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LEGION PULSE VS CELLUCOR C4 ORIGINAL: WHICH PRE-WORKOUT IS BETTER?



Cellucor's C4 is the top-selling pre-workout supplement in America, and for good reason. It's affordable and widely available and contains well-known ingredients like creatine and beta-alanine, so it's no surprise that you find it in gym bags everywhere.

How good is it, though, and how does it compare to my pre-workout supplement Pulse, which also contains known winners like citrulline malate, betaine, and theanine?

Well, the short story is this: If you're looking for a simple, inexpensive pre-workout supplement that may slightly enhance your physical performance, then C4 is for you. If you're looking for a premium, 100% natural supplement that can noticeably enhance your workouts, however, then you want Pulse.

DO YOU WANT SCIENCE-BACKED INGREDIENTS AND DOSAGES?

These days everybody says their formulations are "backed by science," but what does that mean, really?

Well, it boils down to this: For a product to fully have science on its side, every ingredient must be proven effective in well-designed, well-executed, and peer-reviewed scientific research, and every dosage of every ingredient must conform to the dosages used in these studies ("clinically effective dosages").

If a product doesn't meet these simple criteria—if the majority of its ingredients haven't been proven effective in sound research and most of the dosages are below the clinically effective levels—then it's not "backed by science," and probably not worth buying.

Both C4 and Pulse claim to have scientifically validated formulations, so let's see how they compare in this regard.

WHAT DOES SCIENCE HAVE TO SAY ABOUT C4?

C4 contains eight active ingredients:

01. 150 Milligrams of Caffeine

Caffeine is a stimulant that increases resistance to fatigue, boosts strength and power, and improves cognition and alertness.

Research shows that the clinically effective dosage of caffeine for improving physical performance is 3 to 6 milligrams per kilogram of body weight, which is about 200 to 400 milligrams for a 150-pound man.

Thus, 150 milligrams of caffeine in each serving of C4 is on the low end for a pre-workout supplement, but is still high enough to be effective. If you were to take two servings at a time, as many people do, then it would give you the full clinically effective dosage.

02. 1.6 Grams of Beta-Alanine

Beta-alanine is an amino acid that reduces fatigue associated with exercise and improves anaerobic workout capacity, which can lead to an increase in lean mass. It accomplishes all this primarily by reducing the buildup of lactic acid in muscles during exercise.

The clinically effective dosage of beta-alanine is 2 to 4.8 grams per day, and when you look at the data, 4.8 grams is slightly more effective than 2 grams but there isn't too much of a difference when the supplement is taken every day.

So, the 1.6 grams of beta-alanine in C4 is low but enough that you'll likely notice some benefits, but it may take some time for you to notice its effects.

03. 1 Gram of Creatine Nitrate

Creatine nitrate is a more water-soluble form of creatine monohydrate, a supplement that can increase strength, muscle growth, and anaerobic performance by increasing your body's ability to regenerate cellular energy.

The clinically effective dosage of creatine is 5 grams per day, and if you want to see benefits as quickly as possible, you can "load" it by taking 20 grams per day for the first 5 to 7 days, and then continuing with 5 grams per day.

Now, theoretically, there's no reason to think that creatine nitrate wouldn't work as well as creatine monohydrate. As it stands, though, no studies have ever been done on creatine nitrate, so we can't say for sure that it's equally effective.

Assuming it does work the same way as monohydrate, the 1 gram of creatine nitrate in C4 is far lower than the clinically effective dosage—the amount you'd need to see any noticeable improvements in the gym.

04. 1 Gram of Arginine Alpha-Ketoglutarate

Arginine is an amino acid that's required to regulate blood flow, and when it's combined with a salt called alpha-ketoglutarate, you get arginine alpha-ketoglutarate, or AAKG.

Now, L-arginine is best known as a "nitric oxide booster," meaning that it's meant to raise the levels of nitric oxide in your blood. In case you're not familiar with it, nitric oxide is a gas produced by the body that widens blood vessels and improves blood flow. So, anything that increases nitric oxide production should increase blood flow.

When you look at the research, though, L-arginine turns out to be very hit-and-miss for this purpose. Some studies show it does indeed increase nitric oxide levels and blood flow and others don't, and most studies have found that it doesn't improve strength, power, or body composition in otherwise healthy people.

Arginine alpha-ketoglutarate is considered a slightly better option than L-Arginine as it's better absorbed, but it still doesn't reliably increase blood flow and doesn't work as well as L-citrulline.

The dosages of arginine AAKG used in the studies ranged between 3.7 and 4 grams, so the 1 gram found in C4 is about 4 times less than you'd need to see any potential benefits (and even then it's a crap shoot).

05. Theacrine

Theacrine is a stimulant that's structurally similar to caffeine, and while there's evidence that it may enhance mental performance, its effects on physical performance are currently unknown.

