

# Glycine Propionyl-L-Carnitine (GPLC)

## The Scientific Research In Determining Its Impact

By Rick Bloomer PhD

**H**undreds if not thousands of new sport supplements are introduced each year, many of which have little or no scientific evidence of effect. More importantly, based on the relevant biochemistry and the suggested recommended dosage provided by the manufacturer, there is little reason to believe that many of these products would have any meaningful effect. Rather, aggressive marketing campaigns, coupled with paid endorsements from top athletes (and a bit of "placebo" effect thrown in for good measure), catapult these products to the top of their respective class within months of being on the market.

Photo Jason Mathas Model: Mark Perry



This is particularly true for the class of supplements defined as nitric oxide (NO<sub>2</sub>) stimulators. Most of these products contain a form of the amino acid precursor to NO<sub>2</sub>, L-arginine, often at a dosage of 3 grams per serving. In addition, many products contain other ingredients (typically at less than optimal dosages) that are suggested to act synergistically with L-arginine. More recently, these ingredients have included various antioxidants (e.g., vitamin C), as formulators realize the importance of antioxidants in maintaining NO<sub>2</sub> bioavailability. Antioxidants may be considered an important component in any supplementation plan, as these agents help to maintain overall health and may facilitate exercise recovery. The ingredient Glycine Propionyl-L-Carnitine (GPLC)—GlycoCarn<sup>®</sup> has been reported in the scientific literature to result in both an increase in blood NO<sub>2</sub>, (Bloomer et al., 2007; in press), as well as to function as an antioxidant agent (Bloomer et al., in press). This article provides an overview of NO<sub>2</sub> supplement science and briefly summarizes the impact of GlycoCarn<sup>®</sup> on NO<sub>2</sub> and antioxidant activity.

#### Nitric Oxide Overview

Nitric oxide is released from endothelial cells (the inner liner of blood vessels), and was initially known as endothelium derived relaxing factor (EDRF). As mentioned above, NO<sub>2</sub> is biosynthesized from the amino acid

L-arginine and oxygen by nitric oxide synthases, of which there are three forms (endothelial derived nitric oxide synthase, inducible nitric oxide synthase, and neuronal nitric oxide synthase; Collier and Vallance, 1991). Nitric oxide is a gaseous compound that has several known functions within the body, including glucose and fatty acid oxidation (Jobgen et al., 2006), the stimulation of satellite cells (Anderson, 2000), regulation of muscle tissue hypertrophy (Salanova et al., 2008), and decreasing clot and lesion formation within blood vessels.

While the above effects are important from a health perspective, most sport

ent delivery during an acute exercise bout. For strength athletes/bodybuilders, the increased blood flow could relate to a better "pump," which in turn may allow for greater oxygen and nutrient delivery during exercise and a greater stimulation of post exercise growth. In both cases, the desired outcomes of enhanced performance and recovery are suggested. Unfortunately, there exists little to no objective evidence to confirm these claims. With the exception of our two studies using GlycoCarn<sup>®</sup> (Bloomer et al., 2007; in press), no published studies exist using either the NO<sub>2</sub> stimulating ingredient or the finished product. While we failed to note any

ing is improved with GlycoCarn<sup>®</sup> supplementation. These findings may have implications for individuals involved in repeated high intensity bouts of exercise.

#### Lifestyle Factors, Pharmaceuticals, Dietary Supplements, and Nitric Oxide

First things first, if interested in optimizing blood flow, possibly mediated via NO<sub>2</sub>, then start by doing one thing in particular—EXERCISE! Both single sessions (Bode-Boger et al., 1994; Clarkson et al., 1999; Gilligan et al., 1994; Hickner et al., 1997) and regular, structured, chronic exercise (Edwards et al., 2004; Poveda et al., 1997; Tordi et al., 2006) has been shown to increase NO<sub>2</sub>. Additionally, several prescription drugs are used to mimic the blood flow stimulating effects of NO<sub>2</sub>, including nitrates (patch or spray) and propionyl-L-carnitine (intravenous). L-arginine has also been used with success to stimulate blood flow. However, it is important to note that such studies have involved intravenous injection of L-arginine at relatively high dosages (10-30 grams). Unfortunately, the same effect has not been reported for oral intake of L-arginine (at dosages ranging from 10-20 grams). This is clearly shown in several studies (Adams et al., 1995; Chindusting et al., 1996; Robinson et al., 2003). In addition, L-arginine at an oral dosage of only 10 grams per day has been noted to result in gastric distress



