

Carnipure™ Focus

Weight Management

Lonza

Introduction

Overweight and obesity are increasing at an alarming rate in Western societies. Simultaneously with the increase in abdominal girth, cardiovascular disease, diabetes and further chronic diseases are on the rise¹. The degree of obesity is commonly classified by the Body Mass Index (BMI = body weight/height²). By this definition, more than 60% of U.S. adults are overweight (BMI > 25), and the number of overweight children and adolescents is rising steadily^{2, 3}.

Carnipure™ supplementation appears to play a role in promoting a healthy body weight and the build-up of muscle mass when used as part of an overall weight management program which includes energy restriction and exercise⁴.

What is Carnipure™?

Carnipure™ is high quality L-Carnitine manufactured by the Swiss life-science company Lonza. L-Carnitine is a nutrient that plays an important role in energy metabolism. The proprietary Carnipure™ production process was invented by Lonza scientists in Switzerland. It directly produces the L-isomer of Carnitine, the beneficial form found in nature. Products displaying the Carnipure™ quality seal on the packaging show the consumer that they contain pure L-Carnitine from Lonza.



Carnipure™ offers purest L-Carnitine and is a trademark of Lonza Ltd, Switzerland.

Energy balance

The underlying cause of overweight is a positive energy balance leading to weight gain i.e. when the calories consumed exceed the calories expended.

Conversely, weight loss occurs when energy intake is less than energy expenditure over an extended period of time. A restricted calorie diet combined with increased physical activity is generally the advice recommended by dieticians for sustained weight loss and maintenance of a healthy body weight.

Carnipure™ and fatty acid oxidation

The object of body weight reduction and healthy body weight maintenance is to promote the utilization of fat as an energy source. It is reasonable to assume that L-Carnitine should have a major role in this process.



The oxidation of fatty acids takes place inside the mitochondria; however, long-chain fatty acids are unable to penetrate the inner mitochondrial membrane. Therefore a carrier is needed to get the long-chain fatty acids to the place of oxidation⁵. This carrier is known as L-Carnitine.

Researchers found a marked reduction of fat breakdown in the skeletal muscle of obese humans as compared with normal weight subjects^{6, 7}.

It has been shown by two different research groups that oral supplementation of Carnipure™ tartrate stimulates *in vivo* long chain fatty acid metabolism in adults^{5, 8}. Prior to, and after ten days of Carnipure™ supplementation, the subjects received ¹³C-labeled fatty acids with a meal. Labeled ¹³CO₂ as the breakdown product of the labeled fatty acids was then measured in the exhaled air. In the groups that received Carnipure™ tartrate, a significant increase in exhalation of labeled ¹³CO₂ was observed, indicating a significant increase in fatty acid oxidation (Figure 1).

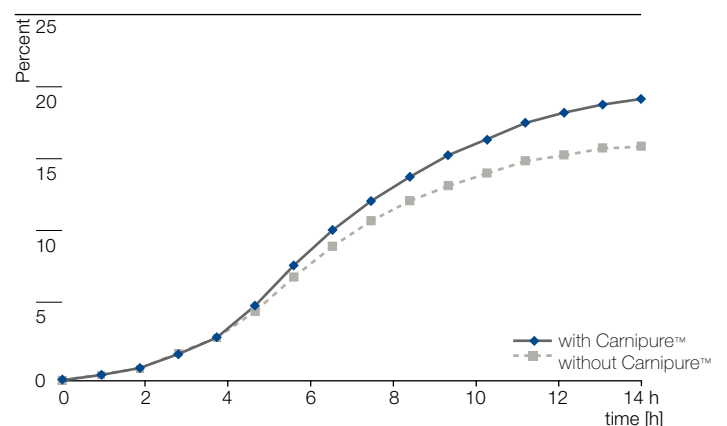


Figure 1: Cumulative 15-hour % of ¹³CO₂ exhalation before and after Carnipure™ tartrate supplementation⁸.

To put it simply, L-Carnitine is needed to turn fatty acids into energy (ATP) and because energy is available from fat, glucose reserves in the body are spared and breakdown of amino acids for energy production is decreased⁹.

The increased availability of amino acids supports hepatic gluconeogenesis which results in an enhanced glucose supply to the brain. As a consequence of the above, L-Carnitine may induce appetite suppression and increase the resting metabolic rate (RMR) which represents the rate at which the body burns energy to sustain bodily functions. It is noteworthy, that a low RMR is a predictor of body weight gain as it is inversely related to body weight¹⁰.

Carnipure™ and food intake

Carnitine-Palmitoyl-Transferase (CPT), the pace-setting enzyme of mitochondrial fatty acid oxidation, seems to participate in the control of food intake by regulating the partitioning of long-chain fatty acids between pathways of storage and intramitochondrial oxidation^{11,12}. Food intake decreases when fatty acid oxidation rates are high, whereas, under conditions in which fat oxidation is low and fat storage favored, food intake tends to increase^{13,14}. Based on research in rats, it was proposed that a shortage of L-Carnitine may increase food intake¹¹.

How does this work at the metabolic level?

