

## The Bodybuilding Supplement Pyramid

Written by Carlon M. Colker, MD, FACN

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The idea of establishing a pyramid for bodybuilding dietary supplements is novel. I simply have never before seen a bodybuilding dietary supplement pyramid. This is startling to me. Here is a most basic concept staring me in the face that no one in our industry had yet seized upon. Perhaps all the experts have forgone this simple concept in favor of the complex analysis. I suppose that when it comes to bodybuilding dietary supplements, I have also been guilty of excessively focusing on science, technical background and clinical research instead of this simplistic idea of establishing a basic hierarchy of efficacy as to what dietary supplement ingredients are traditionally found in the arsenal of muscle building.

The idea of creating a pyramid for dietary supplement use is not new, but restricting it to bodybuilding supplements certainly is, as far as I know. In fact, the Council for Responsible Nutrition does have a dietary supplement pyramid. It contains multivitamins, minerals and folic acid at its base, calcium on the next level up, antioxidants like vitamins E and C on the next level and special-needs products and botanicals on top. While it's cute and kind of nice for the average person interested in general health, for the hardcore bodybuilder, it's completely bereft of any progressive information.

Creating hierarchy among natural ergogenic ingredients in a general fashion is a great first-stroke way to initially approach the idea of what's out there. As I see it, the notion of a stable pyramid is all built upon a solid foundation. The foundation of my approach has always

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been careful attention to the diet. Of course, when it comes to diet, perhaps the greatest and oldest challenge muscle builders have faced throughout our history is getting enough protein. The problem is that if you eat all the protein you need, you can end up developing a bad eating habit by getting used to too many calories. In addition, unless food selection is perfect, you will invariably end up taking in excessive calories and getting fat. Finally, there is the money factor. Protein foods (steak, chicken, fish, eggs, milk, etc.) are generally the most expensive selections on the shelf. That's why (though hardly best from a nutritional standpoint) people starving in third-world nations are often sent cost-effective and easily stored cheap sacks of rice and grain. So eating all that protein if you don't have the deepest pockets can make you end up in the government surplus cheese handout line...if you know what I mean. Most seasoned bodybuilders I know recall this challenge vividly in the youth of their bodybuilding careers.

For these reasons, protein shakes form the &quot;1<sup>st</sup> Rung&quot; of my bodybuilding dietary supplement pyramid. Many times, these protein drinks are called meal-replacement proteins or &quot;MRPs.&quot; Though nothing truly replaces a proper complex meal regardless of the moniker, keep in mind that these products are not meant to exactly do that. Rather, high-end protein drinks provide the muscle builder an easily accessible and cost-effective way to boost overall daily protein while not taking in excessive calories, fostering a bad eating habit or driving one to the poor house.

I have found the best examples of these types of products in powdered form. Though some brands are available in pre-mixed liquid, I tend to find these to be expensive, a bit bulky and inconvenient and usually inferior in terms of ingredient quality. High-end protein blends may also contain some component of essential oils as well as digestive enzymes. Of these, I also tend to like the inclusion of calcium simply because calcium is so critical for vigorous muscular contraction as well as healthy bone development.

So at this first &quot;entry&quot; level to muscle building up until the first year, a good protein shake is perhaps the best dietary supplement you can take to foster muscle growth. After that, protein shakes should likely still form the foundation of your supplement regimen and continue throughout your muscle-building career. But once you are through the first year of consistent training, you will likely be ready to rise to the next rung in the pyramid. Traditionally, most young muscle builders at this point are introduced to creatine monohydrate.

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Creatine is a natural combination of three amino acids (arginine, glycine and methionine) that is found in meat and fish. It works as a shuttle molecule for elemental phosphorus during muscle contraction by more efficiently regenerating ATP (ATP is the currency of energy in the human body). Though creatine can be created by the body through assembling these amino acids, since these very same amino acids are used to form numerous other proteins for higher priority metabolic purposes, natural creatine production is simply not a big priority. For that matter, neither is it a natural priority of the body to build big muscles. The body has to be forced to do this and as such requires exogenous creatine supplementation to more efficiently fill this need. When oral creatine is ingested into the body and taken up by the muscle cells, it binds with a phosphorus molecule to create creatine phosphate. It is then either used during muscular contraction or stored in the muscle sarcoplasm. So the more phosphorylated creatine that is stored in your muscle cells, the more potential energy for contraction each muscle cell has available. This translates to a more powerful muscular contraction and power output, plus a higher tolerance for a heavier workload. It is for this reason that the creatine formulas I've tended to favor over the years contain phosphates. (Note that the "P" in ATP is phosphorus!)

