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Unlocking the Secret of Protein Synthesis

and

The Synergy of Protein Supplements

By
Daniel Gastelu, M.S., MFS
Director of Nutritional Sciences of the International Sports Sciences Association (ISSA)

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Unlocking the Secret of Protein Synthesis

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My search for anabolic truth started over 3 decades ago. Like you, I was training hard and long hours to build muscle and strength, and wanted to do my nutrition right for maximum results. This was back in the days when attention was becoming more focused on anabolic steroids. But not wanting to turn to drugs to reach these goals, my focus was and still is on determining how the body works, then based on what the body needs, designing an exercise and nutrition plan that works best to get the body to respond as desired.

I always thought that turning on the power of the trillions of cells and thousands of biochemical pathways making up the body was more involved then just taking a drug or two. Imagine what effects you can stimulate in your body by making these trillions of cells and thousands of biochemical pathways work to achieve your bodybuilding goals. This is what the science of bodybuilding training nutrition is really about. This approach goes way beyond steroids, and is healthier for you too.

During my search for anabolic truth, a few times each decade, I encounter major discoveries that are made revealing the marvelous inner workings of the human body. In the past few years such a major discovery has been made in providing vital insights to protein synthesis and muscle growth. While the details on this biochemical pathway are still being sorted out, one thing is certain, a key player in the regulation of protein synthesis is certain amino acids. When you think about it, this makes perfect sense, as amino acids are the building blocks of muscle and other biochemicals. If they are present in the body in adequate amounts, then the body's mechanisms would be activated to build tissues. When amino acid intake is deficient, then it would follow that protein synthesis would suffer, in general.

The biochemical pathway I want to review with you in this article is called mTOR, which stands for mammalian target of rapamycin. How it got this name is not as interesting as what discovery it led to concerning amino acids and protein synthesis control.

There many amino acids, all having different functions, most having multiple functions. Early in my research and product development efforts, the group of amino acids referred to as BCAA's caught my attention. Why, because early on I realized that these BCAA's could be used for energy as well as for anabolic processes. Logic would dictate that a nutrition plan which compensates for this non-anabolic use of BCAA's would result in maintaining positive nitrogen balance, as well as increasing the rate of protein synthesis.

The mTOR pathway discovery and other research has supported that my logic was correct. The reality being that amino acids are not only building blocks of proteins, but they are also involved in providing nutritional signals to activate translation initiation and protein synthesis. As an aside, this quick take home lesion supports the bodybuilding eating approach of spreading out nutrient intake over several meals/snacks per day.

Discovering mTOR

As it turns out, this protein synthesis biochemical pathway was not discovered by exercise physiologists experimenting on making the best muscle building discovery. The mTOR-protein synthesis regulation discovery was made by accident from research conducted in the field of microbiology.

As previously mentioned mTOR stands for mammalian target of rapamycin. Rapamycin is a drug that is actually manufactured by a microorganism called *Streptomyces hygroscopicus*, which lives in the soil. What attracted the attention of the medical community was that researchers observed *S. hygroscopicus* secreted something that inhibited the growth of another microbe, *Candida albicans.*

So, the original use of rapamycin was thought to be potentially as an antibiotic. But, upon clinical study researchers found that rapamycin had potent undesirable immunosuppressive activities, which made it unsuitable for use as an antibiotic drug for humans. However, due to rapamycin's effects it is being used on a limited basis in other medical applications, but that's another story.

During the course of all this early research to determine what it was about rapamycin that made it inhibit the growth of certain microbes, scientists found that it blocked the activity of a substance that was involved in controlling cell growth and protein synthesis. They gave this substance the name mammalian target of rapamycin. The mTOR molecule is actually a protein kinase, a type of enzyme that drives biochemical chain reactions.

The Leucine Connection

As more and more research was conducted to see just how mTOR functioned in protein synthesis, it was determined that the essential amino acid leucine was involved in regulating this biochemical's activity. The mTOR substance is actually just one player in a series of biochemical reactions that includes other familiar anabolic substances like insulin and IGF-1 for example.

Making the Jump From Microbes to People

There are many studies which have been previously conducted using BCAA's, which report beneficial effects of significance to bodybuilders and other athletes. Some of these benefits include: reduction of fatigue, inhibit post exercise immunosuppression, and of course, increased muscle protein synthesis.