The activity of CPT1 is reduced in obese humans as compared to lean subjects^{5,15}. Supplementation with Carnipure™ has been found to increase CPT1 activity in humans significantly more than exercise alone¹⁶. Several studies indicate that enhancing CPT1-activity will both increase energy expenditure while reducing food intake, which could lead to a substantial reduction in body fat^{14,17}. In a recent *in vitro* trial using adipocytes, L-Carnitine was found to stimulate lipolysis, increase mRNA levels of enzymes that participate in lipid catabolism such as CPT1 and down-regulate factors that are involved in adipogenesis¹⁸.

Carnipure™ and weight management

Numerous studies have been conducted that clearly define the role of L-Carnitine in weight management. L-Carnitine can be recommended to be used as part of a healthy weight management program for individuals concerned about their weight.

L-Carnitine is supplied to the body through both the endogenous synthesis and food intake. Ideally, a well balanced diet with the best sources being of animal origin could supply an additional 100–300 mg of L-Carnitine to the body¹⁹. During dieting, the amount of dietary L-Carnitine intake decreases significantly^{20,21}, which provides the most convincing support for the use of supplementary dietary

Carnipure™ as a safe and effective approach for weight management.

There is substantial evidence from animal studies showing the beneficial effects of supplementary L-Carnitine in weight management and to increase lean muscle growth^{9,22,23}.

A placebo controlled study with obese adolescents showed that L-Carnitine supplementation (2 g/day for 12 weeks) promoted significant weight loss, a decrease in BMI and body fat content when used as a component of an overall weight management program²⁴. A study performed in 100 obese people provided convincing data

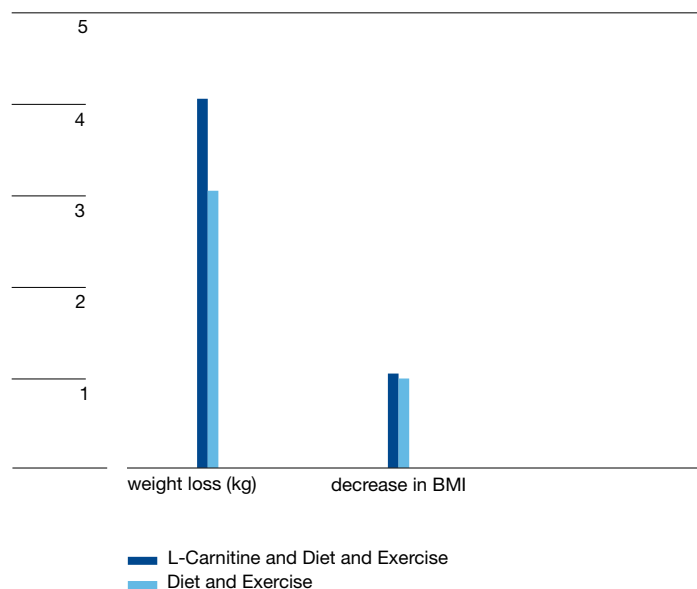


Figure 2: In an open, non controlled study, 100 obese people (average body weight 96.18 kg, 27 to 64 years of age) received diet (1200 kcal/day) or diet supplemented with L-Carnitine (3 g/day for 4 weeks) in conjunction with moderate exercise. Weight loss and decrease in BMI are shown following treatment with L-Carnitine. The difference in weight loss between L-Carnitine supplementation and control was significant⁴.

about the beneficial effects of L-Carnitine in conjunction with dieting and moderate exercise. Obese people had a 25% greater loss in body weight if they supplemented with L-Carnitine and their BMI dropped by 1.5 (Figure 2), indicating that they were coming closer to their ideal body weight. Total cholesterol, Low Density Lipoproteins (LDL), blood sugar and blood pressure were significantly lower in the L-Carnitine group as compared to control. The authors concluded that supplementary L-Carnitine supports optimal fat oxidation and consequently body weight reduction⁴.

In an open clinical trial with 40 obese subjects, 19 to 68 years of age, dietary supplementation with high fiber cookies, chromium picolinate and L-Carnitine in combination with a low fat diet during 8 weeks led to a significant higher reduction in body weight, loss of body fat, reduction in total cholesterol and LDL cholesterol than low fat diet alone. In addition, subjects reported to feel more energy, less hunger and fewer cravings for sugar which enabled

them to adhere easier to the diet regimen once they received diet supplementation²⁵.

Among all the substances whose concentration decreases with age, L-Carnitine diminution is fundamentally important, given its function in the production of energy²⁶. Studies performed in elderly and very old subjects showed a decrease in total fat mass and an increase in total muscle mass following supplementation with L-Carnitine^{27, 28}.

Carnipure™ and exercise training

About 95% of EU citizens agree that overweight is harmful for health, however most of them feel trapped in a sedentary life that restricts their attempts to lead a healthy lifestyle²⁹. Prevention of muscle soreness in untrained people can assure that the once started regular exercise program will be maintained for a long time. Supplementation of Carnipure™ (1g/day) allows for decreased production of free radicals, less tissue damage, reduced muscle soreness and better utilization of fat as an energy source during recovery after strenuous exercise^{30, 31}.

