

Supplement Performance

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Beta-Alanine: Science Meets Real World Results

With literally hundreds of different supplements available and so many that are based on bogus claims and ridiculous hype, it's almost an impossible challenge to find even one that delivers results. If you've rummaged through the garbage of the supplement scrap heap, you know that finding solid science or real-world proof has been a waste of time... until now!

Beta-Alanine is the absolute exception in every way. Finally, a supplement that actually lives up to its claims! Beta-Alanine efficacy is backed by major university, peer-reviewed studies performed on humans, not the typical cell or rat studies upon which other supplement manufacturers typically base their claims. The science behind Beta-Alanine makes sense. When you finish reading this article, you will have a clear understanding of just how Beta-Alanine works. You will also learn how to safely maximize its use and how it can significantly help you work out harder and longer. Used properly, Beta-Alanine can take your training and results to new levels, helping you set personal records and add lean muscle mass.

Below is a list of the purported extraordinary benefits obtainable from Beta-Alanine. Next, you'll discover what makes these claims a real-

ity. You'll get the supporting details that make a clear distinction between highly effective Beta-Alanine and other ineffective supplements that rely on clever marketing jargon and pseudoscience to confuse you.

Benefits of Beta-Alanine as Supported by Scientific Studies*

Increases:

- Lean muscle mass (LBM)
- Total work done (TWD)
- Power output (PO)
- Time to exhaustion (TTE)
- Intramuscular carnosine concentrations, increasing buffering capacity
- Aerobic endurance

Delays:

- The onset of fatigue from physical working capacity/fatigue threshold (PWCft)
- Ventilatory threshold (VT) threshold
- Lactate threshold (LT)

In Other Words:

- Boost explosive muscular strength and power output
- Increase lean muscle mass
- Boost muscular anaerobic endurance
- Increase aerobic endurance
- Increase exercise capacity so you can train harder and longer

History and Background of Beta-Alanine

Although only recently brought to the forefront, Beta-Alanine was discovered over 100 years ago. Beta-Alanine, also known as 3-aminopropanoic acid, is a non-essential amino acid and is the only naturally occurring beta-amino acid. Not to be confused with L-Alanine, Beta-Alanine is classified as a non-proteinogenic amino acid, as it is not used in the building of proteins and enzymes the way the other 20 proteinogenic (standard) amino acids are. L-Alanine is a proteinogenic amino acid utilized and metabolized very differently in the body than Beta-Alanine.

The greatest natural dietary sources of Beta-Alanine are believed to be obtained through ingesting the Beta-Alanine-containing dipeptides: carnosine, anserine and balenine. These dipeptides are commonly found in protein-rich foods such as chicken, beef, pork and fish. However, obtaining Beta-Alanine through these dipeptides is not the only way, as our bodies can synthesize it in the liver from the catabolism of pyrimidine nucleotides, which are broken down into uracil and thymine and then metabolized into Beta-Alanine and B-aminoisobutyrate. Of course, it can also be ingested through direct supplementation, which is the focus of this article.

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In 2003, researchers began studying Beta-Alanine and examining its effects on exercise performance and lean muscle mass. Their ongoing research has revealed how to properly use these compounds and how to safely and effectively maximize their benefits. One of the key scientists pioneering the performance research on Beta-Alanine is Dr. Roger Harris, the same man who brought creatine to the bodybuilding world with his groundbreaking study 1992. It looks like the good doctor has found another juggernaut of a supplement in Beta-Alanine. However, he is not alone. In the last two years, highly respected research scientist Dr. Jeffrey Stout has been in a frenzy compiling and publishing research on Beta-Alanine and it doesn't look like he'll be slowing down any time soon. Other notables who have been publishing research on Beta-Alanine include Drs. Hill, Kim and Tallon. The support of researchers of this caliber speaks volumes about the efficacy of Beta-Alanine and the science itself is very impressive.

How Does Beta-Alanine Work?

Much of Beta-Alanine's effects are realized by boosting the synthesis of carnosine, a dipeptide (two amino acids) intracellular (inside the cell) buffer. To understand how Beta-Alanine works, you must first understand its connection to carnosine. It is by boosting carnosine levels that Beta-Alanine exerts its outstanding performance benefits.

History and Background of Carnosine

The Russian scientist Gulewitsch was the first to identify carnosine back in 1900. Eleven years later, he would discover and identify its constituent amino acids, beta-alanine and histidine. Seven years later, Barger, Tutin, Baumann and Ingvaldsen confirmed Gulewitsch's findings. However, it wasn't until 1938 that the first research on carnosine and its effects on muscle

buffering were published.