The new research direction from the mTOR perspective has now revealing how leucine works at the cellular control level. The most recent research reveals that leucine, and other amino acids, may have unique roles in metabolic regulation beyond the role of protein synthesis. For example some researchers have found that an additional role for leucine is in the control of glucose balance by enhancing the recycling of glucose and a direct link to insulin signaling.

These additional nutritional insights of leucine may have important applications in weight management and also in prevention and management of diabetes. As a side note, I always contended that the average intake of protein in our country was too low and needed to be increased across the board, because amino acids have multiple functions in the body, including precursors of neurotransmitters, which control the way the entire body works.

L-Leucine- the key to the BCAA's

L-leucine is the only BCAA that can be completely oxidized by muscles for energy, and each molecule yields 3 acetyl groups. By contrast, L-isoleucine and L-valine provide relatively little energy for muscles, and a molecule of either yields only one acetyl group. During strenuous exercise, L-leucine is oxidized at a greatly accelerated pace. Supplemental amounts of L-leucine act to compensate for those losses. In addition, L-leucine has the benefits of conserving glucose (blood sugar), the body's primary energy source, as well as sparing the other amino acids in muscle.

The result is greater endurance throughout the duration of a strenuous workout, and a net increase in muscle growth (due to diminished catabolism of muscle protein both during and after a workout). Ironically, well-conditioned athletes and bodybuilders have an even greater need for supplemental L-leucine, since trained muscle uses more L-leucine than untrained muscle. However, all three amino acids need to be ingested for optimum health, the point here is focusing on which one or ones are needed in vastly greater amounts.

The Anabolic Cascade

Is mTOR and Leucine the anabolic salvation? It is part of what has become know as the anabolic cascade. You see there are many nutritional and biochemical factors involved in the anabolic (tissue and substance building) processes in the body. So, yes leucine is beneficial, along with all the other essential and semi-essential nutrients.

Practical Applications

As we learn more about the way the body works, it becomes clearer that a comprehensive nutrition plan is indeed the foundation of health and getting great results from your training efforts. For me, one area of applying these scientific discoveries to nutrition practice has been in the development of sports nutrition supplements that do just that, they supplement the diet to make it better to reach a training particular goal. In the case of mTOR, extra leucine in protein supplements makes perfect sense, as leucine is also used by the body for energy, so extra amounts makes the protein supplement more anabolic. For example, Explosive Growth Blend is an example of this new category of super-supplements for maximum muscle growth, repair, recovery, strength, and energy production.

With athletes being more active and using more leucine disproportionately over the other amino acids, they therefore need to take in more leucine from supplements. This will actually make your total diet more anabolic.

But more leucine is not the entire answer to bodybuilding diet perfection. This requires eating and supplementing right to best achieve your specific goal(s). Supplementing right is means more than taking a magic pill. It means including a variety of supplements to top off what your diet can't accomplish alone, plus fortifying your diet with the essential vitamins, minerals, lipids, amino acids, etc., to ensure all your vital nutrition needs are covered. Taking several supplements and spending $150 to $200 or more a month is what it typically takes to get the supplements you need for optimum bodybuilding and strength athlete enhancing results. However, most people just try one or two supplements, and fall short of supplying their body what it actually needs for maximum results. However, customized all-in-one products like Explosive Growth Blend that are high in quality and comprehensive formula ingredients, can translate in to getting the best results you are training to achieve.

Another practical application from the mTOR and other biochemical discoveries is to learn what not to do.

Regarding leucine and mTOR, researchers found that alcohol impairs skeletal muscle protein synthesis. Apparently alcohol blocks the ability of leucine to trigger the mTOR protein synthesis pathway. So, those alcoholic drinks you may look forward to consuming, are actually canceling out all of your hard training and muscle building nutrition efforts. What is most amazing is that there are dozens of things like this that otherwise hard working, diligent bodybuilders are doing wrong, which if prevented would result in massive muscle gains.