Most good creatine regimens involve taking it after a workout, because of the creatine depletion that occurs during training. When taken this way, the difference in the workout is usually obvious for most people. Some research indicates that giving creatine along with a carbohydrate helps deliver the creatine more efficiently. While I have found this to be somewhat true, too many formulas have an overabundance of sugar. Look for formulas that minimize sugars. As a general rule of thumb, pick formulas that keep total carbohydrates under 10 grams per 3 grams of creatine.

Common doses have been classically described in the research literature with a loading phase of 20 grams per day for five days and 5 grams per day every day after that. I personally have found that (assuming you are using a high-quality creatine product with a minimal-to-moderate carbohydrate profile) loading is simply unnecessary and may carry with it some of the minor annoying side effects of stomach upset and diarrhea. So, 5-10 grams at any one time is plenty. As far as duration, I think after four or five weeks of creatine, you can really take a break from it for a few weeks. This will keep your body sensitized to its effects. Don't be too concerned about backing off it and feeling like you are missing something, because creatine is easily stored and has a significant half-life in the body. Too much for too long unnecessarily taxes your system.

By the way, poor-quality creatine is a growing concern. While one German company I've worked with has attended nicely to this issue of proper creatine manufacturing, countless others are taking up the rear. Creatine that is made by substandard production may contain high

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amounts of dicyandiamide (a cyanide derivative) and/or dihydrotriazine (a chemical byproduct of synthetic creatine production). These byproducts may or may not represent a health hazard. Scientists as yet are not precisely sure. In addition, creatine that comes to the United States from certain foreign countries may sit too long in shipping containers (weeks to months), resulting in even more time to get on the shelf and into your body. As a result, this creatine degrades to creatinine (a naturally occurring waste product of the kidneys). As long as you have normal kidney function, extra creatinine probably won't hurt you, but it just adds up to more waste and more wasted money.

At this &quot;2<sup>nd</sup> Rung,&quot; along with creatine supplementation and high-energy phosphates, the amino acid L-glutamine may also be an important and highly effective addition. Glutamine is an extremely common nonessential amino acid that can be found in virtually every dietary protein and can readily be synthesized in nearly every tissue in the body. Yet, glutamine is a fascinating amino acid because while it is not often listed as an essential amino acid, it is still considered by experts in the field of sports nutrition to be a conditionally essential in those athletes under extreme physical exertion. The reason for this relative essentiality is due to the fact that glutamine becomes quite depleted during the course of a catabolic insult such as a heavy workout, injury or even infection. So despite the relative predominance in the diet and the body's own ability to manufacture it, when our bodies are taxed beyond the normal state of health, we have an immediate requirement for more than that which can be readily attained in the diet or produced in our tissues.

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Since up to around 8 percent of the naturally occurring proteins that an average sedentary person might consume contain glutamine, it can be estimated that such an average diet contains as much as 10 grams of glutamine in a single day. In the case of the bodybuilder, once the body is taxed with regular training, muscles are challenged and broken down. Glutamine needs increase at the cellular level beyond that which can be readily satisfied by just this dietary contribution. It is for this reason that bodybuilders have for years successfully used glutamine to curtail symptoms of delayed onset muscle soreness (DOMS) and to prevent overtraining syndrome (OTS). Glutamine has been widely and I think correctly viewed as a recovery agent.

There are a couple of other facets that make glutamine interesting. They include the fact that

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glutamine has been shown to support and stimulate growth hormone production. Also, glutamine is very helpful in supporting the health of the gastrointestinal tract and assisting in nutrient absorption. I generally use about 2 grams of glutamine per day. Doses of up to 5 grams seem to me to be equally effective, but not of greater effect. Some bodybuilders take in as much as 10 grams of additional glutamine per day, but I have seldom seen this higher dose as being of added benefit.

