Glutamine: The Single Most Important BCAA

To most people, glutamine is just one of the 20 amino acids that are used to make protein. It's not even considered to be an essential amino because the body is capable for making it for itself. However, glutamine may be the single most important amino acid in the body for creating anabolic conditions in the muscle and protecting us from the ravages of overtraining.

It seems almost unbelievable that a single, free amino acid could accomplish so many things in the body. The importance of glutamine is underscored by its sheer abundance. Although every bodily tissue contains glutamine, many human tissues contain very high levels, and it is the most abundant amino acid in muscle and plasma. When something is normally found in large amounts in the body, it is an important function, especially in those tissues that contain the most. The question is, what happens when our bodies are put under stress and these levels of glutamine start to fall? This is exactly what is being asked about the effects of exercise, which can quickly reduce the levels of glutamine in the muscles and plasma.

Glutamine Metabolism

Glutamine is considered to be a nonessential amino acid because it is made by the body and is not absolutely required to be obtained through the diet. Although we do get glutamine in our diets, it is necessary for the body to produce more to meet the vast amounts required.

The major tissue in the body for producing glutamine is muscle. Muscle is capable of combining ammonia and the amino acid glutamate to form glutamine. The production of glutamine in the muscle is so great that it accounts for more than 60% of the free amino acid pool in muscle cells. These large muscle stores also account for most of the body's glutamine reserves, and they can release glutamine into the circulation to maintain plasma levels and provide other tissues with glutamine.

The Effects of Stress on Glutamine

Under normal physiological circumstances the body can produce all the glutamine that it needs. A delicate balance is maintained between tissues that produce and release glutamine and those that depend on it. The reason so many tissues need glutamine is that is had so many functions in the body. It regulates ammonium levels in the tissues, which can be toxic to the body's cells. The ammonium is used to produce glutamine for release into the blood. Here, glutamine is transferred to other tissues to be used for fuel, especially the cells of the immune system. Glutamine is directly involved in the regulation of protein synthesis and breakdown and is a powerful anabolic stimulus. For these reasons, glutamine is perhaps one of the most versatile amino acids in the body.

When the body's physiology is altered by factors, such as stress or disease, its demands for extra glutamine can change drastically. One form of stress that occurs to the body is when a person bodybuild using heavy poundages and intense training. During this training the use of glutamine by other organs of the body increases in response to bodily stress. As a result, plasma gluta mine levels begin to plummet drastically. To replenish these levels, the muscles start to release their glutamine stores into the blood.

Intense exercise also cause the production of lactic acid and ammonium by the muscles. To deal with these toxic products, the production of glutamine from glutamate and ammonia is also increased. this extra glutamine is rapidly transported into the blood to such a degree that plasma glutamine levels begin to rise within five minutes of exercise. As a result, the many tissues that need glutamine, but can't produce it, are provided with ample supplies during the exercise induced stress. The problem is that the muscles are having their intracellular stores depleted in the process.

Intense exercise also cause the release of catabolic hormones, such as corticosteroids. These glucocorticoids also contribute to the depletion of muscle glutamine stores by increasing the release of glutamine from muscle cells. These catabolic steroids can cause glutamine to continue to be release from muscle even after exercise has stopped and the body no longer needs extra supplies. The result is that muscle become severely glutamine depleted.

Glutamine - the Anabolic Stimulator

Glutamine is known to promote anabolic conditions in muscle cells and increase the rate of protein synthesis. It was long thought that glutamine was directly responsible for this anabolic state, but it no seems that glutamine indirectly promotes growth by increasing the hydration state of muscle cells.

The amount of water in cells can change in a matter of minutes, going from being fully hydrated to a state of dehydration. It has been found that the amount of water inside a cell can alter its metabolism, especially protein synthesis and turnover. When cells are swollen with water, this inhibits the breakdown of protein, glycogen and glucose. It also stimulates protein and glycogen synthesis. If a cell becomes dehydrated, it shrinks and immediately goes into a carbolic state that breaks down the muscle's vital proteins.

Experiments have shown that if isolated muscle cells are placed in a solution that contains insulin and amino acids, the insulin drivers the amino acids into the muscle cells and protein synthesis is increase. Protein synthesis can also be increased by placing the cells in pure water, which causes them to swell. Interestingly, when placed in a salt solution, this quickly draws water out of the cells and they rapidly enter a catabolic state. Thus, it appears that cell swelling is necessary for maintaining an anabolic state.