Carnosine is found in both type-1 and type-2 muscle fibers, though in significantly higher concentrations in type-2 fibers (the fibers we primarily use in high-intensity strength workouts and which are most responsive to growth). Before we discuss how carnosine works, you must first have a general understanding of what is physiologically occurring during exercise. Specifically, what is negatively affecting muscular pH, making us weaker and causing fatigue?

Hydrogen ions are released during exercise, causing performance to plummet. When we exercise, especially high intensity exercise, our bodies accumulate a large amount of hydrogen ions (H+) causing our muscles' pH to drop (become more acidic). This process is occurring whether you feel a burn or not.

The breakdown of ATP and the subsequent rise in H+ concentrations occur in all our energy systems, but H+ buildup is most prevalent in an energy system called glycolysis, which also produces lactic acid. At physiological pH, lactic acid dissociates a H+ and is the primary source of released H+ ions during exercise, causing pH to drop. It is the released H+ from lactic acid that causes muscular performance problems, not the leftover lactate ions as many incorrectly believe. While lactic acid is the primary source of released H+, by no means is it the only source. H+ ions are also being released at a rapid rate when you break down the high energy compound ATP during exercise. With the presence of many sources during energy production releasing H+, pH drops fast and subsequently, so does muscular performance, slowing progress and lean muscle gains.

How Does Carnosine Work?

There are a handful of ways carnosine is thought to impact performance, but its most studied function, and the focus of this article, is its role as an intracellular buffer. Carnosine helps,

helping to stabilize muscular pH by soaking up hydrogen ions (H+) that are released at an accelerated rate during exercise.

Our bodies work to keep our pH in balance by utilizing various buffering systems. Buffers largely work by soaking up H+ to maintain, maintaining optimal pH balance, which is we need to function optimally. As mentioned above, our muscles function best in a specific pH range. When pH drops below that range, so does muscular performance. By helping to keep us in a more optimal pH range, our muscles can continue to contract forcibly for a longer time.

There are a handful of buffering systems that work in our bodies. Some maintain pH in the extracellular fluids (ECF) outside of the cell, while others perform their duties in the intracellular fluids (ICF) inside of the cell, and some perform in both. As mentioned above, the primary source of H+ released during exercise is from lactic acid and ATP breakdown. Take a guess where this breakdown and release of H+ is occurring? If you guessed inside our muscles, or intracellularly, you would be correct. As a result, the first line of defense in absorbing all the H+ is going to come from right inside the cell— from intracellular buffers such as carnosine— not from extracellular buffers.

Aside from carnosine being just where we need it, buffering H+ inside our cells, it has some other unique attributes that make it really shine. Carnosine is unique in that the other natural buffering systems our bodies use are also used in many other cellular reactions aside from buffering, watering down much of their buffering abilities. However, what makes carnosine really exciting is that by supplementing with extra Beta-Alanine, we can specifically and dramatically increase carnosine levels. How much, you ask?

Researchers have shown that when supplementing with Beta-Alanine for just four weeks, we can increase our carnosine concentration by 42-65 per-

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cent. Longer Beta-Alanine studies of up to 10-12 weeks show carnosine concentrations increased up to 80 percent. This is a tremendous increase in an already powerful intracellular buffer. It's this large increase in buffering capacity within our muscles that is largely responsible for the strength, lean muscle, power and muscular endurance gains that researchers are seeing from Beta-Alanine studies.

FAQ on Beta-Alanine and Carnosine

• *Is Beta-Alanine safe?*

While this is not a frequently asked question, it should be. We understand many people care most about gaining muscle, looking great and performing at their best, but safety should not be overlooked. We believe it should actually be the first question asked when considering a new supplement.

The answer to whether Beta-Alanine is safe is a resounding YES. Studies, going up to 12 weeks of continued Beta-Alanine use, have looked at a large array of blood biochemical, hematological and hormonal markers and no negative changes have occurred whatsoever. While it's impossible to say Beta-Alanine is 100 percent safe until longer-term studies are completed, we do know that up to at least 12 weeks of continued Beta-Alanine supplementation is, indeed, safe.

• *Why not just take Carnosine instead of Beta-Alanine?*

When you ingest carnosine intact, most of it is broken down in the gastrointestinal (GI) tract into its constituent amino acids, beta-alanine and histidine. Some intact carnosine does escape the GI tract freely, but even that amount is quickly broken down in our blood by the enzyme carnosinase. In a very short time, all the carnosine you just ingested is either eliminated or broken down into beta-alanine and histidine. These two amino acids are then taken into the muscle, where they are converted

back into carnosine with the help of the enzyme carnosine synthetase.