Endurance exercise training elicits many skeletal muscle adaptations, including an increased capacity for oxidative metabolism of fatty acids^{32, 33}. It has been shown that with increasing exercise intensities, the availability of free L-Carnitine is decreased. Lack of free L-Carnitine and thus substrate for CPT1 may in turn lead to decreased fat oxidation³⁴.

When people lose weight by dieting, they lose at least 25-30% of the weight from dehydration (fluid loss), muscle, bone density and lean tissue rather than fat. Losing lean tissue is unhealthy and counter-productive for weight management and weakens the body, thus making physical activity very difficult. Growing scientific evidence indicates that supplementation with Carnipure™ helps to promote a healthier body weight and favor muscle (lean tissue) deposition^{9, 27}.

And so to conclude

The studies presented here lead to the conclusion that Carnipure™ supplementation can act to optimize fatty acid oxidation and therefore stimulate the return to normal weight.

Suboptimal levels of L-Carnitine may strongly impair β -oxidation. Clinical studies demonstrated the effectiveness of supplementary Carnipure™ for weight management, the improvement of exercise performance and maintenance of a healthy heart. With the above information on hand, it is anticipated that Carnipure™ is the nutritional supplement of choice to support successful weight management.



References

1. Klein S et al (2007). Am J Clin Nutr 85:1197–1202
2. Ogden CL et al. (2006). JAMA 295:1549–1555
3. Max Rubner Institut (2008). www.bmelv.de
4. Lurz R & Fischer R (1998). Aerzte f Naturheilverf 39(1):12–15
5. Müller DM et al. (2002). Metabolism 51(11):1389–1391
6. Kim JY et al. (2000). Am J Physiol Endocrinol Metab 279:E1039–E1044
7. Westerterp K et al. (2008). Am J Clin Nutr 87:132–135
8. Wutzke KD & Lorenz H (2004). Metabolism 53(8):1002–1006
9. Owen KQ et al. (2001). J Anim Sci 79(12):3104–3112
10. Ravussin E et al. (1988). N Engl J Med 318(8):467–472
11. Friedman MI et al. (1990). Am J Physiol 258:216–221
12. Thupari JN et al. (2004). Am J Physiol Endocrinol Metab 287:E97–E104
13. Leonhardt M & Langerhans W (2004). Physiol Behav 83(4):645–651
14. Kuhajda FP & Ronnett GV (2007). Curr Opin Investig Drugs 8(4):312–317
15. Colberg SR et al. (1995). J Clin Invest 95:1846–1853
16. Lohninger A et al. (2005). Chemical Monthly 136:1425–1442
17. Bruce CR et al. (2007). Am J Physiol Endocrinol Metab 292:E1231–E1237
18. Lee MS et al. (2006). J Med Food 9(4):468–473
19. Feller AG & Rudmann D (1988). J Nutr 118:541–547
20. Hoppel CL & Genuth SM (1980). Am J Physiol 238:E409–E415
21. Davis AT et al. (1990). J Am Coll Nutr 9(3):261–264
22. Center SA et al. (2000). J Vet Intern Med 14:598–608
23. Blanchard G et al. (2002). J Nutr 132:204–210
24. Sufeng Z et al. (1997). Acta Nutr Sin 19(2):146
25. Kaats GR et al. (1992). Curr Ther Res 51(2):261–274
26. Costell M et al. (1989). Biochem Biophys Res Commun 161(3):1135–1143
27. Pistone G et al. (2003). Drugs Aging 20(10):761–767
28. Malaguarnera M et al. (2007). Am J Clin Nutr 86:1738–1744
29. European Commission (2006).
http://ec.europa.eu/health/ph_publication/eb_food_en.pdf
30. Volek JS et al. (2002). Am J Physiol Endocrinol Metab 282:E474
31. Spiering BA et al (2007). J Strength Cond Res 21(1):259–264
32. Tunstall RJ et al. (2002). Am J Physiol Endocrinol Metab 283:E66–E72
33. Bruce CR et al. (2006). Am J Physiol Endocrinol Metab 291:E99–E107
34. Kiens B & Roepstorff C (2003). Acta Physiol Scand 178:391–396

Note: This document is an overview of published scientific information on L-Carnitine and published scientific information on clinical and nutritional trials with L-Carnitine and its derivatives. No claims are made herein for any particular consumer product, nor can these statements be used on such consumer products. The recommended use for Carnipure™ is as a nutrient or dietary supplement.

The statements in this document have not been evaluated by any Food and Drug Administration. Lonza's Carnipure™ is not intended to diagnose, treat, cure or prevent any disease.

No statement is intended or should be construed as a recommendation to infringe any existing patent. The information contained herein is believed to be correct and corresponds to the latest state of scientific and technical knowledge.



For more information:

Worldwide

Lonza Ltd, Basel, Switzerland

Tel +41 61 316 81 11

In the USA

Lonza Inc, Allendale, NJ

Tel +1 800 365 8324

carnipure@lonza.com

www.carnipure.com

www.lonzanutrition.com.



Carnipure™ offers purest L-Carnitine and is a trademark of Lonza Ltd, Switzerland.