There is no clinically effective dosage of theacrine, as it's never been shown to improve performance, and it's also just a very under-researched molecule. It provides just 23 hits in pubmed overall compared to 314 for "beta-alanine supplementation", 1,754 for "creatine supplementation," and 347 for "citrulline supplementation".

The amount of theacrine in C4 isn't listed, as it's lumped into their proprietary "Explosive Energy Blend," so who knows what you're actually getting here.

06. N-Acetyl-L-Tyrosine

L-tyrosine is an amino acid that can reduce stress and improve mood and cognitive function, but doesn't improve exercise performance, and N-acetyl-L-tyrosine is just a more water-soluble form of L-tyrosine.

Despite the fact that the body uses L-tyrosine to create epinephrine, norepinephrine, and dopamine, supplementing with it only seems to improve mood and cognition during times of extreme stress such as prolonged cold or altitude exposure. It's never been proven to improve strength, focus, or mood under normal conditions.

Now, you could say that even if a tough workout isn't the physiological equivalent of subjecting yourself to 5 hours of oxygen deprivation and freezing temperatures, it could theoretically deplete your tyrosine levels to some degree.

If that is the case, the clinically effective dosage for raising your tyrosine levels is 100 milligrams per kilogram (or 7 grams for a 150 pound man) or 10 grams per day.

The L-tyrosine in C4 is part of a proprietary blend, so we don't know the exact amount that's included. The entire blend is only 425 milligrams, though, so we can say for sure that it's many times below the amount you'd need to notice any improvement in mood.

07. L-DOPA

L-DOPA is another amino acid involved in the production of dopamine, which is a neurotransmitter that plays a role in your motivation to exercise.

L-DOPA isn't typically included in pre-workouts to directly increase your performance (because it won't), but rather to improve your overall mood state and preparedness to train.

Well, while we know that it can boost dopamine levels, it's debatable how effective it really is for the purpose of elevating mood and motivation.

The L-DOPA in C4 comes from an unspecified amount of velvet bean extract, which is included in their proprietary blend. Velvet bean seed extract is typically around 0.5 to 6% L-DOPA, which makes it possible, but quite unlikely that C4 has enough actual L-DOPA to produce any noticeable effects whatsoever.

At a low dose of 100 milligrams, L-DOPA only produces significant effects when it's paired with something that helps it get to the brain, like the drug carbidopa (which is commonly used to treat Parkinson's disease). C4 doesn't list any compound like this that would help L-DOPA enter the brain, so it's likely there is none.

08. B Vitamins & Vitamin C

B vitamins are involved in hundreds of biological processes in the body, mostly related to the metabolism of food and the production of hormones and red blood cells.

Vitamin C is an antioxidant that helps maintain healthy tissues, teeth, and gums; promotes wound healing; and boosts the immune system.

C4 contains small amounts of vitamins B3, B6, B12, and B9 (folate) probably because some people report feeling more energized when they take B vitamins, but there's no evidence that they're performance-enhancing per se. These effects are likely due to the correction of a deficiency or simply the placebo effect.

Vitamin C is often taken to improve recovery, but there's no evidence that it helps and some that it may actually impair adaptations to exercise. It's a moot point, though, as the amount in C4 is many times less than you'd need to experience these effects, and it's typically included in pre-workouts to improve the flavor.

None of these vitamins have been proven to improve performance, so there is no clinically effective dosage. That said, these vitamins are dirt cheap and may help some people feel a little better, so there's no foul play in including them.

WHAT DOES SCIENCE HAVE TO SAY ABOUT PULSE?

Pulse contains six active ingredients:

01. 350 Milligrams of Caffeine

Caffeine is a stimulant that increases resistance to fatigue, boosts strength and power, and improves cognition and alertness.

Research shows that the clinically effective dosage of caffeine for improving physical performance is 3 to 6 milligrams per kilogram of body weight, which is about 200 to 400 milligrams for a 150-pound man.

Thus, the 350 milligrams of caffeine in Pulse is going to be effective for most people.

02. 8 Grams of L-Citrulline DL-Malate

L-citrulline is an amino acid that boosts muscle endurance, minimizes muscle soreness, and enhances aerobic performance by increasing your body's production of nitric oxide. (Nitric oxide, you'll remember, improves blood flow.)

It does this by increasing the amount of arginine in the blood, and it does so far more reliably than supplementing with L-arginine itself (weird, I know).

Malic acid is added to L-citrulline to create L-citrulline DL-malate, which reduces the amount of L-citrulline that's broken down in the body into other, less beneficial compounds.

The clinically effective dosage of L-citrulline for improving performance is 6 to 8 grams per day. Pulse contains 8 grams of L-citrulline, more than enough to notice a significant boost in performance.

03. 4.8 Grams of Beta-Alanine

Beta-alanine is an amino acid that reduces fatigue associated with exercise and improves anaerobic workout capacity, which can lead to an increase in lean mass.

The clinically effective dosage of beta-alanine is 2 to 4.8 grams per day.

