Creatine Monohydrate

What is it?

Creatine is formed in the human body from the amino acids methionine, glycine, and arginine. Creatine is stored in the human body as creatine phosphate (CP) or phosphocreatine. The average person's body contains approximately 120 grams of creatine stored as creatine and creatine phosphate.

Creatine can also be supplied by foods. Certain foods such as beef, herring, and salmon, are fairly high in creatine, but a person would have to eat pounds of these foods daily to equal what can be found in one teaspoon of powdered creatine from a supplement.

What is it supposed to do?

During short maximal bouts of exercise such as weight training or sprinting, stored adenosine triphosphate (ATP) is the dominant energy source. However, stored ATP is depleted rapidly. To give energy, ATP loses a phosphate and becomes adenosine diphosphate (ADP). At this point, the ADP must be converted back to ATP to derive energy from this energy producing system.

When ATP is depleted, it can be recharged by creatine, in the form of creatine phosphate. That is, the CP donates a phosphate to the ADP making it ATP again. An increased pool of CP means faster and greater recharging of ATP and, therefore, more work can be performed for a short duration, such as sprinting, weight lifting and other explosive anaerobic endeavors.

Other effects of creatine may be increases in protein synthesis and increased cell hydration, though researchers are still elucidating the mechanisms.

What does the research say?

The above is, of course, an immensely oversimplified review of an exceptionally complex system, but the basic explanation is correct. To date, research has shown ingesting creatine can increase the total body pool of CP which leads to greater generation of force with anaerobic forms of exercise,

such as weight training, sprinting, etc.

Early research with creatine showed it can increase lean body mass and improve performance in sports that require high intensity intermittent exercise such as sprinting, weight lifting, football, etc.

Creatine has had spotty results in research that examined its effects on endurance oriented sports such as swimming, rowing and long distance running, with some studies showing no positive effects on performance with endurance athletes.

Whether or not the failure of creatine to improve performance with endurance athletes was due to the nature of the sport or the design of the studies is still being debated. But one thing is for sure; the research is stronger in high intensity sports of short duration.

Recent findings with creatine monohydrate have confirmed previous research showing it's a safe and effective supplement. More recent research has focused on exactly how it works, and has looked deeper into its potential medical uses.

Several studies have shown it can reduce cholesterol by up to 15%, and may be useful for treating wasting syndromes such as HIV. Creatine is also being looked at as a supplement that may help with diseases affecting the neuromuscular system, such as muscular dystrophy (MS) and others.

A plethora of recent studies suggest creatine may have therapeutic applications in aging populations, muscle atrophy, fatigue, gyrate atrophy, Parkinson's disease, Huntington's disease, and other mitochondrial cytopathies, neuropathic disorders, dystrophies, myopathies and brain pathologies.

The importance of creatine is underscored by creatine deficiency disorders: inborn errors of metabolism that prevent creatine from being manufactured. People born without the enzyme(s) responsible for making creatine suffer from a variety of neurological and developmental symptoms which are mitigated with creatine supplementation.

As for safety, some have suggested that creatine might increase the need for extra fluid intake to avoid potential dehydration and muscle pulls. Still, creatine has not been shown to increase either dehydration or muscle pulls

in the research. In some people, creatine may increase a by-product of creatine metabolism called creatinine, which is a crude indicator but not a cause of kidney problems.

Some doctors have mistakenly thought that high creatinine levels (in athletes using creatine) are a sign of kidney problems, but that is not the case.

Creatinine is not toxic to the kidneys and most doctors are not aware that creatine may raise creatinine levels with no toxicity to the kidneys. People with pre-existing kidney problems might want to avoid creatine due to the effects it can have on this test, though creatine supplementation has never been shown to be toxic to the kidneys and the vast number, of studies to date have found creatine to be exceedingly safe.

It's interesting to note that there has been a concerted effort by many groups and ignorant medical professionals to portray creatine as being somehow poorly researched (flatly untrue) and unsafe for long term use.

They systematically ignore the dozens of studies that exist showing it's both safe and effective. Even more bizarre, they ignore the recent studies that are finding creatine may help literally thousands of people with the aforementioned diseases. This is unscientific, unethical, and just plain immoral, in my view.

One question that often comes up regarding creatine is whether or not the loading phase is required. Originally, the advice for getting optimal results was to load up on creatine followed by a maintenance dose thereafter. This advice was based on the fact that the human body already contains approximately 120 grams of creatine (as creatine and creatine phosphate) stored in tissues and to increase total creatine stores, one had to load for several days in order to increase those stores above those levels.

