

The results of the above studies suggest that Carnipure® L-Carnitine can be used to sustain energy in a wide variety of populations. For example, Carnipure® L-Carnitine could be beneficial for young adults enjoying a late night out with friends. Carnipure® supplementation might also help parents with multiple obligations stay energized throughout their hectic work and home schedules. These are just a few examples of the diverse populations who could benefit from Carnipure® L-Carnitine.

Carnipure® L-Carnitine and Weight Management

Decreasing fat mass while preserving muscle mass is the goal of long term, sustained weight management. In order to decrease fat mass, fat stores must be broken down and used for energy. As discussed above, Carnipure® supplementation can increase beta-oxidation. This in turn results in glucose sparing and decreased breakdown of amino acids for energy production.¹⁰ The next section reviews the outcomes of clinical trials, which have looked to define the role of L-Carnitine in weight management. The results of these studies provide further support for using the Carnipure® ingredient as part of a weight management plan. You can find a summary of the studies in Table 1.

One study evaluated the effectiveness of L-Carnitine supplementation when used in conjunction with a weight management program for obese adolescents. They found that L-Carnitine supplementation at 2 g/ day for 12 weeks promoted significant weight loss and a decrease in body mass index (BMI) and body fat content.¹¹ A similar study with obese adolescents in Korea found that exercise and Carnipure® sup-

plementation led to significant decreases in weight, BMI and percent body fat, as compared with the exercise only group.¹²

Another study, which included 100 obese adult volunteers, looked at the impact of L-Carnitine supplementation on body weight and BMI. The L-Carnitine supplement group had a 25 percent greater loss in body weight and their BMI dropped by 1.5 points. Other metabolic factors, such as low density lipoproteins (LDL cholesterol), blood sugar and blood pressure, were also lower in the supplemented group.¹³

In another clinical trial, obese participants followed a low fat diet alone or the same diet supplemented with a high fiber cookie containing L-Carnitine. Those who received the cookie lost more body weight and body fat than those who only followed the low fat diet. Moreover, the supplemented group had greater reductions in total and LDL cholesterol as compared with the control group.¹⁴

Table 1
Summary of Studies with L-Carnitine Related to Fatty Acid Metabolism and Weight Management

Study author	Participants	Outcome
Wall, 2011 ⁵	Healthy adults	Decreased muscle glycogen utilization
Müller, 2002 ⁴	Healthy adults	37 percent increase in fatty acid oxidation
Wutzke, 2004 ³	Healthy adults	22 percent increase in fatty acid oxidation
Pistone, 2003 ⁷	Elderly volunteers	Six times more fat mass loss as compared with placebo
Lurz, 1998 ¹³	Healthy overweight adults	25 percent more weight loss as compared with placebo
Sufeng, 1997 ¹¹	Healthy overweight adults	Ten times more weight loss as compared with placebo
Sawyer, 2010 ¹²	Obese female adolescents	Decrease in body weight, BMI and percent body fat

Conclusion

The studies presented in this Carnipure® Focus illustrate the basic metabolic function of Carnipure® L-Carnitine in increasing fatty acid oxidation and its potential as an aid for weight management programs and for sustained energy. With excellent technological properties, Carnipure® L-Carnitine is an ideal ingredient for applications that depend upon turning fat into energy.

References

1. Karlic H et al. (2002). J Histochem Cytochem 50(2):205–212
2. Kuhajda FP & Ronnett GV (2007). Curr Opin Investig Drugs 8(4):312–317
3. Wutzke KD & Lorenz H (2004). Metabolism 53(8):1002–1006
4. Müller DM et al. (2002). Metabolism 51(11):1389–1391
5. Wall et al. (2011). J Physiol 589(4):963–973
6. Malaguarnera M et al. (2007). Am J Clin Nutr 86:1738–1744
7. Pistone G et al. (2003). Drugs Aging 20(10):761–767
8. Cha YS et al. (2001). J Nutr Sci Vitaminol 47:378–384
9. Murosaki S et al. (2007). J Nutr 137:2252–2257
10. Owen KQ et al. (2001). J Anim Sci 79(12):3104–3112
11. Sufeng Z et al. (1997). Acta Nutr Sin 19(2):146
12. Sawyer et al. (2010). Med Sci Sports Exerc. 42(5):445
13. Lurz R & Fischer R (1998). Aerztezt f Naturheilverf 39(1):12–15
14. Kaats GR et al. (1992). Curr Ther Res 51(2):261–274



Built on Quality. Backed by Science.™

Europe

Lonza Ltd
Muenchensteinerstrasse 38
4002 Basel, Switzerland
Tel +41 61 316 81 11
carnipure@lonza.com

USA

Lonza Inc.
412 Mt. Kemble Ave., Suite 200S
Morristown, NJ 07960
Tel +1 800 365 8324
carnipure@lonza.com

Review and follow all product safety instructions. The statements made in these materials have not been evaluated by the U.S. Food and Drug Administration or any other regulatory authority. Lonza's products are not intended for use to diagnose, treat, cure or prevent any disease. All product information corresponds to Lonza's knowledge on the subject at the date of publication, but Lonza makes no warranty as to its accuracy or completeness and Lonza assumes no obligation to update it. Product information is intended for use by recipients experienced and knowledgeable in the field, who are capable of and responsible for independently determining the suitability of ingredients for intended uses and to ensure their compliance with applicable law. Proper use of this information is the sole responsibility of the recipient. This information relates solely to the product as an ingredient. It may not be applicable, complete or suitable for the recipient's finished product or application; therefore republication of such information or related statements is prohibited. Information provided by Lonza is not intended and should not be construed as a license to operate under or a recommendation to infringe any patent or other intellectual property right. No claims are made herein for any specific intermediate or end-use application. All trademarks belong to Lonza or its affiliates or to their respective third parties and are used here only for informational purposes.

© 2019 Lonza

www.lonza.com

www.lonzanutrition.com

www.carnipure.com