

# Anabolic Warfare Veiniac: Pump it Up a Notch with the Return of Norvaline

written by PricePLOW Staff | November 4, 2022

Anabolic Warfare has been releasing a *ton* of new pre-workouts in their *Black Series*, and most of them – like Black Series *Maniac* have been *high-stim* formulas.



Anabolic Warfare's newest addition to their Black Series is Veiniac, a stim-free pre-workout with a clean and effective ingredient profile.

Now they're throwing us a bit of a fun curveball: their latest Black Series entry is a *stimulant-free* pre-workout called **Veiniac** to complement the Maniac!

To be fair, we should have expected this day would eventually arrive. Consumer tastes have been shifting more toward stim-free pre-workouts, and most pre-workout lines these days have at least one stim-free option.

## Some Veiniac for your Maniac

Veiniac is a strong and long-lasting formula formula. Nearly all of the ingredients here are industry mainstays in their category, and adequately dosed to get us some serious results.

Yet we also see the reappearance of *norvaline*, reports of whose demise, in our opinion, have been greatly exaggerated.

Before we get into the details, let's check the PricePLOW news and deals:

# Anabolic Warfare Veiniac - Black Series – Deals and Price Drop Alerts

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Get Veiniac - Black Series Price Alerts  
Get Anabolic Warfare alerts  
Get Stimulant-Free Pre Workout Supplements price drops

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## Ingredients

In a single *1-scoop* (17 gram) serving of **Veiniac** from **Anabolic Warfare**, you get the following:

Fruit Explosion		
Supplement Facts		
Serving Size: 1 Scoop (17g)		
Servings per Container: 20		
	Amount Per Serving	%DV
Sodium (as Pink Himalayan Sea Salt)	55 mg	2%
Potassium (from Nitrosigine®)	40 mg	<1%
L-Citrulline	6000 mg	*
Betaine Anhydrous	2500 mg	*
GlycerSize™ (65% Glycerol Powder)	2000 mg	*
Beta Alanine	1500 mg	*
Inositol-Stabilized Arginine Silicate (Nitrosigine®)	1200 mg	*
AGMass® (Agmatine Sulfate)	500 mg	*
Norvaline	250 mg	*

\*Daily Value (DV) Not Established

**Other Ingredients:** Natural and Artificial Flavors, Malic Acid, Citric Acid, Silicon Dioxide, Calcium Silicate, Sucralose, Acesulfame Potassium, Salt

**MANUFACTURED IN A FACILITY WHICH PROCESSES MILK, EGGS, FISH, SHELLFISH, TREE NUTS, PEANUTS, WHEAT, SOYBEANS, AND SESAME.**

**Nitrosigine®** Nitrosigine®, including the Nitrosigine® logo, is a trademark of Nutrition 21, LLC. Nitrosigine® is patent protected.

GlycerSize™ is a trademark of Pinnacle Ingredients Pty Ltd (Australia)  
AGMass® is exclusively distributed by Compound Solutions.

- **L-Citrulline – 6,000 mg**

**Citrulline** is a conditionally essential amino acid that's capable of boosting *nitric oxide* (NO) production.[1]

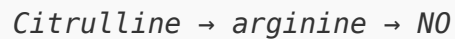
By *conditionally essential*, we mean that the *amount* of citrulline your body can produce on its own may be limited under special pathophysiological conditions. Examples are *illness, stress, or injury* – likely anything that *increases* your metabolic requirements above baseline.

Under those conditions, citrulline then becomes *essential*. At that point, you

must consume a certain amount to compensate for the deficit between what your body requires and what it's capable of producing on its own.

### **Citrulline in context: conversion pathway to nitric oxide (NO)**

The *conversion pathway* from citrulline to NO looks like this:



There's actually an *intermediate step* between citrulline ingestion and NO synthesis: the *conversion of citrulline to arginine*.

So why not supplement with arginine instead? The answer is that the oral bioavailability of arginine is pretty bad. Citrulline is much better absorbed, and thus actually does *better* than supplemental arginine at raising arginine blood levels.[2,3] Higher arginine, in turn, raises NO blood levels.



Feel the burn with Anabolic Warfare's NO-boosting Veiniac.

More NO is a good thing for athletes and gym-goers, as well as anyone who cares about their long-term cardiovascular health. The reason is that NO causes *vasodilation*, a process in which blood vessels expand in diameter and allows *more blood* to flow through them. As a result of vasodilation, tissue perfusion improves, and your heart doesn't have to work as hard to pump blood. Increased NO production also leads to drops in heart rate and, crucially, *blood pressure*. [4-6]

Other benefits of vasodilation include *better tissue oxygenation*, *improved nutrient delivery*, and *more efficient disposal of metabolic waste*. All three of these help you perform better in the gym, and recover faster when you go to sleep at night.

Athletic *endurance*, in particular, hugely benefits from NO upregulation.

The research literature on citrulline indicates that it can do the following:

- Improve *power* by increasing oxygen utilization[7]
- Increase *athletic endurance* by about 50%[8]
- Decrease post-workout *muscle soreness*[8]
- Upregulate *growth hormone* (GH) secretion[9]
- Decrease protein breakdown[10]
- Increase *muscle protein synthesis*[11,12]



ARE YOU A MANIAC?  
ANABOLIC WARFARE'S PRE  
PRICEFLOW ARTICLE

Need an ultra aggressive Anabolic Warfare pre-workout that can also boost nitric oxide levels even more? See *Anabolic Warfare Black Series Maniac*

Lastly, citrulline supplementation has been shown to raise blood levels of *ornithine*,[13] an amino acid that's responsible for clearing *ammonia* from the body.[14] *Ammonia* causes both mental and physical fatigue, so *decreasing* your body's burden of ammonia is just another one of citrulline's endurance-increasing effects.