When glutamine levels are high in the muscle cells, this stimulates the entry of other amino acids into the cell. Amino acids cannot directly enter into the muscle cell, but must be carried in by a special transport system. The unique thing about this transport system is that when it allows am amino acid to enter, it also allows sodium to enter A the amino acid and sodium levels increase inside the muscle, this excess sodium causes water to be absorbed across the membrane and the cell swells to an anabolic state.

When glutamine levels are depleted during exercise, this reverses the transport of amino acids and sodium. The cells become dehydrated and enter a catabolic state.

The Role of Glutamine in Overtraining

Men and women who are serious athletes and bodybuilder walk a fine line between being undertrained and overtrained. Overtraining results when increasing volumes and intensity of training become out of balance with recovery time. Once a person crosses over the line and sets foot in the overtraining zone, from there on out all their hard work and effort will only send their performance spiraling downward. The harder they work, the less their gains.

One reason a person experiences the overtraining syndrome is that they may deplete their bodies of glutamine to the point that they can't recover. As explained above, an intense exercise cycle can deplete the muscles of glutamine. Studies have shown that after such a session, glutamine levels in the muscles bottomed out between 4 to 6 hours post-exercise and took more than 24 hours to fully recover to pre-exercise levels.
It is easy to see that if a person trains intensely each day that they will start depleting their muscles glutamine stores before they have fully recovered from the workout. The result is that each day the amount of muscle glutamine gets a little lower.

Eventually, the muscle go below the critical amount of glutamine needed to sustain a anabolic state and they revert into a long term catabolic state. The more a person works out to try and makes their muscles grow, the more glutamine they use and the greater the catabolic response. Some athletes have suffered from the overtraining syndrome for over two years and have been shown to have low plasma glutamine levels for the entire time. This may be due damage to the muscle's glutamine synthesizing system as a result of it being overtaxed from too much training.

Individuals suffering from overtraining also are more susceptible to disease and infections as a result of lowered immunity. This may be due to the role of glutamine as a primary source of fuel for the cells of the immune system, particularly lymphocytes, macrophages and killer cells. In addition, glutamine is used as precursor in the synthesis of nucleic acids, which are necessary for cell division.

It is thought that adequate amounts of metabolic intermediates for building key molecules are needed to allow a rapid response when immune cells are faced with a challenge. During periods of immunological assaults, glutamine metabolism is increased to support the rapid cell division, protein synthesis and the production of antibodies and cytokines. These immune cells rely on the plasma to supple them with adequate supplies of glutamine. If these supplies are not met by the plasma, which is ultimately provided by the muscles, the immune

cells cannot mobilize to defend the body against an infection of disease. Thus, low glutamine levels severely impair the immune system.

Don't Forget the Glutamine

Because intense exercise can severely deplete the muscles of glutamine and the overtraining syndrome may be the result from the progressive and prolonged loss of glutamine, it is imperative to conserve the muscle's glutamine stores. Previously it has been suggested that glutamine was broken down to glutamate in the stomach and that oral supplementation was of no benefit. Now reports show that oral glutamine is a safe and effective means of providing supplemental free glutamine to the body. Oral glutamine has been shown to reduce the loss of glutamine from muscles and help them maintain their reserves during a variety of catabolic conditions.

For this reasons, it makes sense to take a glutamine supplement that provides the free from of this amino prior to intense exercise. This will raise plasma glutamine levels and prevent the depletion of muscle glutamine stores. After exercise, a high quality protein carbohydrate supplement should be taken within 30 minutes to aid in recovery. The protein will promised amino acids, especially glutamine, and the carbohydrate will boost insulin levels, which will help transport these amino acids to the muscle.

As the amino acids are transported into muscle, they will also promote water uptake to keep the muscles hydrated. This superhydrated state will prevent the muscles from entering into a catabolic state and promote anabolic growth. Because glutamine stores are not depleted, recovery time will be shorted and there is less chance that one will become the victim of the overtraining syndrome due to progressive loss of glutamine stores.

Glutamine may be considered to be a nonessential amino acid for the normal individual because the body has the ability to make it, this there is not a great a need to acquire it in the diet. However, for the elite centurions of the bodybuilding community who use iron to forge a better body, glutamine can be considered to be a "conditionally essential" amino acid. It is conditional essential because intense weight training pushes the body to use glutamine in such vast amounts that it cannot be produced fast enough and thus causes temporary and eventually long term deficiencies.

Therefore, keep in mind that glutamine is one of the most important amino acids in the body and may be the single most important amino acid supplement for the bodybuilder.