



BCAA'S 3:1:1 LOADED

Scientific Research

During competition preparation, which is characterised by a significant increase in training volume and intensity, referred to as overreaching, the body is subjected to rigorous physiological challenges. If the increased workload is not managed properly and physiological adaptation cannot surpass the challenge, the athlete is at increased risk of untimely overtraining syndrome. The outcome includes illness, injury and decreased mental and physical performance (8). To decrease these risks and optimise performance, it is vital that recovery is maximised with factors like anabolic nutrition, including Branched Chain Amino Acids (BCAA's). BCAA's are free essential amino acids, comprising Leucine, Isoleucine, and Valine and make up about 35% of muscle protein. They are rapidly absorbed and metabolised in the skeletal muscle cells to have a pronounced effect on muscle function and muscle mass.

Mental and physical energy

Fatigue during physical exercise is the combined effect of central and peripheral factors like depletion of muscle glycogen and phosphocreatine, increased metabolic muscle acidity, dehydration, hyperthermia, poor transmission between the nerves and muscles, decreased blood glucose and increased tryptophan influx to the brain (1).

BCAA's exhibit a significant anti-fatigue effect by preserving mental clarity and reducing neural exhaustion during prolonged, high intensity exercise. One of the mechanisms includes the inhibition of tryptophan transport into the brain and alleviating the sense of fatigue which is governed by the central nervous system (2). Valine in particular is known as a glucogenic amino acid and can be metabolised into glucose to serve as an instant substrate for brain and muscle energy. BCAA's regulate blood glucose and preserve liver and skeletal muscle glycogen by increasing oxidation of fat as fuel and limiting glycogen degradation and depletion (3).

By preserving muscle energy and promoting mental energy, BCAA's allows athletes to perform at higher intensity for longer duration.

Muscle hypertrophy and integrity

BCAA's produce an anabolic hormone balance. They decrease exercise induced increases in cortisol and creatine kinase (indicator of muscle damage), and increase testosterone and growth hormone levels during and after training. Consequently, BCAA's protect against inflammatory muscle degradation and muscle

fatigue and advance efficient muscle recovery and lean muscle hypertrophy. Leucine's predominant role is to stimulate muscle protein synthesis by activating the protein synthesis mTOR pathway. It also increases insulin secretion to provide for cellular glucose as fuel and protect against muscle protein degradation (5,6,7). Increased fat oxidation which is stimulated by Leucine and Isoleucine, in addition to enhanced glucose tolerance as promoted by Isoleucine, promotes a leaner body physique whilst maintaining optimal lean muscle mass (4).

Immune protection

The immune system provides systemic protection from pathogenic microorganisms and other harmful insults. For immune cells to respond efficiently during an infection or insult, they require a marked increase of substrates. These substrates provide cellular energy and are precursors for the production of effector molecules like antibodies, acute phase proteins and cytokines, new immune cells, and protective molecules like glutathione. BCAA's are crucial for immune cells like lymphocytes to produce protein, RNA and DNA, as well as for cell division. To ensure that the immune system is provided with optimal amino acids, the body activates its catabolic processes and thus increases proteolysis (the breakdown of protein) within the muscles to provide enough amino acids. Inadequate dietary consumption of BCAA's may impair immune function and increases the susceptibility to pathogens. A bacterial infection may drain the body of 60g of protein while a malarial infection can use up to 500g protein. Therefore, it is essential to

provide the body with optimal amounts of protein and amino acids during an infection, after illness, following surgery, or during a rigorous competitive training season to protect

against protein breakdown in the muscles and ensure optimal immune function when the body needs it most (9).

Quality event training can thus be maintained with BCAA's, which promote significant lean muscle sculpting, whilst protecting against overtraining syndrome and decreasing the risk of injury or illness (8).

REFERENCES

1. Blomstrand E. A Role for Branched-Chain Amino Acids in Reducing Central Fatigue. *J. Nutr.* February 2006; 136 (2): 544S-547S.
2. Blomstrand E, Hassmen P, Ekblom B, Newsholme EA: Administration of branched-chain amino acids during sustained exercise--effects on performance and on plasma concentration of some amino acids. *Eur J Appl Physiol Occup Physiol.* 1991, 63 (2): 83-88.
3. Blomstrand E, Ek S, Newsholme EA: Influence of ingesting a solution of branched-chain amino acids on plasma and muscle concentrations of amino acids during prolonged submaximal exercise. *Nutrition.* 1996, 12 (7-8): 485-490. 10.1016/S0899-9007(96)91723-2.
4. Sharp C, Pearson D. Amino Acid Supplements and Recovery from High-Intensity Resistance Training. *Journal of Strength and Conditioning Research.* 2010; 24(4): 1125-1130.
5. Kimball SR, Jefferson LS: Signaling pathways and molecular mechanisms through which branched-chain amino acids mediate translational control of protein synthesis. *J Nutr.* 2006, 136 (1 Suppl): 227S-31S.
6. Rome S, Clément K, Rabasa-Lhoret R, Loizon E, Poitou C, Barsh GS, Riou JP, Laville M, Vidal H. Microarray profiling of human skeletal muscle reveals that insulin regulates approximately 800 genes during a hyperinsulinemic clamp. *J Biol Chem.* 2003 May 6; 278(20): 18063-8. Epub 2003 Mar 5.
7. Borgenvik, M, Nordin M, et al. Alterations in Amino Acid Concentrations in the Plasma and Muscle in Human Subjects during 24 Hour of Simulated Adventure Racing. *European Journal of Applied Physiology.* 2012.
8. Sharp C, Pearson, D. Amino Acid Supplements and Recovery from High-Intensity Resistance Training. *Journal of Strength and Conditioning Research.* 2010. 24(4), 1125-1130.
9. Calder PC. Branched-Chain Amino Acids: metabolism, physiological function and application. *Journal of Nutrition,* 2006; 136: 288S-293S.