Ornithine has also been shown to *improve metabolic function* and enhance *sleep quality* while decreasing subjective feelings of stress in those who take it. Ornithine's ability to *lower* the cortisol-to-DHEA ratio seems to play a big part in this process.[14]

### Citrulline dosing

There's a lot to say about *citrulline dosing*.

First, the *minimum effective dose* of citrulline has been measured at just

*under 3,000 milligrams, and we have more than twice that amount in Anabolic Warfare's Veiniac – so that's definitely a good thing.*

After all, at least *some* of citrulline's effects have been shown to be dose-dependent,[15] and the gains don't start to diminish until you get to *10,000 milligrams* daily![16]

So if you *wanted* to double-scoop Veiniac, you'd be getting more out of the citrulline than you would with a single scoop.

- **Betaine Anhydrous – 2,500 mg**

**Betaine**, sometimes referred to by its chemical name *trimethylglycine* (TMG), is one of the supplement industry's mainstay *ergogenic aids*. If you aren't familiar with betaine, you can use *creatine* as a helpful point of reference. Betaine resembles creatine in its effects, although it has a different mechanism of action.

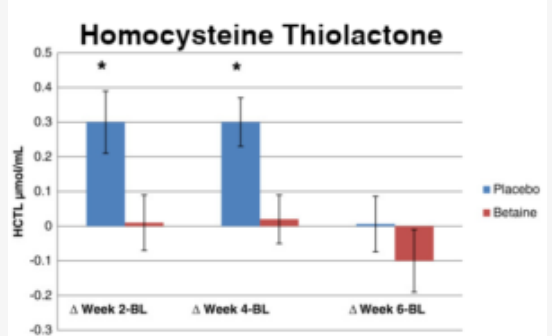
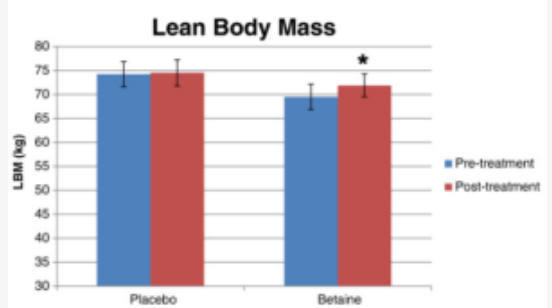
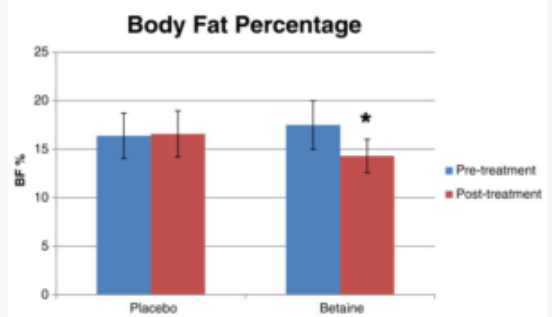
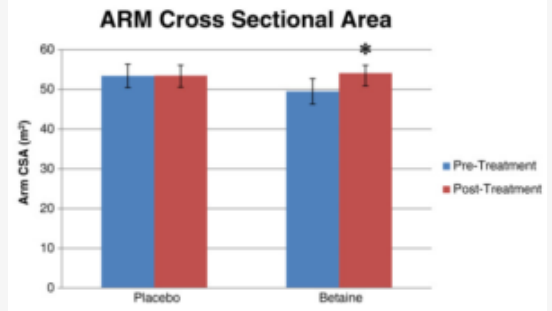
#### **Betaine as a methyl donor**

The big commonality between betaine and creatine is they both increase *adenosine triphosphate* (ATP) production.[17]





# Betaine: 2.5g/day





A landmark 2013 study showed that 2.5 grams of betaine every day can have *profound* effects on body mass and strength[18]

However, creatine does this by acting as a *phosphate donor* – a molecule that drives metabolism by transporting high-energy phosphate groups to the site of phosphate-dependent metabolic processes. *Betaine*, on the other hand, is a *methyl donor*. [19] In fact, betaine is one of the most potent methyl donors known to nutritional science. [20] It's capable of improving other metabolic processes by *sparing* key nutrients like methionine and choline from having to act as methyl donors themselves. For this reason, betaine can help control your *homocysteine blood level*, [21] which is a major established risk factor for cardiovascular disease (CVD) and *cardiovascular events* like heart attack and stroke. [22] Betaine's effect on homocysteine metabolism makes it a great investment in your *long-term* cardiovascular health and physical ability.

### **Betaine's ergogenic effects**

Betaine is an *osmolyte*, which means that it can improve *cellular hydration* by raising the osmotic pressure around cells. Since solutes and fluids naturally move from an area of *higher* osmotic pressure to one of *lower* osmotic pressure, this has the effect of *forcing a larger than ordinary amount of water into cells*.