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The Synergy of Protein Supplements

Daniel Gastelu, M.S., MFS
Director of Nutritional Sciences, International Sports Sciences Association (ISSA)

When I first embarked in developing protein and amino acid supplements, I just didn't want to go through the motions. I wanted to roll-up my sleeves, and get elbow deep in to the research. This was back in the 1980's, and what I discovered to be true back then about protein, continues to be proven over and over again today.

This was during the pioneering days when scientists did not believe that taking supplements of any kind could produce benefits above and beyond eating a health diet. Where they wrong about this general statement, especially when it concerns sports nutrition and protein!

Not All Proteins Are Created Equal

Protein is essential for all living things, especially humans. Our bodies are mostly made up of various proteins. But not all of the proteins we eat are created equal. What proteins are made of has an impact on whether or not they work well in your body. Your body's activity level, and the type of activity you perform, will dictate what type of protein you need. Whey protein has gotten the reputation of being the "king" of all proteins, especially as a supplement for athletes. Its reputation is well-deserved, as the benefits of whey protein are confirmed in medical research, including sports performance scientific studies by some of the world's leading researchers, universities and medical centers: from Shanxi Medical College in China to Harvard University, USA.

Whey Protein Scores the Best

But how do scientists know what proteins are best? During the mid 1990s, when researchers were experimenting with proteins from plant and animal sources, they discovered that some proteins have all the essential amino acids in proper proportions to support growth and health while others do not. After years of testing and retesting, they determined that whey protein not only scored the highest in amino acid composition, but more importantly it also had a high biological value, or BV, a measure of how much of a protein is actually used by your body. Premium quality whey protein isolate also scores high on other rating scales as well.

Whey Protein Has Multiple Benefits

Like with all proteins, there is more to the whey protein story. As scientists continued researching proteins, they started to focus on their building blocks, the individual amino acids. As they tested each amino acid separately, they were amazed to learn that individual amino acids exerted profound beneficial effects on the body. In fact, most amino acids have multiple benefits.

Below are some of the functions of the main amino acids in high-quality whey protein that occur in significant amounts to promote beneficial effects. These functions are not only important to your good health; they are also of particular interest to the fitness-minded.

Summary of Whey Protein's Key Amino Acids Benefits

BCAA's (Branched-Chain Amino Acids: Leucine, isoleucine, & valine)
* Increase endurance
* Prevent fatigue
* Improve mental performance
* Increase energy levels
* Stimulate protein synthesis
* Improve nitrogen balance

Phenylalanine
* Maintains nervous system health
* Relieves depression
* Elevates mood
* Decreases pain
* Boosts memory
* Suppresses appetite

Tryptophan
* Relieves mild to moderate depression
* Relieves insomnia and promotes restful sleep
* Promotes weight loss by suppressing appetite
* Reduces overall sensation of pain (i.e. migraine headaches, fibromyalgia, general muscle pain)

Arginine
* Increases growth hormone levels
* Protects against heart disease
* Reduces cholesterol
* Lowers blood pressure
* Improves poor circulation
* Aids in the production of creatine, an important source of energy
* Lowers ammonia levels, which can be increased in athletes due to frequent exercise
* Boosts NO production

Glutamine
* Boosts immune system function
* Maintains muscle mass
* Prevents muscle catabolism (breakdown)
* Enhances glycogen storage
* Aids recovery from exercise
* Promotes healing
* Increases growth hormone levels

Proline
* Rebuilds cartilage and bones
* Speeds injury repair
* Promotes tissue recovery following exercise
* Protects against overuse injuries (sprains, strains, tendonitis)

Whey Protein Gets Results – It Is Money Well Spent

While high-quality whey protein isolate is the most expensive of the primary protein sources used in protein products, it has some distinct nutritional advantages. It enhances the production of glutathione, one of the body's most powerful natural antioxidants. It has the highest levels of BCAA's and has been shown to boost immune system functioning and promote and support protein synthesis. It is high in glutamine and arginine. It has a good proportion of essential and nonessential amino acids.

Additionally, whey protein has been clinically proven to build muscle and improve athletic performance. It has also been shown to help reduce body fat, while at the same time increase lean muscle mass when taken as part of an exercise program. Another important benefit of the protein is its ability to raise levels of IGF-1, a muscle-building biochemical, and decrease levels of cortisol, a muscle & tissue degrading substance.

