

# 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.



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## 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.<sup>1</sup> Furthermore, a review by researchers from Johns Hopkins University School of Medicine concluded that enhanced CPT1 activity could increase energy expenditure.<sup>2</sup>

Two independent research groups, Wutzke and Müller, studied the impact of Carnipure® supplementation on fatty acid oxidation.<sup>3,4</sup> Both groups used <sup>13</sup>C 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 <sup>13</sup>C fatty acids. In both of these studies, the supplemented group showed a significant increase in <sup>13</sup>CO<sub>2</sub> 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.<sup>5</sup> 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)<sup>6</sup>, 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.<sup>7</sup> 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.<sup>8</sup> 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.<sup>9</sup>

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.<sup>10</sup> 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.<sup>11</sup> 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.<sup>12</sup>

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.<sup>13</sup>

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.<sup>14</sup>

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

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

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