Unfortunately, only approximately about 40 percent of the carnosine you take actually contains beta-alanine, making it an inefficient source at best. You are better off, from both an efficiency and a financial standpoint, taking Beta-Alanine directly. You would have to take substantially more carnosine just to approach the increased concentrations of Beta-Alanine achieved by taking the scientifically recommended dose of Beta-Alanine itself. Clearly, taking Beta-Alanine is the superior solution to increasing carnosine levels.

• *How do we know Beta-Alanine is actually increasing carnosine levels?*

Researchers have proven it by actually taking muscle biopsies (using a hollow needle to remove a small sample of muscle tissue) prior to the study and at various time points throughout the study. What they found is that Beta-Alanine does, in fact, effectively and significantly increase carnosine concentrations in the range of 42-80 percent, depending on the dosing and duration of the study.

• *Shouldn't I take extra histidine along with Beta-Alanine since histidine is a component of carnosine?*

No. Histidine is already present in high concentrations in muscle, while Beta-Alanine is present only in small amounts. Researchers have determined that it's Beta-Alanine that drives carnosine synthesis, not histidine. Since this has been proven repeatedly in research, there is no need to supplement with extra histidine to increase carnosine levels. There are potentially some select populations like vegans, vegetarians or the elderly that may not get enough histidine in their diets and are thus deficient, which may compromise optimal carnosine levels. But, we still don't recommend taking just extra histidine with Beta-Alanine.

Instead, we recommend that these groups simply bump up their total protein intake, which will in turn solve their possible histidine deficiency. For the majority of healthy people, only Beta-Alanine is needed, as histidine deficiency is rare and no extra supplementation is needed to increase carnosine concentrations.

• *At what point during my workout set will extra carnosine concentrations exert their strongest effects?*

Boosting carnosine levels with Beta-Alanine is effective at all points during your set, whether you're lifting heavy or doing endurance work. Your body uses three energy systems to perform work: the ATP-PC system, which is primarily used during heavy lifting and for sets in the 5 to 6-rep range; the glycolytic system, which is predominantly used within the seven to 15 rep range and up; and the oxidative/fat system, which is used primarily in endurance training. Our energy systems are utilized simultaneously; however, depending on the level of intensity or duration of exercise and the fitness level of the individual, certain energy systems will become more dominant in producing energy needed for that activity. Anybody who trains with weights will primarily use the first two systems and the buildup of hydrogen ions will contribute to fatigue in both systems, especially glycolysis.

This is where the supplement creatine falls a little short. It's mostly effective in the ATP-PC system, which relies on stored ATP and re-synthesis using phosphocreatine (PC) for intense, high-energy contractions. Taking creatine will help your explosive strength, but it won't help you much in that the 7 to 15-rep range. As anyone trying to build bigger muscles knows, you must train in both heavy and moderate ranges to gain lean mass. Beta-Alanine, by increasing carnosine concentrations, can buffer/fight the H⁺ buildup that occurs in both these ranges, allowing you to maintain forceful contractions for longer periods of time.

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Decreasing cellular fatigue is an yet another strength of Beta-Alanine. A recent study, in fact, demonstrates that Beta-Alanine significantly outperformed creatine in decreasing cellular fatigue, giving it yet another advantage over what has been considered the most effective sport supplement of the last decade. With Beta-Alanine yielding impressive results in university performance studies, creatine's days at the top may be numbered.

• **Does Beta-Alanine replace creatine?**

Beta-Alanine does not replace creatine. As shown above, they work differently and creatine is still effective for maximizing strength and power. If anything, they should be taken together as the ultimate one-two punch.

• **How much Beta-Alanine is needed to cause performance increases?**

Research has shown that you can take an amount between 3.2 grams and 6.4 grams per day to significantly boost carnosine levels and improve performance. The most recent research, now using 4 to 5 grams a day, is showing comparable carnosine concentration and performance improvements in those using 6.4 grams daily.

• **Who can benefit from Beta-Alanine?**

Individuals participating in weight training looking to gain lean muscle mass and increase strength.

Any individual involved in athletic activities where strength, power and muscular endurance are needed.

Active individuals who have reached a training plateau and are looking for a supplement to take them to the next level.

