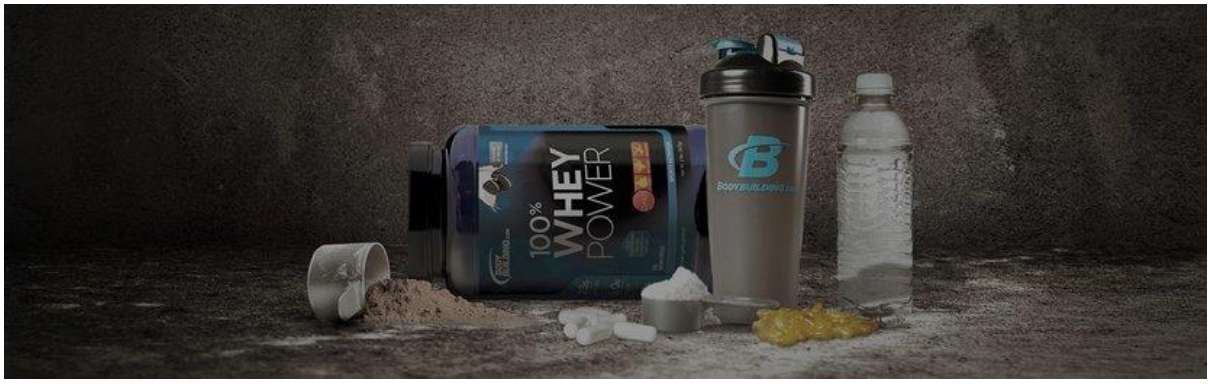
BCAAS: The Building Blocks Of Muscle!

Branched Chain Amino Acids are among the most beneficial and effective supplements in any sports nutrition program.



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Amino acids are the building blocks of proteins. Muscles cannot grow without them.

Branched-chain amino acids, or BCAAs, are a special group of amino acids. They are some of the most proven athletic supplements you can take. The benefits of BCAAs include less muscle fatigue, faster recovery, higher levels of other amino acids, and better protein absorption.[1] Not getting enough of them can cause muscle loss.

Here's a closer look at how these supplements work and why you should include BCAA supplementation in your regimen.

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Amino Acids
Proteins are made from long strings of molecules called amino acids.

Amino acids do various things:

- Build cells and repair tissue
- Create energy
- Form antibodies
- Take part in the enzyme and hormonal system
- Build RNA and DNA
- Carry oxygen throughout the body

Amino acids are needed to build muscle, red blood cells, and hundreds of other molecules. The human body can produce all but nine of these, which you have to get through your diet or supplementation. You can get them from eating protein or taking amino acid supplements.

The group of nine aminos the body can't produce are called essential amino acids. These include isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, histidine, and valine.

Non-Essential Amino Acids

- Alanine
- Arginine
- Asparagine
- Aspartic Acid
- Cysteine
- Glutamic Acid
- Glutamine
- Glycine
- Ornithine
- Proline
- Serine
- Tyrosine

Essential Amino Acids

- Histidine
- Isoleucine
- Leucine
- Lysine
- Methionine
- Phenylalanine
- Threonine
- Tryptophan
- Valine

Branched-Chain Amino Acids

The branched-chain amino acids are a group of three essential amino acids:

- Leucine
- Isoleucine
- Valine

The branched-chain group is diffe is different from other essential amino acids in that they are mostly metabolized in skeletal muscle instead of the liver.[2]

Roles of BCAAs

BCAAs play many roles:

- protein synthesis
- energy production
- forming other amino acids (alanine and glutamine)
- leptin regulation

Protein Synthesis

Branched-chain amino acids can increase muscle protein synthesis. This makes them both anabolic (muscle building) and anti-catabolic (protect against muscle damage).[3]

Muscle protein synthesis is when amino acids combine to form muscle tissue. Protein synthesis stimulates insulin production, which allows blood sugar to be taken up by the muscle cells and used as energy. This insulin production promotes amino acid uptake by the muscle.

Energy Production

Amino acids are categorized as glucogenic, ketogenic, or a combination of both. A glucogenic amino acid can be used to make glucose through gluconeogenesis. A ketogenic amino acid makes acetyl-CoA, a fatty acid precursor.

Leucine is completely ketogenic, valine is completely glucogenic, and isoleucine is both glucogenic and ketogenic. Valine and isoleucine can both be used for glucose production.

Leucine is especially powerful for energy production. It can provide skeletal muscle with a high amount of ATP. ATP is a molecule that moves energy to cells for muscle contraction (among other jobs).

To meet the increased demand for energy during exercise, the body breaks down muscle tissue to use its BCAAs. By taking extra BCAAs during exercise, you can

meet the increased demand without losing your gains. This helps maintain energy and glucose levels.[4]

Formation of Alanine and Glutamine

The human body's need for alanine and glutamine increases during exercise. It is met by amino acids from muscle protein breakdown.5 Increased breakdown of protein means loss of muscle mass, which no athlete wants. By supplementing with branched-chain amino acids, you can get the materials for both alanine and glutamine from somewhere other than your biceps.