Whey Protein Source Glutamine and the Athlete

Dr. Eric Newsholme and his associates at Oxford University in the United Kingdom were among the first to hypothesize that an amino acid imbalance may result from strenuous exercise and as a consequence induce a number of phenomena that are collectively referred to as the "over-training syndrome." Decreased performance, depressed mood and increased incidence of infections are among the many symptoms that are related to the syndrome, which has been described by runners, cyclists, swimmers, skiers, ballet dancers, rowers and even racehorses. Dietary glutamine plays a role in counteracting these phenomena because, as has been shown repeatedly, prolonged exercise decreases the plasma glutamine level, suggesting that the muscles cannot provide enough of the nutrient.

Inadequate amounts of circulating glutamine may lead to impaired immune function and increased susceptibility to infection among athletes suffering from over-training syndrome. In addition, glutamine use by the small intestine has been found to occur at a very high rate. Observations of gastrointestinal disorders, particularly of diarrhea and food allergies may be due, at least in part, to low concentrations of circulating glutamine. Recently, it was also shown that glycogen storage in the muscles occurred significantly faster when study subjects consumed protein together with carbohydrates as compared to carbohydrates alone. One of the responsible dietary factors for this faster glycogen recovery is thought to be glutamine.

BCAA's Help Increase Training Strength, Endurance and Muscle Mass

A study reported in the journal Medicina Dello Sport looked at the effect of taking supplemental BCAA's on bodybuilding progress. The study involved thirty-one male bodybuilders between the ages of eighteen and thirty-four, all of whom were drug-free, or "natural," bodybuilders. The subjects were divided into two groups: sixteen took a placebo and fifteen took a BCAA supplement. The results showed that while both groups experienced increases in body weight, the BCAA group had greater weight gains. An analysis of the weight gain in the BCAA group showed increases in the lean body mass in both the legs and arms, with no changes in the trunk area of the body. In contrast, the group taking the placebo showed no lean-mass gains in these areas. The BCAA group also showed strength gains in both the squat and bench-press exercises, while the placebo group gained strength only in the squat exercise. In addition, the BCAA group showed improvements in measures of exercise intensity.

From my experience developing protein and amino acid products, and the most recent research, using BCAA's to fortify whey protein can further enhance the anabolic and strength boosting actions. In July 2004 independent researchers reported findings of their newest research that serves to reconfirm my earlier discovery that fortification of whey protein with BCAA's, in particular leucine, will result in greater gains in strength and muscle size. D. J. Housh, and coworkers conducted their study at the exercise physiology lab at the University of Nebraska-Lincoln. Men were divided in to either a placebo group or a leucine fortified whey protein group. Subjects trained 3 times a week for 8 weeks. At the end of the 8 weeks the males who were strength training and ingesting the leucine fortified whey protein had significantly greater increases in strength and muscle size when compared to the males who were taking a placebo.

There are specific bio-energetic and physiological control mechanistic reasons why extra amounts of leucine and the other BCAA's, isoleucine and valine, help to boost anabolism.

Synergistic Effects.

The word synergistic gets used a lot in ad and brochures for sports nutrition products. By strictest definition, as it applies to nutrition or pharmacology, synergistic refers to the phenomenon of the simultaneous action of ingredients having total effect than the sum of their individual effects. For example, creatine and whey protein taken together produce an increase in strength and lean body mass when compared to the sum of their individual effects.

So when it comes to proteins, the amino acid composition of some, like whey protein isolate, may indeed have some synergism going on. Ideally, you want your entire nutrition program to be synergistic, and strive to have optimum amounts of all of the know nutrients and performance enhancers. This is been the way I have approached sports nutrition for over 2 decades, to understand what makes the body work, then provide a synergistic nutrition plan. When the synergy kicks in, your body's performance will make a giant step forward in progress.

