

Your Complete Guide To Creatine Monohydrate

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Just a few years ago, creatine was something that was talked about like it was a "secret weapon" that was really only for bodybuilders, powerlifters, and other hardcore strength athletes. Today, the secret is definitely out! Athletes of all types take creatine as a way to get more results from their training, and to help them recover between sessions.

Make no mistake: Creatine isn't a shortcut to results. If your training and nutrition aren't in order, the benefits it provides will be far less than if they were. But the research is clear that for many athletes, this is one supplement that comes with a significant upside.

"There are plenty of supplements out there where people report great results anecdotally, but the science is either wishy-washy, or simply not there," explains Douglas Kalman, Ph.D., RD. "With creatine, not only has it built a solid reputation among lifters and many other types of athletes, but the science backing it as a legit performance enhancer is robust and pretty consistent. With over 2,000 studies to date, it's the most effective performance-boosting supplement out there."

Intrigued? You're not alone. Here's everything you need to know.

What Is Creatine Monohydrate?

"Creatine is a combination of three different amino acids: glycine, arginine, and methionine. That's it—nothing more than a combination of amino acids," writes world-class powerlifter Layne Norton, Ph.D., in the article "Creatine: What It Is and How It Works."

And yet, that simple compound is involved in a vast number of processes in the body. It's a fundamental component in how your body creates its primary form of energy in muscle cells, the compound adenosine triphosphate, or ATP. When muscles contract explosively, or for brief, intense work lasting no longer than 8-12 seconds, creatine (bonded with phosphoric acid as creatine phosphate) is how the muscle creates the energy necessary to do it.

Most of the creatine in your body is created in the liver and kidneys, but the majority of it is stored in muscle tissue. Creatine is not considered an "essential" nutrient, because healthy human bodies are capable of creating it, and it can also be easily obtained through a diet that contains animal products.

However, dietary creatine pretty much only comes from animal products. So vegan and vegetarian athletes don't get nearly as much creatine in their diet as those who eat dairy products, eggs, and/or

meat. This is one reason why creatine is often recommended as an important supplement for vegetarians.

Creatine monohydrate, the most popular form of creatine supplements, is simply creatine with one molecule of water attached to it—hence the name monohydrate. It is usually around 88-90 percent creatine by weight.

You may occasionally see people claim that creatine is a steroid. Norton says this couldn't be further from the truth.

"No, creatine is not a steroid, it is totally different and works in a different manner," he writes. "It is also not a stimulant, although it is sometimes combined with stimulant ingredients like caffeine in pre-workout formulas.

What Does Creatine Monohydrate Do?

As Layne Norton, Ph.D., explains in the article "Creatine: What It Is and How It Works," "Creatine itself is a fuel source." More specifically, the phosphate-bonded form of creatine is "your body's first choice of energy when performing anaerobic activity, such as lifting weights."

When your body is trying to create the compound that powers quick muscle contractions, ATP, it does so by "borrowing" a phosphate molecule from phosphocreatine and combining it with another compound, ADP. Only after a muscle has largely used up its store of phosphocreatine does it start to produce ATP from other sources, like glucose or fats.

"Supplementation with creatine serves to increase creatine stores and phosphocreatine availability in the body, resulting in faster ATP formation," writes exercise physiologist Ciaran Fairman, Ph.D., in the article "6 Side Effects of Creatine Debunked." "Bottom line: The more phosphocreatine you have, the more work you can accomplish before fatigue sets it."

A secondary function of creatine is to draw water into muscle cells, making them more hydrated.

"When muscle cells are hydrated a few things happen, the most notable being an increase in protein synthesis," explains Norton.

As many lifters will attest, this action of drawing water into the cell can also make their muscles look bigger or fuller.

What Are The Benefits Of Taking Creatine Monohydrate?

Creatine's reputation among athletes is largely built around gains in strength and muscle. And according to strength coach and researcher Brad Schoenfeld, Ph.D., CSCS, that reputation is well-earned.