• **How long will it take to start noticing benefits?**

Performance benefits typically occur in as little as two weeks, although some individuals will notice benefits within one week. As carnosine

levels increase, the benefits will follow. The most dramatic results are generally experienced within the three- to four-week range, but they don't stop there. Research is now showing carnosine levels continue to increase for a minimum of 12 weeks, which is why we recommend staying on Beta-Alanine for at least three months to optimize your carnosine levels.

Immediate benefits: Many users experience intense vasodilation/pumps from the very first dose of Beta-Alanine. This experience occurs because Beta-Alanine increases carnosine, and carnosine is a powerful precursor in generating nitric oxide synthase (a group of enzymes necessary for making the powerful vasodilator nitric oxide).

• **Are there any methods that may increase Beta-Alanine's ability to increase carnosine levels?**

Yes. A recent study showed that a group of subjects taking Beta-Alanine with carbohydrates increased performance gains in half the time compared with a group taking an equal amount of Beta-Alanine without carbohydrates. Carbohydrates spike insulin and one of insulin's effects is to increase amino acid (such as Beta-Alanine) transport into our cells.

• **What's the prickling feeling I get when I first take IntraXCell Beta-Alanine?**

The prickling— called parathesia—is caused by Beta-Alanine binding to nerve receptors, activating them and causing them to discharge/fire. Many of these nerves are below the skin, giving a prickling/pins-and-needles sensation. This sensation begins approximately 15-20 minutes after ingesting Beta-Alanine and usually continues for one to 1.5 hours. The intensity varies depending on dosing, individual sensitivity and potentially from activators of Ca²⁺ channels, such as caffeine.

This sensation, though generally enjoyed by many people, often subsides over a few weeks of continued

use. Carbohydrates/food may also blunt the prickling effect.

• **If I don't feel the prickling, does that mean Beta-Alanine isn't working on me?**

The prickling sensation does not occur at all in some individuals, even when taking 4 to 6 grams of Beta-Alanine at one time. Do not worry if you are in this group. The prickling is *not* a sign that Beta-Alanine is working or being absorbed by your muscles and converted to carnosine. If you're feeling nothing, Beta-Alanine is still increasing your carnosine stores as research has repeatedly shown. A good example of this phenomenon is when combining carbohydrates with Beta-Alanine. Not only do carbohydrates blunt much of the prickling sensation, they also increase Beta-Alanine's performance gains faster than Beta-Alanine without carbohydrates. Another good example is comparing studies that measure carnosine concentrations using multiple, small 800-milligram doses of Beta-Alanine vs. studies using multiple doses of 1.6 grams of Beta-Alanine. The total daily amount of Beta-Alanine ingested is similar and the duration of the studies using both dosage strategies is matched up, as well. The 800 milligrams is low enough to cause little to no prickling, based on feedback from both research and anecdotal records, whereas 1.6 grams can cause quite a lot. The outcome of both studies showed carnosine concentrations were very similar.

• **Is taking taurine at the same time as Beta-Alanine going to stop Beta-Alanine from boosting carnosine and performance levels?**

While there's certainly potential for problems when taking these two together (they share the same transporter into tissues), it hasn't yet been supported in the research to any level of significance. Actually, a recent study by Dr. Harris showed that the increase in muscle carnosine with Beta-Alanine was *not* reduced when taurine was

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taken along with it.

Remember, carnosine concentrations are highest in type-2 muscle fibers, while taurine concentrations are much higher in type-1 muscle fibers, minimizing their conflict further. We could get into the biochemistry of why taking taurine with Beta-Alanine may not seem like a good idea, but we have a simpler and more conclusive explanation. Since there's a group of studies that used either Beta-Alanine by itself or Beta-Alanine with taurine, we examined them to determine if there were any differences in the resulting carnosine concentrations.

While more research is always needed, there are quite a few Beta-Alanine vs. Beta-Alanine plus taurine studies and their outcomes are all the same. There is little to no difference in carnosine concentrations. In other words, taurine does not appear to inhibit Beta-Alanine from being absorbed, otherwise carnosine levels would have been dramatically lower in the Beta-Alanine plus taurine studies.

Summing Up

In conclusion, we hope we've given you a much better understanding of why Beta-Alanine is looked at as the

next creatine, as it draws many parallels with creatine in terms of efficacy and university research-supported studies. It really is the next big thing in sports nutrition and we may not see anything as effective for 10-15 years again, just as it was with creatine. Look for Beta-Alanine to grow in popularity as more and more people get to experience the power firsthand. ■

Sebastian Balcombe is the owner of Athletic Edge Nutrition. Anssi Manninen has no financial interest with companies selling beta-alanine supplements.

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