Effects of Creatine Monohydrate Plus Whey Protein

A study conducted by D.G. Burke and co-workers sought to measure muscular developments during 6 weeks of resistance training, among 36 males who were randomly assigned to supplementation with whey protein, whey protein and creatine monohydrate, or a placebo (maltodextrin). At the end of the 6 week study period the following results were observed:

- Lean body tissue mass increased to a greater extent in the whey-creatine group compared to the other groups; and also in the whey group when just compared to the placebo group: + 4 kg, 6.5% in the whey-creatine group; +2.3 kg, 3.8% in the whey group; and +0.9 kg, 1.5% in the placebo group.
- Bench press strength increased to a greater extent in the whey-creatine group compared to the other groups: +15.2 kg, 17% in the whey-creatine group; 6.3 kg, 7% in the whey group.
- Knee extension peak torque increased significantly with training in the whey-creatine and whey groups, but not for the placebo group.

The researchers also observed that continued training for an additional 6 weeks without supplementation resulted in maintenance of strength and lean tissue mass in all groups. The results of this study revealed a synergistic effect among males taking the whey protein and creatine supplement, which resulted in greater increases in lean tissue mass and bench press performance.

Creatine and Protein Supplementation

W. Derave and co-workers wanted to determine the effects of creatine monohydrate and creatine plus protein supplementation on GLUT-4 and glycogen content of human skeletal muscle. Note that GLUT stands for glucose transporter. There are 5 main GLUTs which tend to be tissue specific, and GLUT-4 is more abundant in skeletal muscle tissue and also adipose tissue. This double-blind, placebo-controlled trial was performed on 33 young healthy subjects (26 men and 7 women). The subjects' right legs were immobilized with a cast for 2 wk, followed by a 6-wk resistance training program for the right knee extensor muscles.

The research participants were supplemented throughout the study with either placebo (maltodextrin) or creatine & maltodextrin, or with creatine plus protein during immobilization and creatine plus protein, maltodextrin, amino acid blend, and multivitamin blend during retraining. Needle biopsies were bilaterally taken from the vastus lateralis (a muscle of the Quadriceps femoris group, of the thigh). GLUT-4 protein expression was reduced by the immobilization in all groups. During retraining, GLUT-4 content increased in both creatine (+24%) and creatine-protein (+33%) groups, which resulted in higher post training GLUT-4 expression.

When compared with the placebo group, the muscle glycogen content was higher in the trained leg in both creatine and creatine-protein groups. Supplements had no effect on GLUT-4 expression or glycogen content in control legs. Area under the glucose curve during the oral glucose tolerance test was decreased from 232 mmol. per liter per minute at baseline to 170mmol. per liter per minute at the end of the retraining period in creatine-protein group, but it did not change in the creatine or placebo groups. The researchers concluded that creatine intake stimulates GLUT-4 and glycogen content in human muscle only when combined with changes in activity level, and that combined protein and creatine supplementation improved oral glucose tolerance.

Creatine and Glutamine

This was an interesting study conducted by M. Lehmkuhl and co-workers who recruited twenty-nine athletes, 17 men and 12 women, who were collegiate track and field athletes. Ten were randomly assigned to take creatine monohydrate, ten to take creatine monohydrate and glutamine, and nine to take a placebo. The creatine monohydrate taking group received 0.3 grams creatine per kilogram of body mass per day for 1 week, followed by 0.03 g creatine per kilogram of body mass per day for 7 weeks. The creatine monohydrate – glutamine taking group received the same creatine dosage scheme as the creatine monohydrate taking group plus 4 grams of glutamine per day. All 3 treatment groups participated in the same strength and conditioning program during preseason training. Measurements observed during the study included body composition, vertical jump, and cycle performances before and after the 8-week supplementation period. After the study period it was determined that body mass and lean body mass increased at a greater rate for the creatine monohydrate and creatine monohydrate – glutamine taking groups, compared with the placebo treatment. Additionally, the creatine monohydrate and creatine monohydrate – glutamine taking groups exhibited significantly greater improvement in initial rate of power production, compared with the placebo treatment.

The field of nutritional synergy is one that excites me, as it opens up a whole new frontier of performance nutrition opportunity. So when you are deliberating over which supplements you want to purchase, shop with your primary goal in mind (muscle gain, strength gain, endurance improvement, fat loss, etc.) and think synergy to help guide your way. Special, high quality, multi-ingredient bodybuilding / sports supplements like Explosive Growth Blend are scientifically developed to promote greater results from your training and nutrition programs.

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