"If you were to ask me for a single supplement recommendation when muscle growth is the goal, I'd say hands-down, no-brainer: creatine," Schoenfeld explains in the article "Ask the Muscle Doc: How Does Creatine Help Muscle Gains?" "Gains of several pounds of muscle are routinely reported when lifters supplement with creatine, over and above just performing resistance training alone.[1,2]

There are hundreds of studies showing improvements in strength, power, muscle size, fatigue resistance, and overall body composition when people who regularly strength train take creatine. No, it won't

simply make you stronger by magic, but it may be able to help you do a few more reps with a heavier weight. And that, over time, can definitely make you stronger.

But if you think the benefits end once you step out of the weight room, think again.

"Contrary to what most people think, you don't have to be a strength or power athlete to reap the benefits of this remarkable supplement," explains researcher Krissy Kendall, Ph.D.

Specifically, Kendall says, creatine has been shown to help endurance athletes store more glycogen to use during training or competition. It has also been shown to reduce inflammation and cell damage following lengthy, intense exercise. In layman's terms, that means less pain after training, and less time before you feel up to training again.

The athletic benefits of this supplement may be even more pronounced in vegetarians. For example, one study that compared creatine use by vegetarians and nonvegetarians found that the vegetarians experienced greater increases in lean tissue and the ability to perform high-volume leg workouts than a nonvegetarian group. This is likely because the vegetarians had lower amounts of stored muscle creatine prior to the experiment.[3]

How Does Creatine Monohydrate Work?

Creatine is one of the most-studied sports supplements, with over 2,000 studies to date. And that research is largely consistent in showing that creatine does provide some benefit to most people who take it.

And yet it isn't exactly clear about how, exactly, creatine monohydrate achieves these benefits, as Brad Schoenfeld, Ph.D., CSCS, explains in the article "Ask the Muscle Doc: How Does Creatine Help Muscle Gains?" One explanation is that since creatine boosts strength gains, it allows lifters to move more overall weight and generate more of what is called "mechanical tension." Mechanical tension is known to be one of the primary creators of muscle growth.

However, it's also possible that because creatine draws water into muscle cells, it contributes to another one of the creators of muscle growth, cellular swelling. The third of the major mechanisms of muscle growth is muscular damage.

"It's entirely possible that creatine can positively impact two, or even all three, of those mechanisms," Schoenfeld writes.

What Is The Best Form Of Creatine?

While creatine monohydrate is the most-studied and most-popular form of supplemental creatine, it's definitely not the only option on the market. Three other popular variations right now include creatine hydrochloride, which is creatine combined with hydrochloric acid; kre-alkalyn, which is creatine buffered with bicarbonate or other alkaline ingredients; and creatine nitrate, which (you guessed it) is creatine bound to a nitrate molecule.

Supporters of the three "alternative" creatines claim that these bonding agents increase your ability to absorb or store the creatine over simple monohydrate. Theoretically, this could mean that smaller doses are necessary, and there would be less risk of the side effects that sometimes accompany high-dose creatine supplementation, such as bloating or stomach distress.

Exercise physiologist and researcher Nick Coker compared the research supporting these three side-by-side (by side) in the article "Which Form of Creatine is Right For You?" "Exotic new forms of creatine notwithstanding, good old creatine monohydrate seems to win out time and time again," he writes. "Monohydrate's high solubility and improved bioavailability [from micronization] make uptake into skeletal muscles very efficient—and makes monohydrate very tough to beat."

This doesn't mean that the other forms of creatine are completely ineffective, though. It simply means that right now, the research doesn't support them being any better than the original—and least expensive—version of the supplement.

It's worth noting that many of the side effects that lead people to seek out alternative forms of creatine are the result of them using a "loading" protocol, where they take creating up to five times a day for a week to "load" their cells before switching to a "maintenance" dose of 3-5 grams daily.

If that has happened to you, here's what researcher Krissy Kendall, Ph.D., recommends in the article "5 Reasons Why Your Creatine May Not Be Working": "To avoid any short-term weight gain or GI discomfort, use a lower-dose protocol of 5 grams daily. It'll take a little longer to maximize your creatine stores—about four weeks—but you're less likely to experience weight gain or bloating."

Is Creatine Monohydrate Safe?