With more water comes more *nutrients* and *fuel*, which fortifies your cells against metabolic stress [18,23] and *heat stress*. [24]

These cellular effects translate into better strength, power, and even *body composition* for the user. [25-30]

One particularly impressive study, published in 2013, found that subjects who took 2,500 milligrams of betaine daily – the same dose used in Anabolic Warfare's Veiniac – gained over *5 pounds of muscle* and *lost over 6 pounds of fat* during the 1.5 month study period. That's a 3% decrease in body fat. [18,31]

In 2018, a similar study was published, this one involving *collegiate women*. It found that women who took betaine while doing a weight-training program lost over 4 pounds *more* body fat than the control group (i.e. the group that exercised but didn't take betaine). [32]

- **Glycerol Powder (65% Glycerol) (GlycerSize) – 2,000 mg**

Next up we have another osmolyte, **glycerol** – and in a *big* dose.

In multi-ingredient formulas, we rarely see 2,000 milligrams. Instead, 500 or 1,000-milligram doses are a more common.

## Glycerol in context

Glycerol is a *sugar alcohol* produced as a *metabolic byproduct* of glucose and fatty acid oxidation.[33,34] It helps drive *hepatic gluconeogenesis*,[35] the process by which the *liver* converts non-glucose substrates, like *dietary protein*, into glucose.

Oral glycerol supplements are metabolized by the *liver* and *kidneys*, after which the glycerol gets spread out across pretty much every tissue in the body. Importantly, the *brain* and *eyes* are unaffected by the glycerol saturation process[36] – which makes perfect sense as you don't want swelling, to any extent, in either of these two organs.

Just like betaine, glycerol works by increasing osmotic pressure around cells.[36]

Again, in the process of *osmosis*, water moves from an area of *higher solute concentration* to one of *lower solute concentration*. [37] In the case of glycerol and other osmolytes, this osmotic process occurs across the *cellular membrane*.

As with betaine, the result is the same: *cellular hyperhydration*,[38] and all of its endurance-boosting benefits.[36]

- **Beta-Alanine – 3,000 mg**

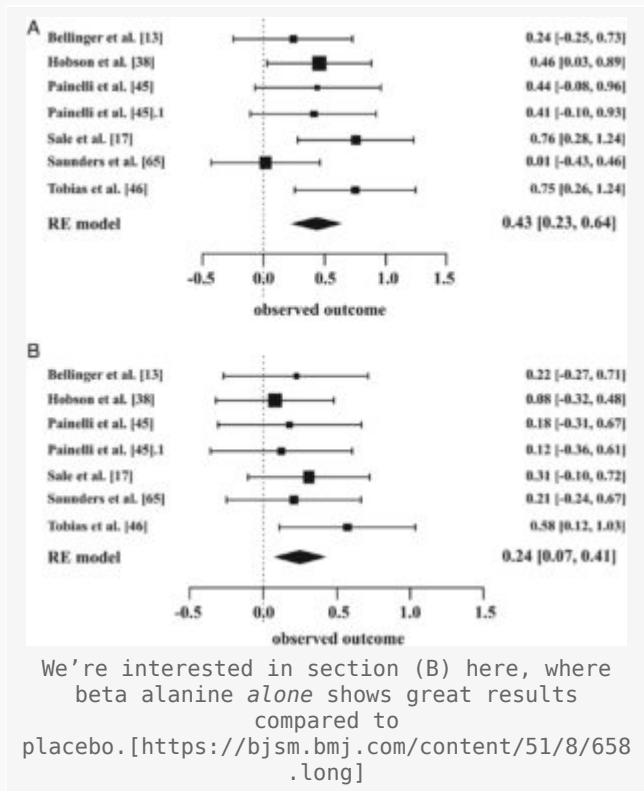
Now we have another *ergogenic aid*: **beta-alanine**.

Beta-alanine has one of the longest track records of any ingredient in the supplement industry, because it *works*. We don't see this one going anywhere any time soon.

When beta-alanine combines with *L-histidine*, an essential amino acid, they form *carnosine*.

Carnosine is a *dipeptide molecule* that naturally concentrates in *muscle tissue*, where it works to remove lactic acid.[39] Since the buildup of lactic acid produces *muscle fatigue*, reducing the lactic-acid burden by increasing carnosine levels can help *extend endurance*.

You might be wondering: *Why not just take a carnosine supplement instead?*



The answer is similar to the interplay between *citrulline* and *arginine*, which we discussed in the citrulline section at the beginning of this article. As an oral supplement, the bioavailability of carnosine is not impressive. Its precursor *beta-alanine* is significantly more bioavailable. In fact, your *beta-alanine* level is actually the rate-limiting factor in your body's production of carnosine.[40,41] So taking supplemental beta-alanine is a *great* way to increase carnosine production and, thus, decrease your burden of lactic acid. Two big meta-analyses looking at over 40 different peer-reviewed studies on beta-alanine supplements and athletic performance found that beta-alanine is *best* at increasing endurance during exercise sessions lasting between 30 seconds and 10 minutes in duration.[39-46] A 3,000-milligram dose is close enough to the clinically-validated dose of 3,200 milligrams that we don't think you have to worry about this ingredient being underdosed.

## Beta-alanine tingles

When taking beta-alanine, you'll probably experience a *tingling* sensation in your upper body. Although it can be uncomfortable, and maybe alarming if it's your first time experiencing it, rest assured that there's no evidence that the "beta-alanine tingles" are harmful.[47]

## • Inositol-Stabilized Arginine Silicate (as Nitrosigine) – 1,200mg

**Nitrosigine** is a *nitric oxide* (NO) boosting ingredient, just like citrulline.

Recall how we discussed previously in the citrulline section that oral arginine bioavailability is *low*, which prompted the supplement industry to use

arginine precursor *citrulline* as a substitute NO-boosting ingredient.