The &quot;3<sup>rd</sup> Rung&quot; of the bodybuilding supplement pyramid is governed by nitric oxide precursors, namely arginine and arginine alpha-ketoglutarate. Arginine is another conditionally essential amino acid since under some conditions the body cannot make enough and we must therefore obtain it through dietary intake. While in the sedentary adult population arginine is considered to be a nonessential amino acid, infants, growing children, the injured, as well as hard-training athletes and bodybuilders need more arginine. Arginine is needed for many metabolic processes in the body including hormone secretion, detoxification and immunity. Arginine is also a precursor of nitric oxide ( NO). NO is normally produced in the body to increase vascular flow throughout the body, most notably the genitalia. So arginine is used in the support of male and female sexual function.

Most bodybuilders know arginine to be a natural magnifier of growth hormone production by inhibiting a chemical messenger in the brain called somatostatin, which normally inhibits GH release. In this way, a higher growth hormone level can boost muscle mass by increasing protein synthesis, improved recovery and reduced body fat. Arginine may also be effective at promoting muscle strength, as a recent study found. Four grams of arginine alpha-ketoglutarate (AAKG)- the major active ingredient in most NO products- or placebo was given to 35 male weightlifters three times a day. They trained for eight weeks and at the end of the study the placebo group increased their bench press strength by about 5 pounds, while the AAKG group boosted their bench press strength by almost 20 pounds.

Typical doses among bodybuilders range from as low as 1 gram to as high as 5 grams, taken one to three times a day. One powerful tool I use is to have a powdered form as a preworkout pump-enhancing boost before training, while having a more complex arginine-based product in divided doses throughout the day.

Arginine-alpha-ketoglutarate (AAKG)-based formulas have been popularized in the last few years as &quot; NO&quot; ingredients are touted as having a specific advantage over their

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respective core amino acid backbones. AAKG-based diets have been studied and observed in science with a certain fascination in the field of immune boosting and cancer prevention research, anti-catabolism (preventing muscle breakdown), amino acid sparing and growth hormone stimulation. This naturally occurring amino acid variation may in fact introduce some added benefit to the straight amino acid arginine. That's not necessarily to say it's better, but just different in adding another dimension to curtail muscular breakdown and support hormone production. Few head-to-head trials test the core amino acids against their respective alpha-ketoglutarate derivatives. But it certainly seems that from a practical and clinical standpoint, there are some differences, in my opinion.

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Alpha-ketoglutarate itself has been tested in research as improving amino acid metabolism (arginine in particular), as well as electrolyte profile in hemodialysis patients, both aspects of which may help bodybuilders who seriously tax their body. Alpha-ketoglutarate and arginine may be considered to exert both anabolic and anti-catabolic effects in certain situations through their involvement in protein metabolism. Magnifying normal dietary concentrations by way of supplementation may further support these functions.

In my opinion, while standard arginine might be a more practical magnifier of growth hormone production in the body, the AAKG derivative is the better vasodilator. So if you are looking to maximize a delivery system for a particular ingredient to get to the muscle by way of the circulation, I think the AAKG might be a better bet.

With some committed bodybuilding training under the belt, some bodybuilders turn to dietary supplements to either support or possibly enhance their own natural testosterone levels. Zinc and magnesium combinations have become a popular staple in this approach. Zinc is a mineral essential to the body and present to some degree in almost every cell. Zinc is a key component in normal testosterone production and therefore critical for the male bodybuilder. Hard training causes testosterone levels to temporarily wane after a tough workout. These levels need to be built back up with the assistance and consumption of zinc. However, zinc in combination with magnesium seems to be all the rage.

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Clinical studies, in particular out of Western Washington University, show that supplementing with zinc and magnesium actually elevate

testosterone levels

. The effect on muscular size and strength should be obvious. One study on football players reported 2.5 times greater muscle strength gain

verses

a placebo

over eight weeks of training. Supplementing with these ingredients has also been shown to influence

insulin-like growth factor-1 (IGF-1)

Another "4<sup>th</sup> Rung" approach to enhancing testosterone levels at this stage is the use of the herb tribulus terrestris.

