

Recovery - A Crucial Component for Athletic Success

By Steve Born



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Training causes physical stress and depletion. Recovery is when adaptation to that stress occurs; it involves improvements not only in muscle performance, but also in glycogen storage. Hard training followed by timely, adequate nutritional replenishment increases your glycogen storage, as if your body is saying, "If there's another workout like this tomorrow, I better be prepared with a good supply of available fuel." If you feed your body correctly after a workout, you'll have that fuel, muscle glycogen, the next day.

This article answers questions about how to enhance your recovery, and it offers guidelines on what nutrients you need and how much of them to use. If you follow these guidelines, you'll give your body the support it requires to meet the demands of your next training session or race.

Athletes tend to focus on training and neglect recovery, specifically the critical step of refueling as soon as possible after each workout. We tend to think that a hard workout deserves a nice reward. Do you usually first go for a shower or relaxation after a hard workout? Are beer and pretzels your favored post-workout snack? If so, I want to remind you that a hard workout has left your body in a state of utter depletion and physiological vulnerability. However, it's also in a state of prime receptivity, ready to absorb nutrients. Taking those few extra minutes to properly refuel is one of the most important things that you can do to improve your race day results. In fact, properly refueling your body immediately after your training session is as important as anything you did in the actual workout. When you give your body what it needs as soon as possible after exercise, it will respond wonderfully in the following ways:

- Your body will be able to store more and more of a premium, ready-to-use fuel known as muscle glycogen.
- You will strengthen, not weaken, your immune system.
- You will "kick start" the rebuilding of muscle tissue.

You can really give yourself a major advantage come race day if you'll take the time to put some quality fuel into your body as soon as possible after all of your workouts.

If you're at all serious about performing better in your racing and staying healthier, then take heed to

this saying: **“When you've finished training, you're still not finished with training!”** Here's what I mean: You must attend as much to recovery as you do to active exercise if you expect to reap the benefits of hard training. In other words, how well you recover today will be a huge factor in how well you perform tomorrow. Exercise, done properly, creates enough stress on your muscles and cardiovascular system to instigate a rebuilding and strengthening program, but without causing big-time damage. Your body responds by adapting to the stress you placed upon it. Too much exercise at once leads to over-training syndrome. If you train within limits, but fail to supply your body with adequate fuel and nutrients, you get pretty much the same thing: over-use symptoms such as weakening, increased susceptibility to infections, and fatigue.

Recovery includes many factors, including rest, stretching, muscle stimulation, and sleep, but we will limit our present discussion to the nutritional aspects. This article will cover the four essential nutritional areas of recovery: rehydration, the two macronutrients (carbohydrates and protein), and micronutrients (primarily antioxidants).

Rehydration

Technically, of course, water has no nutrient value, but it's essential for performance and recovery, and well worth a couple of paragraphs here. The normal course of recovery nutrition intake will meet most hydration needs, but it is possible for an athlete to suffer from chronic dehydration. In the article on hydration (“Hydration – What you need to know”) we caution against excess fluid intake, a more common problem than dehydration, especially among the mass of recreational and fitness athletes. Top-level competitors, however, tend to under-hydrate during races.

As a rule of thumb, you want to finish a workout with no more than about 2% body weight loss, and certainly no weight gain. Weight loss in excess of 2% signals performance decline. For example, if you go out at 160 lbs (approx 72.5 kg) and return several hours later at 156 lbs (just under 71 kg), you're probably a bit dehydrated, but that would not be an unusual deficit after a hard workout or race. (Obviously, a steady, reliable scale is important here). At a pint per pound (roughly 475 ml per kilogram), four pounds (nearly two kilograms) lost means you need to drink at least a good half-gallon (64 ounces, or just under two liters) of fluids in the next few hours. That's fairly easy, and much of the fluid intake will come in the normal course of nutritional replenishment anyway.

Carbohydrate replenishment – The sooner the better

Now let's consider carbohydrate replenishment, the most obvious nutritional issue caused by endurance exercise. When you know the mechanism of carbohydrate replenishment, you can very effectively dial in your energy recovery program, so let's briefly review your energy use and restoration cycle.

When you begin a workout or race, the primary fuel your body uses for the first 60–90 minutes or so is known as muscle glycogen, a glucose polymer that contains tens of thousands of glucose units arranged in branched chains. As your stores of muscle glycogen become depleted, your body switches over to burning fat reserves along with carbohydrates and protein consumed during exercise. You've only got a finite amount of this premium fuel, muscle glycogen, but its importance can't be overstated. In fact, several studies have shown that the pre-exercise muscle glycogen level is the most important energy determinant for exercise performance. Needless to say, to have a good race or workout, you need to start with a full load of muscle-stored glycogen; athletes who have more of this readily available fuel in their bodies have a definite advantage. The good news is that you can substantially increase your glycogen storage capacity through the process of training and replenishing.

Here's how your body does it: Along with insulin, which regulates blood sugar levels of ingested carbohydrates, an enzyme known as glycogen synthase converts carbohydrates from food into glycogen and stores it in muscle cells. This also drives the muscle repair and rebuilding process. However, to maximize the recovery process, you need to take advantage of glycogen synthase when

it's most active. Carbohydrate replenishment as soon as possible after exercise, when the body is most receptive to carbohydrate uptake, maximizes both glycogen synthesis and storage. To paraphrase the late Ed Burke, a well-known nutritional scientist, "The sooner you do it, the better." Glycogen synthesis from carbohydrate intake takes place most rapidly the first hour after exercise, remains fairly active perhaps another hour, and then occurs at diminished levels for up to 4–6 hours longer. Researchers at the University of Texas at Austin demonstrated that glycogen synthesis was highest when subjects were given carbohydrates immediately after exercise. Depletion followed immediately by carbohydrate intake yields the maximum glycogen re-supply.