Nutrition21 decided to attack this problem from a different angle: they developed a *more bioavailable form of arginine*.

That's what Nitrosigine is. Specifically, Nitrosigine is *arginine silicate inositol* made from chemically-bonded arginine, inositol, and potassium silicate.[48]



The inositol and potassium silicate buffer the arginine against degradation by the enzyme *arginase*, which usually breaks down arginine in the *stomach* before it's absorbed through the intestinal wall.[49]

Nitrosigine *acts fast* and lasts for a while. People who take Nitrosigine can expect NO blood levels to rise within 30 minutes of ingestion, and stay elevated for up to 6 hours.[50,51]

This is slightly less than the customary Nitrosigine dose of 1,500 milligrams. So you should really understand that it's here to *complement* citrulline, which is the primary NO-boosting ingredient in Anabolic Warfare's Veiniac.

If you want to learn more about Nitrosigine, read our long-form article on this awesome ingredient: Nitrosigine: The Nitric Oxide Booster That Enhances Brain Function – but we'd need 300 more milligrams to be able to make claims supported by the cognitive research demonstrated at the 1,500 milligram dose.

- **AGMass Agmatine Sulfate – 500 mg**

For any substance whose concentration in the human body we want to change, there are generally two factors to consider: *how quickly it builds up*, and *how fast it breaks down* (or is eliminated).

When it comes to *increasing* the concentration of, say, arginine, the more common strategy is to *increase arginine rate of production*, for example by taking a large dose of citrulline.



Make your workouts count with Anabolic Warfare's Black Series of supplements.

Now we have an ingredient that changes the *other* side of the equation: **agmatine sulfate**, which *slows the rate at which* arginine is degraded by the enzyme *arginase*. [52]

This gives us a great *one-two* punch at the heart of Anabolic Warfare's Veiniac: *citrulline and Nitrosigine* boost NO production while the agmatine sulfate *keeps NO levels high* by maintaining high arginine levels.

Agmatine sulfate can also *increase NO production* itself by upregulating *nitric oxide synthase*, [53] the enzyme responsible for synthesizing NO.

Agmatine is also a good little *mood booster*, thanks to its neurotransmitter-like properties. [54]

Mood-boosting ingredients are a great addition to any pre-workout, since mood *does* have a significant impact on our motivation to start and finish a workout.

## Norvaline – 250 mg

Anabolic Warfare finishes Veiniac off with another arginase inhibitor, **norvaline**.

We've already said pretty much all there is to say about this mechanism: by inhibiting arginase, norvaline keeps arginine blood levels high for longer, which in turn keeps NO production high.[55]

But there's a more pressing issue at hand that we haven't discussed in a while:

### Is norvaline safe?

It must be mentioned that norvaline fell out of favor with supplement consumers and manufacturers a few years ago because of a study that showed large *in vitro* doses of norvaline can be *cytotoxic*. [56]



The next wave of warfare is here from Austin, TX based *Anabolic Warfare* – **Project Muscle!** Inside we introduce the *e*leven incredibly unique supplements, three of which lean on epic anabolic plant-based ingredient, *turkesterone*.

Specifically, this study, published in 2019, found that brain cells exposed to norvaline *in vitro* (i.e., as part of a cell culture in something like a Petri dish) died from mitochondrial dysfunction.[56] The authors of the study propose that the precise mechanism by which this happens is norvaline's ability to *mimic* other amino acids, which leads to norvaline getting included in proteins where it doesn't belong.

- Flawed protein synthesis is a very serious matter – this similar to the mechanism behind the progression of horrific *prion* diseases like

*Creutzfeldt–Jakob disease (CJD) and bovine spongiform encephalopathy (BSE), the latter of which is also known as mad cow disease.*[57]

However, the applicability of *in vitro* study results to *in vivo* models – that is, to real living human beings – is generally quite limited. For one thing, the aforementioned study on norvaline’s *cytotoxicity* (toxicity to cells) used a *huge* dose of norvaline – in absolute terms 4-5 times what we typically see in workout supplements.

And of course, whereas during *in vitro* studies the compound under examination is applied directly to cell lines, everything we actually *ingest* goes through the digestive system first, a process which very often modifies the effect that any given substance can have on us.

For these two basic reasons, the conclusions of the study have been questioned in peer-reviewed journals, most notably by a response in the peer-reviewed journal *Brain Sciences*, in which the authors Baruh Polis, Michael A. Gilinsky, and Abraham O. Samson state that:[58]

*“In brief, the conclusions of the study by Samardzic and Rodgers are significantly overstated and omit the fact that L-norvaline toxicity is limited to specific in vitro assays at exceedingly high concentrations. As such, the title could inadvertently be grossly exaggerated and may have instigated unfounded news reports about human toxicity of the dietary supplement L-norvaline. Most importantly, the study at hand does not confirm any human toxicity of L-norvaline; however, it makes claims unsupported by actual data, which resonate in newspaper articles and interviews. For example, they claim that ‘Bodybuilding supplement could be bad for the brain’, [59] which is a misleading and false statement.”*[58]

They also point out that *“In fact, it is well-established that most amino acids at concentrations ~100 μM and above are cytotoxic in vitro”*[58] and cite a study going as far back as 1955 that acknowledges this![60]

In fact, there’s even evidence that norvaline supplementation might *improve* cognitive health and function.[61]

Since this is our first time discussing norvaline in a while, we wanted to present a summary of both sides. There’s a chance that the *in vitro* cytotoxicity study caused an overreaction from the supplement industry. However, we’ll never chastise brands for erring on the side of consumer safety

until more about a topic is known.



