

Should You Take Citrulline Supplements?

The amino acid citrulline is gaining popularity as a supplement for health and exercise performance.

It's produced naturally in the body and found in foods, but taking supplements increases citrulline content in the body above typical levels.

While some people are convinced of its effectiveness for health and exercise performance, others are skeptical.

This article will tell you everything you need to know about citrulline and whether you should take it.

What Is Citrulline?

Citrulline is an amino acid that was first found in watermelon.

It is considered nonessential, meaning that your body can naturally produce some on its own.

However, you can increase your levels by eating foods containing citrulline or by taking dietary supplements, rather than relying on your body's production alone.

These higher levels may produce beneficial effects on health and exercise performance, as discussed later in this article.

Citrulline has important roles in the body, but unlike some amino acids, it is not used to build proteins.

However, it plays a necessary part in the urea cycle, which rids your body of harmful compounds. Specifically, the urea cycle removes ammonia from the body. The final product of this cycle is urea, which your body gets rid of in urine.

Citrulline can also help widen your blood vessels and may play a role in muscle building.

Summary:

Citrulline is an amino acid made naturally in the body, found in food and available as a dietary supplement. Increasing your intake may have beneficial effects on health and exercise performance.

How Does It Work?

Citrulline produces several important effects in the body.

One major way it works is by increasing vasodilation.

Vasodilation refers to the widening of arteries or veins. It's associated with lower blood pressure and increased blood flow.

After citrulline is consumed, some is converted to another amino acid called arginine.

Arginine is converted into a molecule called nitric oxide, which causes vasodilation of blood vessels by relaxing the smooth muscle cells that constrict them.

Interestingly, consuming citrulline may increase arginine in the body more than consuming arginine itself.

This is because of differences in how the body processes and absorbs arginine and citrulline.

The increase in nitric oxide and blood flow may be one of the processes involved in citrulline's beneficial effects on exercise performance.

Although citrulline isn't an amino acid used directly to build proteins, it has been shown to increase protein synthesis by stimulating an important signaling pathway involved in muscle building

Citrulline may also reduce the liver's uptake of certain amino acids and prevent their breakdown

Through these dual effects on protein synthesis and amino acid breakdown, it may contribute to maintaining or increasing muscle mass.

Summary:

Citrulline may increase blood flow by increasing nitric oxide production. It may also produce positive effects on muscle by stimulating protein synthesis and decreasing amino acid breakdown.

It Is Found in Some Common Foods

In addition to being produced in the body, citrulline is found in several foods.

However, most foods have not been analyzed for their content of this amino acid.

Foods known to contain citrulline include

Watermelon

Pumpkins

Cucumber

Bitter melon

Gourds

Summary:

Citrulline is found in several foods, especially watermelon. Most foods have not been analyzed specifically for their citrulline content.

Types of Citrulline Supplements

There are two major forms of citrulline in dietary supplements:

L-citrulline: This simply refers to citrulline by itself, with nothing else attached.

Citrulline malate: This refers to the combination of citrulline and another compound called malate, which is important for energy production (9)

While the two forms of may produce some similar effects, citrulline malate is more common in sports supplements.

However, when citrulline malate is used, it isn't clear which health effects are due to citrulline and which are due to malate.

Summary:

L-citrulline and citrulline malate are the two forms typically found in dietary supplements. Citrulline and malate can each exert effects in the body.

It Has Several Benefits for Your Health

Researchers have looked into citrulline's potential health effects, including effects on blood vessels, erectile dysfunction and exercise performance.

It May Help Your Blood Vessels Widen.

Improving the ability of the blood vessels to widen can potentially improve blood pressure and blood flow to tissues.

Studies have shown that a single dose of L-citrulline does not improve the ability of the arteries to widen in either healthy or diseased individuals (11)

However, when people who have heart disease or are at risk of heart disease have consumed L-citrulline for seven days or longer, the ability of their arteries to widen has improved (13)

So, although a single dose may not be very effective at widening your blood vessels, taking supplements in the longer term may be more effective.

It May Reduce Blood Pressure.

Citrulline supplements may decrease blood pressure, particularly in people with high blood pressure.

Studies of 30 to 40 participants looked at the effects of citrulline supplements in adults with high blood pressure or other heart conditions.

They found that participants' blood pressure had reduced by 4–15% after eight weeks (15)

What's more, in a small study examining 12 adults with normal blood pressure, researchers found that citrulline reduced blood pressure by 6–16% after 7 days (17)

However, the evidence in healthy individuals is not conclusive, since other researchers found no benefit of citrulline over periods of one to four weeks (14)

Overall, it is unclear if it substantially affects blood pressure in healthy individuals.