The idea also seemed to work well, in practice, with people noticing considerable increases in strength and weight during the loading phase. All was not perfect however as many people found the loading phase to be a problem, with gastrointestinal upset, diarrhea and other problems. At the very least, loading was inconvenient and potentially expensive.

The need for a loading phase was a long held belief, but is it really needed to derive the benefits of creatine? The answer appears to be no, as both

research and real world experience have found the loading phase may not be needed after all. A 1996 study compared a loading phase vs. no loading phase among 31 male subjects.

The subjects loaded for 6 days using 20 g/day and a maintenance dose 2 g/day for a further 30 days. As expected, tissue creatine levels went up approximately 20 percent and the participants got stronger and gained lean mass. Nothing new there! And, not surprisingly, without a maintenance dose creatine levels went back to normal after 30 days.

Then the group was given 3g of creatine without a loading dose. The study found a similar -– but more gradual -– increase in muscle creatine concentrations over a period of 28 days. The researchers concluded:

"...a rapid way to creatine load human skeletal muscle is to ingest 20 g of creatine for 6 days. This elevated tissue concentration can then be maintained by ingestion of 2 g/day thereafter. The ingestion of 3 g creatine/day is, in the long term, likely to be as effective at raising tissue levels as this higher dose."

A more recent study done in 1999 found that 5 g of creatine per day without a loading phase in 16 athletes significantly increased measures of strength, power, and increased body mass without a change in body fat levels (whereas the placebo group showed no significant changes).

The researcher of this 1999 study concluded:

"...these data also indicate that lower doses of creatine monohydrate may be ingested (5 g/d), without a short-term, large-dose loading phase (20 g/d), for an extended period to achieve significant performance enhancement."

So, if you have suffered through the loading phase in the past thinking it was the only way to maximize the effects of your creatine supplement, it appears you can rest assured you don't have to go through all that hassle. A 3 - 5 gram per day dose over an extended period of time will probably do the same thing.

What does the real world have to say?

What can I say? Creatine monohydrate is one of the most widely used supplements in bodybuilding, and I know of very few people who feel that they haven't gotten good results from using it.

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Recommendations:

Creatine can be found in the form of creatine monohydrate, creatine citrate, creatine phosphate, tri-creatine malate, creatine-magnesium chelate and even liquid "creatine serum". The newest form being touted as the best invention since the discovery of testosterone is creatine ethyl ester. However, the vast majority of research to date showing creatine effects on muscle mass and performance used the monohydrate form and most creatine found in supplements is in the monohydrate form.

There are many and surprisingly complicated problems with the above forms, but I will do my best to cover the essential issues. For one thing, these forms have little or no research supporting any of their claims, some of which are either totally outlandish, or biologically impossible. Many companies selling these products make claims, for example, that creatine monohydrate is poorly absorbed and or poorly metabolized by the body. This is simply untrue: research has found that creatine monohydrate is highly absorbable. Some claim less "bloating" or other supposed effects of monohydrate, but don't have a drop of data to support the claim, or even a feasible theory as to why their form would not have the effect vs. the monohydrate form.

They often claim dramatically improved absorption over monohydrate (without data), fewer side effects (without data), the ability to reduce the number of non-responders to creatine (without data), etc. Are you starting to see a theme here?!

Now, it's not impossible for example, that a creatine citrate or malate (both of which are simply creatine bound to a TCA cycle intermediate) may work for a higher percentage of people than the monohydrate form, thus reducing the number of non-responders, but it has yet to be proven.

It may be that the creatine-magnesium chelate form – the most interesting form of the group in my view – may be superior to the monohydrate form for adding LBM or strength, but there has yet to be a single head-to-head study that compared one version to the other. That people are getting some results from these new forms is all well and fine, but are those results above and beyond that of monohydrate? If so, is it simply from the malate, citrate, or magnesium? If a study was to find that an equal amount of creatine-malate, citrate, etc. was 10 percent more effective than monohydrate, but was 4 times as expensive, would you get the same results just

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taking a little more monohydrate? The answer to all those questions, which must be answered to recommend using any of these new forms, is (drum roll) unknown.

So, here we have what may be the most well-researched supplement known to mankind (the monohydrate form), that has been shown to be cheap, safe, and effective, and people clamor for more expensive, poorly researched forms (e.g., malate, citrate, etc.), because some supplement companies tell them it's superior to the monohydrate form! Now, if people want to spend their money on other forms of creatine, there is nothing wrong with that per se, but they should at no time be under the impression (no matter how much the supplement company selling it claims) that what they are buying has been proven to be superior to the monohydrate form.

For increases in strength, LBM, and performance, creatine monohydrate gets an enthusiastic thumbs up.

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