But if there were ever a brand who'd buck the trend and bring it back, it'd be one named *Anabolic Warfare*.

If you aren't sure whether you should take a norvaline supplement, ask your doctor for advice.

## Flavors available

## Conclusion

Anabolic Warfare's Veiniac is a *pump-focused formula* – with 6 grams of citrulline, 2.5 grams of betaine, and 2 grams of glycerol, you're *definitely* going to get some swelling around key muscles.

We love seeing big doses of citrulline – 6 grams *alone* is going to upregulate NO production to a *noticeable* extent. You'll *feel* a difference in your workouts just from taking this much citrulline.

When you combine citrulline with *Nitrosigine* and arginase inhibitors, you'll see



that the Veiniac formula definitely lives up to its name.

But the big story here is the re-addition of L-norvaline to make it last even longer, and we think we've fairly covered the beleaguered ingredient so you can make an informed decision before stacking some Veiniac with your Maniac.

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## References

1. Morita, Masahiko, et al; "Oral Supplementation with a Combination of L-Citrulline and L-Arginine Rapidly Increases Plasma L-Arginine Concentration and Enhances NO Bioavailability."; *Biochemical and Biophysical Research Communications*; U.S. National Library of Medicine; 7 Nov. 2014; <https://www.ncbi.nlm.nih.gov/pubmed/25445598>
2. Ochiai, Masayuki, et al; "Short-Term Effects of L-Citrulline Supplementation on Arterial Stiffness in Middle-Aged Men."; *International Journal of Cardiology*; U.S. National Library of Medicine; 8 Mar. 2012; <https://www.ncbi.nlm.nih.gov/pubmed/21067832>
3. Agarwal, Umang et al; "Supplemental Citrulline Is More Efficient Than Arginine in Increasing Systemic Arginine Availability in Mice."; *The Journal of nutrition*; vol. 147,4; 2017; 596-602; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5368575/>
4. Orozco-Gutiérrez JJ, Castillo-Martínez L, Orea-Tejeda A, Vázquez-Díaz O, Valdespino-Trejo A, Narváez-David R, Keirns-Davis C, Carrasco-Ortiz O, Navarro-Navarro A, Sánchez-Santillán R. Effect of L-arginine or L-citrulline oral supplementation on blood pressure and right ventricular function in heart failure patients with preserved ejection fraction. *Cardiol J*. 2010;17(6):612-8. PMID: 21154265. [https://journals.viamedica.pl/cardiology\\_journal](https://journals.viamedica.pl/cardiology_journal)
5. Wong A, Alvarez-Alvarado S, Jaime SJ, Kinsey AW, Spicer MT, Madzima TA, Figueroa A. Combined whole-body vibration training and l-citrulline supplementation improves pressure wave reflection in obese postmenopausal women. *Appl Physiol Nutr Metab*. 2016 Mar;41(3):292-7. doi: 10.1139/apnm-2015-0465; <https://cdnsiencepub.com/doi/10.1139/apnm-2015-0465>
6. Alsop P, Hauton D. Oral nitrate and citrulline decrease blood pressure and increase vascular conductance in young adults: a potential therapy for heart failure. *Eur J Appl Physiol*. 2016 Sep;116(9):1651-61. doi: 10.1007/s00421-016-3418-7; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4983290/>
7. Bailey, Stephen J, et al; "l-Citrulline Supplementation Improves O<sub>2</sub> Uptake Kinetics and High-Intensity Exercise Performance in Humans."; *Journal of Applied Physiology* (Bethesda, Md. : 1985); U.S. National Library of Medicine; 15 Aug. 2015; <https://www.ncbi.nlm.nih.gov/pubmed/26023227>
8. Pérez-Guisado, Joaquín, and Philip M Jakeman; "Citrulline Malate Enhances Athletic Anaerobic Performance and Relieves Muscle Soreness."; *Journal of Strength and Conditioning Research*; U.S. National Library of Medicine; May 2010; <https://www.ncbi.nlm.nih.gov/pubmed/20386132>