Other Health Benefits

Citrulline can increase the rise in growth hormone (GH) seen after exercise (19)

The post-exercise rise in GH and other hormones may be involved in the beneficial adaptations your body experiences when you exercise (20)

The amino acid may also improve erections in men with erectile dysfunction, probably through its ability to increase blood flow (21)

Summary:

Taking citrulline supplements may reduce blood pressure and improve your arteries' ability to widen. These effects may occur more consistently in people with disease.

Studies Suggest It Can Boost Exercise Performance

Due to its ability to increase blood flow, citrulline has been studied in the context of both endurance and strength-based exercise.

Several studies of endurance exercise have used L-citrulline, while much of the strength-based research has used the form of citrulline malate.

Endurance Exercise

In general, a single dose of citrulline does not seem to improve endurance exercise performance.

Taking supplements for one to two weeks does not change oxygen consumption.

However, it can increase the oxygen content in muscle tissue.

This means that although the amino acid may not allow more oxygen to be used by the body as a whole, it could improve oxygen usage in the exercising muscle. This may ultimately allow for better exercise performance.

This has been demonstrated in cycling, where performance can be increased by taking citrulline supplements.

In one study, cyclists taking citrulline were able to cycle for 12% longer before exhaustion than those taking a placebo.

Taking these supplements for seven days can also improve power output during cycling. That's how much force can be produced in a certain amount of time.

Overall, this supplement may beneficially affect oxygen usage in muscle, which could improve endurance.

Weight Training

Several studies have shown that citrulline malate can improve weight training performance.

One study in 41 men assessed the effects of citrulline malate on the ability to perform repetitions during upper body exercise.

Participants were able to perform 53% more repetitions after ingesting citrulline malate, compared to a placebo.

What's more, participants' muscle soreness in the two days after exercise was 40% lower when they consumed citrulline malate before exercising.

Other researchers also found that citrulline malate decreased fatigue and increased lower body weight training performance.

In both of these studies, participants took the supplement 60 minutes before exercise.

Summary:

Citrulline may increase oxygen content in the muscles and improve exercise performance. Both endurance performance and weight training performance may be improved by taking supplements.

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How Much Should You Take?

Based on current research, a recommended dose is 3–6 grams per day of L-citrulline or approximately 8 grams per day of citrulline malate.

The dose varies depending on form because 1.75 grams of citrulline malate provides 1 gram of L-citrulline. The remaining 0.75 grams are malate.

Below are recommendations for specific uses:

Weight training: Eight grams of citrulline malate provide about 4.5 grams of citrulline, an effective dose for weight training performance.

Oxygen in muscle: To improve oxygen content in muscle, taking 6 or more grams of L-citrulline per day for seven days seems to be effective.

Blood pressure: For improving blood pressure, the daily dose of L-citrulline used in research is typically 3–6 grams per day.

Furthermore, doses of 10 or more grams do not typically cause an upset stomach, unlike other amino acids.

An upset stomach is a sure way to derail a workout, so this is good news if you are taking this supplement to boost exercise performance.

Citrulline is probably better tolerated due to differences in how it is absorbed and processed compared to other amino acids.

Summary:

Doses of 3–6 grams of L-citrulline or 8 grams of citrulline malate may be optimal. No known side effects have been reported with doses of at least 10 grams.

These Supplements Appear to Be Safe

Unlike many supplements, some preliminary information about citrulline's safety at higher doses is available.

One small study examined different doses in eight healthy men. Each participant consumed doses of 2, 5, 10 and 15 grams of L-citrulline at separate visits.

Even with the highest doses, the participants reported no side effects.

However, the highest doses did not appear to increase arginine in the blood as much as expected, meaning there is a limit to how much of this supplement your body can use. Overall, the study indicated that doses greater than 10 grams are unnecessary.

Blood analysis performed in participants after they took citrulline supplements did not show any negative changes to normal body functions or blood pressure.

Summary:

Based on current information, citrulline is safe and well-tolerated. However, doses of greater than 10 grams are probably unnecessary.

The Bottom Line

Citrulline is an amino acid with several health benefits. It also appears to be safe and there are currently no known side effects.

This supplement may promote healthier blood vessels and lower blood pressure, especially in people with heart conditions or high blood pressure.

For weight training, citrulline malate has been studied the most. A dose of 8 grams may reduce fatigue and improve performance in the gym.

If you want to promote heart health or improve your exercise performance, citrulline may be the next supplement you should consider.