Tribulus terrestris is an herb from an African vine containing a biologically active component called protodioscin, which impacts testosterone. This occurs by way of its ability to enhance the testosterone-producing pituitary hormone called luteinizing hormone (LH). LH in turn goes into the circulation on down to specialized testicular cells called Leydig cells. These cells directly produce testosterone. Of course, increased testosterone leads to increased lean muscle mass gains. This rung is wrought with controversy. Though I'm convinced properly sourced tribulus terrestris is unquestionably effective at boosting testosterone's levels, the tolerance profile as it relates to untoward negative feedback might be a concern in taking it inappropriately or in excessive serving size or duration.

The final level of the pyramid is the "5<sup>th</sup> Rung" and it represents the future. It involves a revolutionary but somewhat futuristic concept- the idea of successfully inhibiting myostatin with a dietary supplement. By working on this level the testosterone axis is spared, growth hormone levels are not screwed with and cortisol levels are uninfluenced, as are almost any other unrelated endocrine pathway you can think of. Myostatin is a protein produced by a specific gene sequence in the DNA of nearly every vertebrate-containing

animal. Myostatin works in the embryonic phase and during development to inhibit the growth of muscle in order to control and regulate the production of excess muscle. It is a known fact that mice lacking the gene needed to produce myostatin effortlessly gain slabs of muscle. Also we see the proof of the muscle growth-inhibiting power of myostatin in the Belgian Blue bull and the Piedmontese breeds of cattle who are born with mutations in the sequence of their DNA that produces myostatin. The result of their lack of myostatin is an animal with huge muscle mass.

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Myostatin in the adult human has a similar function. In fact, it is produced when certain diseases occur. For example, myostatin is elevated in certain AIDS patients resulting in muscle deterioration and wasting. Also when muscular injury occurs, myostatin will locally automatically downregulate and thus allow healing to occur.

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In the final analysis, a dietary approach that counters the effects of myostatin will lead to extreme muscle mass gains in the adult human. But again, significant myostatin inhibition through dietary supplementation is still somewhat of a futuristic notion right now. As far as pharmaceuticals, real myostatin inhibitors have been developed, but they have yet to be approved for use in humans. Plus the drug approach they are working on (specifically antibodies to myostatin) is perilous in my opinion. That's because of the irreversible influence on an otherwise normal physiology that was not preprogrammed to deal with the permanent and unmeasured destruction of all myostatin. Finding a natural method of inhibiting myostatin that is not irreversible is a far more acceptable approach. One supplement called *Cystoseira canariensis* has shown some ability to inhibit myostatin in cells; clinical studies are lacking and droves of bodybuilders and athletes have simply not seen the big results with it. So, in short, the 5<sup>th</sup> Rung of the pyramid is not satisfied by *Cystoseira canariensis* and has yet to be satisfied.

Currently our greatest hope of a bona fide 5<sup>th</sup> Rung dietary supplement that significantly inhibits myostatin will likely come from a subdivision of a San Antonio, Texas-based pharmaceutical company called Incell that makes an oral smallpox vaccine. Their subdivision working on the project is a company called Celldyne. Experimentally they truly have what is, as far as I know, the very first and only natural dietary supplement that has been shown in research to inhibit myostatin. Unfortunately, the past year has brought production challenges in preserving a stable and biologically active product to deliver to the consumer. Plus production costs proved exceedingly high. When and if they can get passed these challenges, they will revolutionize the industry in a way that even transcends the coming of creatine or whey protein. We just have to wait and see, but what better or more exciting way to end my discourse? It's exciting to know that such a technology even exists in nature. So the future and the final 5<sup>th</sup> Rung remains undiscovered before us!

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*Dr. Colker's book, Extreme Muscle Enhancement: Bodybuilding's Most Powerful Techniques, is available by calling 1-800-310-1555 or ordering the book online at [www.prosource.net](http://www.prosource.net)*