There is no shortage of rumors about the bad stuff that can accompany creatine use. For example, you can hear people swear that it causes kidney or liver damage, cramping or dehydration, or even the dreaded muscle-destroying condition rhabdomyolysis. You may have heard that it's unsafe for teens or not good for women, or that it even leads people to snap or act out in rage.

However, none of these fears appear to bear out in the existing research. Exercise physiologist Ciaran Fairman, Ph.D., looks at six of the most pervasive medical fears in the article "6 Side Effects of Creatine: Myths Debunked" and concludes, "The safety of creatine has been demonstrated over and over again, with some as long as five years.[4] Bottom line: Creatine does not cause damage to the liver, kidneys, or any other organ for that matter."

Doug Kalman, Ph.D., RD, the co-founder of the International Society of Sports Nutrition (ISSN), says that creatine's bad reputation is just a lack of understanding.



"Why do you occasionally see headlines claiming that creatine is dangerous? In most cases, this is just someone misunderstanding the science, or rejecting all supplements," he says. "It is the position of our organization, the ISSN, that discouraging or restricting creatine use, as has been known to happen in legislatures and sports organizations, is a bad idea." [5]

In the ISSN's position stand paper on creatine monohydrate and exercise, Kalman and a lineup of researchers went a step further, saying, "There is no scientific evidence that the short- or long-term use of creatine monohydrate has any detrimental effects on otherwise healthy individuals," and that it can even help give young athletes a safe and healthy alternative to "potentially dangerous anabolic drugs."

It is true that certain people respond more robustly to creatine use than others, though. Jose Antonio, Ph.D., the other co-founder of the ISSN, says that differences in creatine response often can be explained by muscle fibers. Athletes with more fast-twitch muscle fibers, like lifters and sprinters, tend to respond more to creatine than athletes with more slow-twitch muscle fibers, like endurance athletes.

But that doesn't mean that endurance athletes can't benefit from creatine! In fact, creatine monohydrate is the first supplement on Krissy Kendall, Ph.D.'s list "The Top 7 Supplements to Boost Endurance Performance!"

And if you're worried that creatine counts as a "steroid" or will get you in trouble with your sport, don't be.

"It's not considered a banned substance by any sport-governing body, either, so it won't make you fail a test if you compete at your sport," Kendall explains.

When Should I Take Creatine Monohydrate?

You may think that the majority of research into creatine would be into if it works at all, and if so, how. But there's also been extensive research into how you should—or shouldn't—take it to maximize its effectiveness.

One thing is clear: If you want it to work, you need to take it pretty much daily.

"Creatine is not readily assimilated into muscle, as many people would think," says Darryn Willoughby, Ph.D., in the video "How to Get More Out of Your Supps." "Instead, it takes a while for creatine to saturate the muscle."

For this reason, you probably need to take it consistently for several weeks in order to see any results in the gym. Also for this reason, if you've been simply taking pre-workout that contains creatine monohydrate a few times a week and trusting that it would be enough...it's probably not. Sorry.

Undertaking an intensive five-day creatine "loading phase" may help accelerate things slightly, but probably not much. And it definitely increases the likelihood of experiencing some stomach discomfort, bloating, and some other temporary side effects.

As for when in the day to take creatine, fitness journalist Adam Bornstein breaks down the options in his article "Before, After, or Whenever: The Best Time to Take Creatine?" Researchers have looked into the differences between taking creatine before a workout, after a workout, both, or just "whenever," and the differences have been minor. For this reason, Bornstein says, he's in the "Take it whenever, as long as you take it" camp.

However, some researchers think there may be slight advantages to taking creatine at specific times. Jim Stoppani, Ph.D., recommends taking it before and after a workout for maximum benefit. And Jose Antonio, Ph.D., who co-authored a study on creatine timing in 2013, says there may be a slight advantage to taking it specifically post-workout. However, he adds that once you have been taking it consistently enough to have full creatine reserves in your muscles, it matters far less when you take it. Only if you're not taking it regularly does there appear to be a difference.

How To Take Creatine Monohydrate

If you've never taken creatine before, Krissy Kendall, Ph.D., says the best route is to keep it simple: Take creatine monohydrate, 3-5 grams a day. Don't miss a day, and the first time around at least, don't bother with a "loading protocol." Just add it to what you're already doing, and see what happens!

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