Intense weight training is a highly catabolic condition. Glycogen stores are being rapidly depleted and the liver must synthesize glucose by a conversion of L-alanine to make more energy. BCAA supplementation can help maintain the levels of alanine you need to exercise.

Supplementing with BCAA-enriched drinks can also help the body make the amino acid glutamine inside skeletal muscle.[6] Glutamine levels inside muscle govern protein synthesis and nitrogen balance, and therefore muscle mass gain.[7]

Glutamine is also a powerful cell volumizer.[8] An increase in cell volume, also called cell swelling, stimulates anabolism and inhibits catabolism.[9] In addition, glutamine is a "nitrogen shuttle" between organs, and provides fuel for cells of the immune system and intestines.[5]

Leptin Regulation

Intake of leucine-enriched supplements stimulates expression of the hormone leptin.10 Leptin is involved in the regulation of metabolism, weight, and appetite.

Leptin secretion is linked with body-fat levels; higher body fat is associated with higher leptin secretion and lower body fat is associated with lower leptin levels. When you follow a calorie-restricted diet for fat loss, the amount of leptin you secrete decreases, which makes you "crave" food in an attempt to bring your body-fat level back up to where the body is comfortable (known as the body fat "set point").

Leucine has the ability to activate leptin expression and will cause the body to think it is "fed" or receiving adequate calories, which will keep things running smoothly (specifically your metabolism).

Why Take BCAA Supplements?

Branched-chain amino acids are rapidly depleted from the muscles when training. Taking them pre-workout and/or during your session can delay fatigue. Taking

them post-workout, or with a post-workout meal, will lower muscle damage and feed the muscles faster to keep you in an anabolic state.[11]

Support Protein Synthesis

First and foremost, branched-chain amino acids are used for the synthesis of protein structures.[2]

Protein breakdown and synthesis are always happening throughout the entire body. Your protein stores are in a constant state of flux.

This constant protein flux, plus the increased oxidation of leucine to provide energy, means that leucine is in high demand during exercise. Therefore, it may not be able to participate in muscle growth at its full potential. BCAA supplementation can help you make sure you're supporting protein synthesis as much as possible during your workouts.

Delay Fatigue

BCAAs can move through the blood to the brain and decrease the production of serotonin in the brain's interior, thereby lowering mental fatigue by reducing the amount of serotonin. So supplementing with them during a workout could keep you fresher so you can work harder.[12]

Reduce Muscle Loss

BCAAs are also an excellent anti-catabolic because they can help prevent protein breakdown and muscle loss, which is especially important to those who are on aggressive fat-loss diets. During these times of low caloric intake, branched-chain amino acids are strongly recommended because there is a greater risk of muscle loss due to a decrease in th n the rate of protein synthesis and an increase of proteolysis, which is the breakdown of proteins into simpler, soluble substances such as peptides and amino acids, as occurs during digestion.[13]

Side Effects of Amino Acids

There actually aren't any side effects of taking amino acids, since they are the same substances that you get from eating protein.[14] But, they might make you feel really full if you chug a whole bunch of them at once.

Amino Acid Timing

Drink branched-chain amino acids during your workout and within 30-60 minutes before and afterward. Supplementation before and during a workout will top up your energy and create premium anabolic conditions. This quick energy infusion can be especially helpful if you eat a low-carb diet, since you're not getting quick energy from carbohydrates.

Taking them afterward with a post-workout meal or recovery drink will speed recovery from delayed-onset muscle soreness and help to prevent overtraining.

Try mixing a post-workout shake with about 25 grams of carbohydrates, 10 grams of whey protein, and 5-7 grams of BCAAs. Drink it as soon as you finish training. Your next full meal should take care of most of your nutritional needs, but getting that edge of instant nutrient supply may be just what you need to reduce muscle catabolism and boost training effects.[15,16]

Getting the Right Ratio of Leucine, Valine, and Isoleucine

Due to leucine's metabolic properties, many people focus solely on leucine and not the other two BCAAs, valine and isoleucine. But, taking leucine alone can lead to decreases in the other two and create an imbalance, so it's important to take all three.[4] A 2:1:1 or 3:1:1 ratio of leucine to valine and isoleucine is ideal.

BCAAs in Protein

One question a lot of people have is whether additional BCAA supplementation on top of an already high protein intake will produce any benefits. While branched-chain amino acids are naturally present in protein foods, there are still benefits to taking BCAA supplements.

Even a fast-digesting protein like whey can't get nutrients to your muscles as efficiently as a pure amino acid supplement. Pure BCAAs quickly flood the bloodstream and amino acid pools. While whey protein is absorbed quickly, it does not create the same metabolic response.

Once whey protein reaches the gut, it takes about 45 minutes before the amino acids can be used. If you're relying on protein to give you energy during your workout or boost your recovery afterward, you might not feel its effects until it's too late.

In other words, eating protein does give you plenty of BCAAs, but amino acid supplements give them to you a lot faster than food sources, so they're more effective for your workouts.

Scientific Research on BCAAs

BCAAs are frequently recommended because there's solid research to back up their use. Here are some examples.

