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Cell Volumizing Supplements

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You may have recently noticed lots of advertisements about *cell volumizing* supplements. The reason for this is that recent research has determined that cell volume serves as an important regulator of protein synthesis and cellular metabolism. Further, that several nutrients may affect cell volume and thereby protein synthesis. This article will discuss how cellular hydration affects metabolism and which nutrients may affect cell volume.

What is Cell Volumization?

Cell volumization is a popular term referring to the hydration state of the cell. The volume of fluid within the cell has been shown to help regulate a number of physiological processes. For example, research has shown that cell swelling decreases protein breakdown while stimulating protein synthesis. On the other hand, a reduction in cell volume that often occurs in various disease states promotes protein breakdown and inhibits protein synthesis. Cell volume has also been shown to influence: the expression of several genes; the activity of various enzymes; the impact of hormones on the cell (e.g., insulin and glucagon); and, help regulate metabolism by modifying responsiveness to signaling molecules.[10] Research has also determined that cell volume may be changed rapidly (within a few minutes) under the influence of hormones, nutrients, and oxidative stress.[3] Additionally, that short-term changes in cellular hydration may serve as a potent modifier of cellular metabolism and gene expression.

So what does this mean for the resistance-trained athlete? In my view there are three main points to consider. First, maintaining cellular hydration is important in optimizing cellular function and protein synthesis. Athletes who do not maintain cell hydration during training may inhibit protein synthesis resulting in lesser gains in muscle mass and/or require longer recovery between workouts. Second, exercise affects cell hydration. Exercise causes a shifting of fluid and nutrients in and out of the cell, increases oxidative stress, and promotes a release of anabolic hormones. Consequently, exercise may temporarily alter cellular hydration. Preventing dehydration and optimizing cell hydration following exercise may be important in increasing the anabolic response to resistance-training. Finally, certain nutrients have been reported to increase cell volume. Therefore, increasing dietary availability of these nutrients may play an important role in increasing cell volume in an attempt to optimize protein synthesis during training.

Proposed Cell Volumizing Nutrients

Glutamine

As described in a previous supplement.performance article, glutamine is the most plentiful non-essential amino acid in the body and plays a number of important physiological roles. Several studies indicate that glutamine supplementation increases cell volume and stimulates protein and glycogen synthesis.[1,6,8] Theoretically, glutamine supplementation prior to and/or following exercise (e.g., 6-10 g) would help to

optimize cell hydration and protein synthesis during training leading to greater gains in muscle mass and strength. However, although there is strong scientific rationale, additional research is needed to determine the impact of glutamine supplementation during training on body composition and strength before definitive conclusions can be made.

Creatine

Creatine is a naturally occurring amino acid that is primarily stored in skeletal muscle. Creatine supplementation (0.3 grams/kg/day for 5-7 days and 3-5 g/d thereafter) has been shown to increase intramuscular creatine and phosphocreatine content by 15 to 40%.[9,11] Creatine supplementation during training has been reported to promote significantly greater gains in strength and muscle mass.[9,11] One of the theories for the increase in lean body mass is that creatine may increase cell volume thereby stimulating protein synthesis. In support of this contention, Ziegunfuss, Lowery and Lemon[12] reported that intracellular fluid content increased by 3% following 3-d of creatine loading (0.35 grams/kg/day) with no effect on extracellular fluid content. These findings support contentions that creatine supplementation may at least temporarily increase cell hydration/volume. However, whether the increase in intracellular fluid is one of the mechanisms by which creatine supplementation promotes increases in muscle mass is unclear.

Taurine

Taurine is a conditionally essential amino acid derived from methionine and cysteine metabolism. Taurine is involved in a number of physiological roles including cell volume regulation, antioxidation, detoxification, and carbohydrate metabolism.[2,7] For this reason, taurine has been has been commonly included in cell volumizing supplements. In contrast to glutamine and creatine, there is less evidence supporting the potential ergogenic value of taurine supplementation for athletes. There is some evidence in clinical populations that taurine supplementation in deficient patients may enhance cell volume and metabolism.[2,7] Theoretically, if taurine affects cell volume, taurine supplementation during training may enhance protein synthesis. However, I am aware of no study that has evaluated the effects of taurine supplementation on strength and body composition adaptations during training. We have conducted several studies evaluating the effects of supplements containing carbohydrate, electrolytes, taurine, and creatine.[4-5] Although we have found that creatine supplementation (with and without these nutrients) is effective in promoting gains in strength and muscle mass, we have not found that the addition of taurine (3 grams/day for 2 weeks) had any added benefit.[4] Consequently, additional research is necessary to determine whether taurine has any ergogenic value for athletes.

Summary

Research has demonstrated that alterations in cell volume play an important role in regulating cellular metabolism and protein synthesis. Increasing cell volume through training and/or dietary interventions may play a role in optimizing protein synthesis leading to greater gains in strength and muscle mass during training. Glutamine, creatine and taurine may be among the most important nutrients affecting cell volume. Of these, research has indicated that short-term creatine supplementation can increase intracellular fluid content. Long-term creatine supplementation has been reported to promote greater gains in strength and muscle mass during training. However, it is unclear how much the gains in strength and muscle mass are related to changes in cell volume. Glutamine has been reported to increase cell

volume and protein synthesis yet it is currently unclear whether glutamine supplementation during training would increase strength and/or muscle mass. Less is known about the role of taurine on exercise training adaptations. I'll keep you posted of any new findings as they come available.

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