supplement companies are concerned primarily with the potential impact of NO<sub>2</sub> in facilitating the opening of blood vessels (vasodilation). Supplement companies argue that for endurance athletes, the increased blood flow could relate to enhanced oxygen and nutri-

improvement in aerobic or anaerobic power following eight weeks of GlycoCarn<sup>®</sup> supplementation in previously sedentary individuals (Smith et al., 2008), preliminary evidence from an ongoing study indicates that anaerobic work capacity during repeated sprint-

(Robinson et al., 2003). Based on the above knowledge, it appears clear that the proposed NO $\cdot$  stimulating dietary supplements containing L-arginine as the chief ingredient likely cannot deliver the claims made. One alternative to NO $\cdot$  based products is GlycoCarn $\text{\textcircled{R}}$ .



We have been studying the effects of GlycoCarn $\text{\textcircled{R}}$  in our lab since 2005 and have noted some interesting findings. As mentioned above, we have found an increase in blood levels of NO $\times$  (a marker of NO $\cdot$ ) with oral GlycoCarn $\text{\textcircled{R}}$  intake, at a daily dosage of 4.5 grams (Bloomer et al., 2007; in press). In addition, test subjects who received GlycoCarn $\text{\textcircled{R}}$  were noted as having lower levels of "oxidant stress," likely due to the antioxidant benefits of

GlycoCarn $\text{\textcircled{R}}$ . In this same study, subjects receiving GlycoCarn $\text{\textcircled{R}}$  experienced a slight decrease in blood triglycerides (blood fats). This may have implications related to overall cardiovascular disease risk. Finally, eight weeks of GlycoCarn $\text{\textcircled{R}}$  intake at a daily dosage

of 4.5 grams did not result in any negative change in blood count or chemistry (Bloomer et al., in press), highlighting the safety of this ingredient over short-term supplementation.

**The Future for GlycoCarn $\text{\textcircled{R}}$**

Several finished sports nutrition supplement products currently on the market contain GlycoCarn $\text{\textcircled{R}}$  as a chief ingredient, including, but certainly not limited to NitroCarn $\text{\textcircled{R}}$  1500, Pre-Surge $\text{\textcircled{R}}$ ,

GlyPro $\text{\textcircled{R}}$  XTS and XTS Complete Stack $\text{\textcircled{R}}$ , Max Muscle Nitro EXT $\text{\textcircled{R}}$ , and SutraMax $\text{\textcircled{R}}$  Male Libido. Another new product launching in early 2009 will be Plasmatic $\text{\textcircled{R}}$  with GPLC from EST Nutrition. According to the manufacturer of GlycoCarn $\text{\textcircled{R}}$ , Sigma-tau HealthScience, several other sports supplements products containing GlycoCarn $\text{\textcircled{R}}$  are scheduled for launch in 2009 and numerous mainstream products have included GlycoCarn $\text{\textcircled{R}}$  since 2005.

With regards to continued research, we are currently conducting a study investigating the performance and NO $\cdot$  stimulating benefits of a finished product containing GlycoCarn $\text{\textcircled{R}}$ . One other study is currently underway, and others are being planned for 2009. Data from this work should be available in mid to late 2009. Clearly, Sigma-tau HealthScience is committed to funding scientific research to support their ingredients. So stay tuned over the coming months for more interesting findings related to GlycoCarn $\text{\textcircled{R}}$ .

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