9. Sureda A, Córdova A, Ferrer MD, Pérez G, Tur JA, Pons A. L-citrulline-malate influence over branched chain amino acid utilization during exercise. *Eur J Appl Physiol*. 2010 Sep;110(2):341-51. doi: 10.1007/s00421-010-1509-4; <https://link.springer.com/article/10.1007/s00421-010-1509-4>
10. Breuillard C, Cynober L, Moinard C. Citrulline and nitrogen homeostasis: an overview. *Amino Acids*. 2015 Apr;47(4):685-91. doi: 10.1007/s00726-015-1932-2; <https://link.springer.com/article/10.1007/s00726-015-1932-2>
11. Jourdan M, Nair KS, Carter RE, Schimke J, Ford GC, Marc J, Aussel C, Cynober L. Citrulline stimulates muscle protein synthesis in the post-absorptive state in healthy people fed a low-protein diet – A pilot study. *Clin Nutr*. 2015 Jun;34(3):449-56. doi: 10.1016/j.clnu.2014.04.019; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4309748/>
12. Bahri S, Zerrouk N, Aussel C, Moinard C, Crenn P, Curis E, Chaumeil JC, Cynober L, Sfar S. Citrulline: from metabolism to therapeutic use. *Nutrition*. 2013 Mar;29(3):479-84. doi: 10.1016/j.nut.2012.07.002; <https://www.sciencedirect.com/science/article/abs/pii/S0899900712002584?via%3Dihub>
13. Agarwal, Umang, et al. "Supplemental Citrulline Is More Efficient than Arginine in Increasing Systemic Arginine Availability in Mice." *The Journal of Nutrition*, vol. 147, no. 4, 1 Apr. 2017, pp. 596–602; 10.3945/jn.116.240382; <https://academic.oup.com/jn/article/147/4/596/4584706>
14. Miyake, Mika, et al. "Randomised Controlled Trial of the Effects of L-Ornithine on Stress Markers and Sleep Quality in Healthy Workers." *Nutrition Journal*, vol. 13, no. 1, 3 June 2014, 10.1186/1475-2891-13-53; <https://nutritionj.biomedcentral.com/articles/10.1186/1475-2891-13-53>
15. Filippi, Jerome et al. "Dose-dependent beneficial effects of citrulline supplementation in short bowel syndrome in rats." *Nutrition (Burbank, Los Angeles County, Calif.)* vol. 85 (2021): 111118. doi:10.1016/j.nut.2020.111118 <https://www.sciencedirect.com/science/article/abs/pii/S0899900720304019?via%3Dihub>
16. Allerton, Timothy D et al. "L-Citrulline Supplementation: Impact on Cardiometabolic Health." *Nutrients* vol. 10,7 921. 19 Jul. 2018, doi:10.3390/nu10070921; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6073798/>
17. Lee I. Betaine is a positive regulator of mitochondrial respiration. *Biochem Biophys Res Commun*. 2015 Jan 9;456(2):621-5. doi: 10.1016/j.bbrc.2014.12.005; <https://pubmed.ncbi.nlm.nih.gov/25498545/>
18. Cholewa, Jason M et al. "Effects of betaine on body composition, performance, and homocysteine thiolactone." *Journal of the International Society of Sports Nutrition* vol. 10,1 39. 22 Aug. 2013, doi:10.1186/1550-2783-10-39; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3844502/>
19. Zhao, Guangfu et al. "Betaine in Inflammation: Mechanistic Aspects and Applications." *Frontiers in immunology* vol. 9 1070. 24 May. 2018, doi:10.3389/fimmu.2018.01070 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5976740/>
20. Craig, Stuart AS. "Betaine in Human Nutrition." *The American Journal of Clinical Nutrition*, vol. 80, no. 3, 1 Sept. 2004, pp. 539–549, 10.1093/ajcn/80.3.539. <https://academic.oup.com/ajcn/article/80/3/539/4690529>
21. Olthof, M. R., & Verhoef, P. (2005). Effects of betaine intake on plasma homocysteine concentrations and consequences for health. *Current drug metabolism*, 6(1), 15-22; <https://pubmed.ncbi.nlm.nih.gov/15720203>
22. Ganguly, Paul, and Sreyoshi Fatima Alam. "Role of homocysteine in the development of cardiovascular disease." *Nutrition journal* vol. 14 6. 10 Jan. 2015, doi:10.1186/1475-2891-14-6; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4326479/>
23. Boel De Paepe; "Osmolytes as Mediators of the Muscle Tissue's Responses to Inflammation: Emerging Regulators of Myositis with Therapeutic Potential"; *EMJ Rheumatol*. 2017;4[1]:83-89; <https://www.emjreviews.com/rheumatology/article/osmolytes-as-mediators-of-the-muscle-tissue-s-responses-to-inflammation-emerging-regulators-of-myositis-with-therapeutic-potential/>
24. Caldas, Teresa, et al. "Thermoprotection by Glycine Betaine and Choline." *Microbiology*, vol. 145, no. 9, 1 Sept. 1999, pp. 2543–2548, 10.1099/00221287-145-9-2543; <https://pubmed.ncbi.nlm.nih.gov/10517607/>
25. Roti, M; "Homocysteine, Lipid and Glucose Responses to Betaine Supplementation During Running in the Heat"; *Medicine & Science in Sports & Exercise: May 2003 – Volume 35 – Issue 5 – p S271*; [https://journals.lww.com/acsm-msse/Fulltext/2003/05001/HOMOCYSTEINE,\\_LIPID\\_AND\\_GLUCOSE\\_RESPONSES\\_T0.1501.aspx](https://journals.lww.com/acsm-msse/Fulltext/2003/05001/HOMOCYSTEINE,_LIPID_AND_GLUCOSE_RESPONSES_T0.1501.aspx)
26. Armstrong, Lawrence E, et al. "Influence of Betaine Consumption on Strenuous Running and Sprinting in a Hot Environment." *Journal of Strength and Conditioning Research*, vol. 22,