When you look at the data, 4.8 grams is slightly more effective than 2 grams but there isn't too much of a difference when the supplement is taken every day. To be on the safe side, I included 4.8 grams of beta-alanine in Pulse, matching the upper end of that range and ensuring that it will be maximally beneficial.

04. 2.5 Grams of Betaine

Betaine is another amino acid that boosts strength and muscle endurance.

The clinically effective dosage of betaine is 2.5 to 6 grams per day, and Pulse contains 2.5 grams. Why only 2.5 grams of betaine and not 6?

Well, most studies have shown 2.5 grams is sufficient for the benefits we're after, and the only study that used 6 grams was on obese people who didn't lift weights. If we added more, we believe it wouldn't enhance the effectiveness enough to warrant the cost.

05. 2.2 grams of L-Ornithine

L-ornithine is an amino acid that appears to reduce fatigue during long workouts by reducing the buildup of ammonia in your muscles during exercise. I decided to include it in Pulse for two reasons: there's enough evidence to suggest it could improve performance, and it's completely safe and relatively inexpensive, so I liked the odds.

The clinically effective dosage of L-ornithine depends on how quickly you want to reduce ammonia levels. If you're willing to wait a month to see results, then you only need to take 400 milligrams per day, but to reduce ammonia levels in a matter of hours, you need a higher dose of around 8 to 14 grams.

I included 2.2 grams of L-ornithine in Pulse as it strikes a balance between those two extremes. It's a large enough dose that you should see improvements within a week, but not so large that it becomes too expensive to include.

06. 350 Milligrams of L-Theanine

L-theanine is an amino acid that reduces stress and increases focus, alertness, and mood by increasing the production of calming neurotransmitters. L-theanine can reduce feelings of stress and improve focus by itself, but its main benefit is taking the “edge” off of caffeine. In other words, taking L-theanine with caffeine helps you reap the benefits of caffeine, without feeling overstimulated.

The clinically effective dosage of L-theanine is 100 to 200 milligrams per day, but studies also show that if you consume L-theanine with caffeine, it’s best to take them in equal amounts. That’s why Pulse contains 350 milligrams of L-theanine, which matches the 350 milligrams of caffeine also in Pulse.

The Bottom Line

C4 contains several effective ingredients, like caffeine, beta-alanine, and creatine, but the dosages leave a lot to be desired.

Pulse, on the other hand, contains six scientifically validated ingredients at dosages proven effective in scientific research.

C4 is for people who want a cheap pre-workout that may give a small pickmeup and aren’t concerned about artificial chemicals, whereas Pulse is for people who want a 100% natural, premium product that noticeably impacts performance.

DO YOU WANT A PREMIUM OR BAREBONES SUPPLEMENT?

All things considered, C4 isn’t a bad product. You can usually find it for \$20 to \$30 bucks a bottle, which gets you 30 servings of several ingredients that will probably help you perform at least a little better in your workouts and feel slightly more alert.

Pulse, on the other hand, costs \$40 for 21 servings, but provides a lot more for that money when viewed in terms of effective ingredients per serving and bottom-line results.

Specifically, C4 provides 4 grams of active ingredients in every serving whereas Pulse provides you with 18 grams, and only three of C4’s ingredients are scientifically proven to enhance workout performance with lackluster dosages, whereas all six in Pulse have been scientifically validated and properly dosed.

DO YOU WANT 100% NATURAL INGREDIENTS?

When it comes to choosing a pre-workout supplement, sometimes what isn't in the product is just as important as what is.

In this case, like most pre-workouts, C4 is artificially sweetened, flavored, and colored whereas Pulse contains no artificial chemicals (it's naturally sweetened and colored).

While artificial sweeteners may not be as dangerous as some people claim, studies suggest that regular consumption of these chemicals may be more harmful to our health than is generally recognized.

As far as coloring goes, C4 contains the artificial dye FD&C Red 40, also known as Allura Red AC, whereas Pulse derives its coloring from fruit extracts. Like artificial sweeteners, chemical food dyes aren't as harmful as alarmists would have you believe, but there is evidence that they too may not be as safe for regular consumption as we once thought.

The Bottom Line

If you want to minimize your exposure to potentially harmful chemicals, then go with Pulse. If you're not concerned about artificial sweeteners and food dyes, though, then C4 is still worth considering.

THE BOTTOM LINE ON LEGION PULSE VS. CELLUCOR C4

As far as pre-workouts go, you can do a lot worse than C4. It's affordable, contains a few good ingredients, and is widely available, making it a solid entry-level supplement.

Pulse is very different. It's more expensive, but it also contains far more than C4 in the way of effective ingredients, including citrulline malate, betaine, and L-theanine, as well as clinically effective dosages, which C4 is weak in.

So in the end, it comes down to what you're looking for.

If your primary concern is price, C4 may be better for you. If you want a premium supplement and are willing to pay more for it, though, Pulse is the clear winner.

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