In a study on endurance athletes, BCAA supplementation decreased muscle breakdown. Other studies have also shown that after strength training, even in resistance-trained athletes, muscle catabolism is increased for 4-14 hours, followed by a muscle-building phase. If the anabolic phase is greater than the

catabolic phase, muscle mass and strength will increase. So an amino acid supplement taken after training could be very effective.[17]

Another study compared blood levels of amino acids in 10 men divided into three groups. After training, one group took pure amino acids, another group ate whole protein (cottage cheese), and the third group had some protein and some aminos.

After 15 minutes, the amino acid supplementation groups had much higher circulating amino acids than the whole protein group. The researchers feared these aminos would be quickly flushed out by the kidneys, but that didn't happen. What this shows is the use of BCAA supplements may be more beneficial than whole protein for exercise performance, even in small amounts.[17]

Wrapping Up

Branched-chain amino acids are components of protein that maintain muscle tissue during intense exercise. They function as anabolic agents, which allow the body to maximize fat loss and minimize muscle loss. They can also be used for energy.

BCAA supplementation can result in gains in strength, muscularity, and energy. Taking them before and during a workout can delay fatigue and protect your muscles. Taking them after a workout can help with recovery. They'll reach your muscles faster than aminos from whole proteins.

If you're on a quest for muscle growth, BCAA supplements can be a powerful ally.

References

1. MacLean, D. A., Graham, T. E., & Saltin, B. (1994). Branched-chain amino acids augment ammonia metabolism while attenuating protein breakdown during exercise. *American Journal of Physiology-Endocrinology and Metabolism, 267*(6), E1010-E1022.
2. Layman, D. K. (2003). The role of leucine in weight loss diets and glucose homeostasis. *The Journal of Nutrition, 133*(1), 261S-267S.
3. Blomstrand, E., Hassmén, P., Ek, S., Ekblom, B., & Newsholme, E. A. (1997). Influence of ingesting a solution of branched-chain amino acids on perceived exertion during exercise. *Acta Physiologica, 159*(1), 41-49.
4. Shimomura, Y., Murakami, T., Nakai, N., Nagasaki, M., & Harris, R. A. (2004). Exercise promotes BCAA catabolism: effects of BCAA supplementation on skeletal muscle during exercise. *The Journal of Nutrition, 134*(6), 1583S-1587S.
5. Holeček, M. (2002). Relation between glutamine, branched-chain amino acids, and protein metabolism. *Nutrition, 18*(2), 130-133.

6. Houston, M. E. (2001). >Biochemistry Primer for Exercise Science. *Human kinetics*.
7. van Acker, B. A., von Meyenfeldt, M. F., van der Hulst, R. R., Hulsewé, K. W., Wagenmakers, A. J., Deutz, N. E., ... & Soeters, P. B. (1999). Glutamine: the pivot of our nitrogen economy? *Journal of Parenteral and Enteral Nutrition, 23*(5_suppl), S45-S48.
8. Häussinger, D., Gerok, W., Roth, E., & Lang, F. (1993). Cellular hydration state: an important determinant of protein catabolism in health and disease. *The Lancet, 341*(8856), 1330-1332.
9. Häussinger, D. (1996). The role of cellular hydration in the regulation of cell function. *Biochemical Journal, 313*(Pt 3), 697.
10. Meijer, A. J., & Dubbelhuis, P. F. (2004). Amino acid signalling and the integration of metabolism. *Biochemical and Biophysical Research Communications, 313*(2), 397-403.
11. Mero, A., Pitkänen, H., Oja, S. S., Komi, P. V., Pöntinen, P., & Takala, T. (1997). Leucine supplementation and serum amino acids, testosterone, cortisol and growth hormone in male power athletes during training. *The Journal of Sports Medicine and Physical Fitness, 37*(2), 137-145.
12. Goldberg, A. L., & Chang, T. W. (1978, July). Regulation and significance of amino acid metabolism in skeletal muscle. In *Federation Proceedings* (Vol. 37, No. 9, pp. 2301-2307).
13. Goto, M., Miyahara, I., Hayashi, H., Kagamiyama, H., & Hirotsu, K. (2003). Crystal structures of branched-chain amino acid aminotransferase complexed with glutamate and glutarate: true reaction intermediate and double substrate recognition of the enzyme. *Biochemistry, 42*(13), 3725-3733.
14. Mero, A. (1999). Leucine supplementation and intensive training. *Sports Medicine, 27*(6), 347-358.
15. Riazi, R., Wykes, L. J., Ball, R. O., & Pencharz, P. B. (2003). The Total Branched-Chain Amino Acid Requirement in Young Healthy Adult Men Determined by Indicator Amino Acid Oxidation by Use of l-[1-13C] Phenylalanine1. *The Journal of Nutrition, 133*(5), 1383-1389.
16. Sapir, D. G., & Walser, M. (1977). Nitrogen sparing induced early in starvation by infusion of branched-chain ketoacids. *Metabolism-Clinical and Experimental, 26*(3), 301-308.
17. Stepnick Gropper, S., & Plyler Johnson, A. (1994). Metabolic Effects of Ingestion of L-Amino Acids and Whole Protein. *Journal of Nutritional Medicine, 4*(3), 311-319.