- no. 3, May 2008, pp. 851–860, 10.1519/jsc.0b013e31816a6efb;  
<https://pubmed.ncbi.nlm.nih.gov/18438230>
27. Hoffman, Jay R, et al. "Effect of Betaine Supplementation on Power Performance and Fatigue." *Journal of the International Society of Sports Nutrition*, vol. 6, no. 1, 27 Feb. 2009, 10.1186/1550-2783-6-7; <https://jissn.biomedcentral.com/articles/10.1186/1550-2783-6-7>
  28. Lee, Elaine C, et al. "Ergogenic Effects of Betaine Supplementation on Strength and Power Performance." *Journal of the International Society of Sports Nutrition*, vol. 7, no. 1, 2010, p. 27, 10.1186/1550-2783-7-27; <https://jissn.biomedcentral.com/articles/10.1186/1550-2783-7-27>
  29. Trepanowski, John F, et al. "The Effects of Chronic Betaine Supplementation on Exercise Performance, Skeletal Muscle Oxygen Saturation and Associated Biochemical Parameters in Resistance Trained Men." *Journal of Strength and Conditioning Research*, vol. 25, no. 12, Dec. 2011, pp. 3461–3471, 10.1519/jsc.0b013e318217d48d; <https://pubmed.ncbi.nlm.nih.gov/22080324/>
  30. Pryor, J Luke, et al. "Effect of Betaine Supplementation on Cycling Sprint Performance." *Journal of the International Society of Sports Nutrition*, vol. 9, no. 1, 3 Apr. 2012, 10.1186/1550-2783-9-12; <https://jissn.biomedcentral.com/articles/10.1186/1550-2783-9-12>
  31. Cholewa, Jason M., et al. "Effects of Betaine on Performance and Body Composition: A Review of Recent Findings and Potential Mechanisms." *Amino Acids*, vol. 46, no. 8, 24 Apr. 2014, pp. 1785–1793, 10.1007/s00726-014-1748-5; <https://pubmed.ncbi.nlm.nih.gov/24760587/>
  32. Jason Michael Cholewa, et al; "The Effects of Chronic Betaine Supplementation on Body Composition and Performance in Collegiate Females: a Double-Blind, Randomized, Placebo Controlled Trial"; *Journal of the International Society of Sports Nutrition*; BioMed Central; 31 July 2018; <https://jissn.biomedcentral.com/articles/10.1186/s12970-018-0243-x>
  33. Simon P Van Rosendal, Mark A Osborne, Robert G Fassett, Jeff S Coombes; "Physiological and performance effects of glycerol hyperhydration and rehydration"; *Nutrition Reviews*, Volume 67, Issue 12, 1 December 2009, Pages 690–705, <https://doi.org/10.1111/j.1753-4887.2009.00254.x>; <https://academic.oup.com/nutritionreviews/article/67/12/690/1938382>
  34. Baba, H et al; "Glycerol gluconeogenesis in fasting humans."; *Nutrition* (Burbank, Los Angeles County, Calif.); vol. 11,2; 1995; 149-53; <https://pubmed.ncbi.nlm.nih.gov/7647479/>
  35. Ross, B D et al; "The rate of gluconeogenesis from various precursors in the perfused rat liver."; *The Biochemical journal*; vol. 102,3; 1967; 942-51; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1270348/>
  36. Patlar, Suleyman et al; "The effect of glycerol supplements on aerobic and anaerobic performance of athletes and sedentary subjects."; *Journal of human kinetics*; vol. 34; 2012; 69-79; doi:10.2478/v10078-012-0065-x; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3590833/>
  37. Rye, Connie, et al; "22.1. Osmoregulation and Osmotic Balance."; *Concepts of Biology 1st Canadian Edition*; BCcampus; 1 May 2019; <https://opentextbc.ca/biology/chapter/22-1-osmoregulation-and-osmotic-balance/>
  38. Robergs, R A, and S E Griffin; "Glycerol. Biochemistry, pharmacokinetics and clinical and practical applications."; *Sports medicine* (Auckland, N.Z.); vol. 26,3; 1998; 145-67; doi:10.2165/00007256-199826030-00002; <https://www.ncbi.nlm.nih.gov/pubmed/9802172/>
  39. Trexler, E.T., Smith-Ryan, A.E., Stout, J.R. et al.; "International society of sports nutrition position stand: Beta-Alanine."; *J Int Soc Sports Nutr* 12, 30 (2015); <https://jissn.biomedcentral.com/articles/10.1186/s12970-015-0090-y>
  40. Harris, R. C., et al. "The Absorption of Orally Supplied  $\beta$ -Alanine and Its Effect on Muscle Carnosine Synthesis in Human Vastus Lateralis." *Amino Acids*, vol. 30, no. 3, 24 Mar. 2006, pp. 279–289, 10.1007/s00726-006-0299-9; <https://pubmed.ncbi.nlm.nih.gov/16554972/>
  41. Dunnett, M., and R. C. Harris. "Influence of Oral  $\beta$ -Alanine and L-Histidine Supplementation on the Carnosine Content of Thegluteus Medius." *Equine Veterinary Journal*, vol. 31, no. S30, July 1999, pp. 499–504, 10.1111/j.2042-3306.1999.tb05273.x; <https://pubmed.ncbi.nlm.nih.gov/10659307/>
  42. Hobson, R M, et al; "Effects of  $\beta$ -Alanine Supplementation on Exercise Performance: a Meta-Analysis."; *Amino Acids*; Springer Vienna; July 2012; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3374095/>
  43. Sale, Craig, et al; "Effect of  $\beta$ -Alanine plus Sodium Bicarbonate on High-Intensity Cycling Capacity."; *Medicine and Science in Sports and Exercise*; U.S. National Library of Medicine; Oct. 2011; <https://www.ncbi.nlm.nih.gov/pubmed/21407127>
  44. Van, R, et al; "Beta-Alanine Improves Sprint Performance in Endurance Cycling."; *Current Neurology and Neuroscience Reports*; U.S. National Library of Medicine; Apr. 2009; <https://www.ncbi.nlm.nih.gov/pubmed/19276843>
  45. Kern, Ben D, and Tracey L Robinson; "Effects of  $\beta$ -Alanine Supplementation on Performance

- and Body Composition in Collegiate Wrestlers and Football Players.”; *Journal of Strength and Conditioning Research*; U.S. National Library of Medicine; July 2011; <https://www.ncbi.nlm.nih.gov/pubmed/21659893>
46. Saunders, Bryan, et al. “ $\beta$ -Alanine Supplementation to Improve Exercise Capacity and Performance: A Systematic Review and Meta-Analysis.” *British Journal of Sports Medicine*, vol. 51, no. 8, 18 Oct. 2016, pp. 658–669; <https://bjsm.bmj.com/content/51/8/658.long>
  47. Dolan, Eimear, et al. “A Systematic Risk Assessment and Meta-Analysis on the Use of Oral  $\beta$ -Alanine Supplementation.” *Advances in Nutrition*, vol. 10, no. 3, 13 Apr. 2019, pp. 452–463, 10.1093/advances/nmy115; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6520041/>
  48. Vijaya Juturu V., Komorowski, JR. 2002. US7576132B2 – “Arginine Silicate Inositol Complex and use Thereof.” The United States Patent and Trademark Office. <https://patents.google.com/patent/US7576132>
  49. Komorowski, J., Perez, S., & Sylla, S; “Arginase Inhibition by Inositol-stabilized Arginine Silicate (ASI; Nitrosigine); A Novel Mechanism by which ASI Enhances Arginine Bioavailability”; Poster Presentation. Retrieved from <https://www.eventscribe.com/2018/Nutrition2018/ajaxcalls/PosterInfo.asp?efp=UlhTRFpZVVI00DYw&PosterID=146640&rnd=0.1401379>
  50. Rood-Ojalvo, S. et al. Sep. 2015. “The Benefits of Inositol-Stabilized Arginine Silicate as a Workout Ingredient.” *Journal of the International Society of Sports Nutrition* vol. 12(S1). <https://jissn.biomedcentral.com/articles/10.1186/1550-2783-12-S1-P14>
  51. Sandler, D., et al. June 2016. “Absorption of Bonded Arginine Silicate Compared to Individual Arginine and Silicon Components.” *Journal of the International Society of Sports Nutrition* vol. 13. <https://jissn.biomedcentral.com/articles/10.1186/s12970-016-0144-9>
  52. Morrissey J. et al. Jan. 1997. “Agmatine Activation of Nitric Oxide Synthase in Endothelial Cells.” *Proceedings of the Association of American Physicians* vol. 109,1;51-7. <https://pubmed.ncbi.nlm.nih.gov/9010916/>
  53. Freitas, Andiara E., et al. “Agmatine, a Potential Novel Therapeutic Strategy for Depression.” *European Neuropsychopharmacology: The Journal of the European College of Neuropsychopharmacology*, vol. 26, no. 12, 1 Dec. 2016, pp. 1885–1899, 10.1016/j.euroneuro.2016.10.013; <https://pubmed.ncbi.nlm.nih.gov/27836390/>
  54. Mihail V. Pokrovskiy, Mihail V. Korokin, Svetlana A. Tsepeleva, et al., “Arginase Inhibitor in the Pharmacological Correction of Endothelial Dysfunction,” *International Journal of Hypertension*, vol. 2011, Article ID 515047, 4 pages, 2011. doi:10.4061/2011/515047 <https://www.hindawi.com/journals/ijhy/2011/515047/>
  55. Legaz, M. et al. Feb. 1983. “Endogenous Inactivators of Arginase, L-Arginine Decarboxylase, and Agmatine Amidinohydrolase in *Evernia prunastri* Thallus.” *Plant Physiology* vol. 71,1; 300-2. <https://pubmed.ncbi.nlm.nih.gov/16662821>
  56. Samardzic, Kate, and Kenneth J. Rodgers. “Cytotoxicity and Mitochondrial Dysfunction Caused by the Dietary Supplement L-Norvaline.” *Toxicology in Vitro*, vol. 56, Apr. 2019, pp. 163–171, 10.1016/j.tiv.2019.01.020; <https://www.sciencedirect.com/science/article/abs/pii/S0887233318305782>
  57. Leighton, Patricia L A, and W Ted Allison. “Protein Misfolding in Prion and Prion-Like Diseases: Reconsidering a Required Role for Protein Loss-of-Function.” *Journal of Alzheimer’s disease : JAD* vol. 54,1 (2016): 3-29. doi:10.3233/JAD-160361 <https://content.iospress.com/openurl?genre=article&id=doi:10.3233/JAD-160361>
  58. □Polis, Baruh et al. “Reports of L-Norvaline Toxicity in Humans May Be Greatly Overstated.” *Brain sciences* vol. 9,12 382. 17 Dec. 2019, doi:10.3390/brainsci9120382 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6955955/>
  59. “Body Building Supplement Could Be Bad for the Brain: People Taking the Protein Supplement L-Norvaline Should Be Aware of Its Potential for Harm, Scientists Say.” *ScienceDaily*; February 7, 2019; <https://www.sciencedaily.com/releases/2019/02/190207102627.htm>
  60. Eagle, H. “The specific amino acid requirements of a human carcinoma cell (Stain HeLa) in tissue culture.” *The Journal of experimental medicine* vol. 102,1 (1955): 37-48. doi:10.1084/jem.102.1.37; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2136494/>
  61. Caccamo, Antonella et al. “Reducing Ribosomal Protein S6 Kinase 1 Expression Improves Spatial Memory and Synaptic Plasticity in a Mouse Model of Alzheimer’s Disease.” *The Journal of neuroscience : the official journal of the Society for Neuroscience* vol. 35,41 (2015): 14042-56. doi:10.1523/JNEUROSCI.2781-15.2015 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4604237/>