Complex carbohydrates versus simple sugars

The one time where your body isn't going to put up much of a fuss regarding complex carbohydrates versus simple sugars is right after a hard, glycogen-depleting workout. At this time your body is in such dire need of replenishment that it'll accept just about anything. That said, complex carbohydrates still offer a distinct advantage over simple sugars, which is why we strongly recommend using them. Here's why: Complex carbohydrates (such as the maltodextrin we use in Recoverite) and simple sugars (except fructose) have a high glycemic index (GI). This allows them to raise blood sugar levels and spike insulin rapidly, both desirable functions post-exercise. However, complex carbohydrates allow for a greater volume of calories to be absorbed compared to simple sugars. In other words, when you consume complex carbohydrates instead of simple sugars after exercise, your body is able to absorb more calories for conversion to glycogen without the increased potential for stomach distress that commonly occurs with simple sugar fuels.

Additionally, most of us already over-consume simple sugars from our daily diets. Numerous studies clearly show that sugar consumption in America is outrageously high. A report from the **Berkeley Wellness Letter** stated that each American consumes about 133 pounds (60+ kg) of sugar annually & that's over 1/3 pound sugar every day, 365 days a year! The USDA's "Dietary Assessment of Major Trends in U.S. Food Consumption, 1970–2005" (www.ers.usda.gov/Publications/EIB33/EIB33.pdf) illustrates the U.S sugar/sweetener-consumption problem even more in stating, "In 2005, added sugars and sweeteners available for consumption totaled 142 pounds per person, up 19 percent since 1970."

It is abundantly clear that most-to-all of us are over-consuming sugar, and that excess sugar consumption is implicated in a number of health problems, so for that reason alone their consumption should be extremely limited. Additionally, if they don't offer any specific post-workout benefits (which they don't), then why use them? (Note: Check out the many sugar-related articles in our [Endurance Library](#)—particularly the ones written by Nancy Appleton, Ph.D.—for more information on this important topic).

Bottom line: Simple sugars don't provide any benefits for general health or recovery. Use only high glycemic complex carbohydrates (maltodextrins) to optimally replenish glycogen stores.

Important differences with athletic performance implications!

- A less-fit athlete, or one who has not been refueling properly after exercise, has very limited muscle glycogen available, perhaps as little as 10–15 minutes worth.
- A fit athlete who has been consistently refueling his or her body with carbohydrates immediately after exercise can build up a glycogen supply that will last for up to 90 minutes of intense exercise. For instance, a well-trained 160 lb (72.5 kg) marathoner packing some 2000 calories worth of premium fuel can cover 18 miles in 90 minutes at a 5 min/mile pace. He'll need to consume some carbs to finish the race, but he's in good shape fuel-wise.

Which would you rather have when the gun goes off, 15 minutes of on-board fuel or 90 minutes?

It should now be clear that by taking in ample amounts of carbohydrates immediately after training and

continuing for the next few hours, you can get a head start on refueling your muscles after workouts. Additionally, consumption of carbohydrates will also tip the scales in the direction of protein synthesis instead of protein catabolism (breakdown). In other words, ample carbohydrates are essential in rebuilding muscle cells as well as restoring muscle glycogen. Studies suggest that the carbohydrate inflow gives the muscle cells the necessary fuel to begin the rebuilding process. Using the energy derived from carbohydrates, the muscles absorb amino acids from the bloodstream, helping initiate protein synthesis.

Carbohydrates also boost the production and release of insulin from the pancreas. Insulin is an anabolic (tissue-building) hormone that has a profound positive impact on protein synthesis in muscles, and it also tends to suppress protein breakdown. A University of Texas study found plasma insulin values three to eight times higher post-workout for subjects ingesting carbohydrates versus placebo.

Bottom line: For replenishing glycogen stores and aiding in the rebuilding of muscle tissue, quick replenishment of carbohydrates is a must. As soon as possible after you finish your workout, ideally within the first 30 minutes, consume 30–60 grams of high quality complex carbohydrates.

Protein – Essential component for recovery

Carbohydrate intake promotes many aspects of post-exercise recovery, but it can't do the job alone; you need protein as well. Protein in your post-workout fuel provides these benefits:

- **Raw materials to rebuild stressed muscles** – Whey protein is the premier protein source of the three branched chain amino acids (BCAAs – leucine, isoleucine, valine) used for muscle tissue repair.
- **Enhanced glycogen storage** – Numerous studies have shown that the consumption of carbohydrates plus protein, versus carbohydrates alone, is a superior way to maximize post-exercise muscle glycogen synthesis.
- **Immune system maintenance** – We strongly recommend whey protein, with its high levels of amino acids that spur glutathione production (see below).

Whey is the superior protein source for recovery

Of all the protein sources available, whey protein is considered the ideal protein for recovery, primarily due to its high Biological Value (BV) rating. The BV is an accurate indicator of biological activity of protein, a scale used to determine the percentage of a given nutrient that the body utilizes. In other words, BV refers to how well and how quickly your body can actually use the protein that you consume.

Of all protein sources, whey has the highest BV, with whey protein isolate (the purest form of whey protein) having an outstanding rating of 154, and whey protein concentrate having a 104 rating. Egg protein also has an outstanding BV, with whole eggs rating 100 and egg whites (albumin) rated at 88. With a 49 rating, soy protein ranks far below whey protein, making it a less desirable choice for recovery. (When the BV system was introduced, eggs had the highest known BV and thus were given a value of 100. Whey proteins came to researchers' attention later, and they rang up even higher scores. The 154 BV of whey protein isolate and the 104 BV of whey concentrate are in comparison with the original BV benchmark, whole eggs.)

Other standards that evaluate protein quality/effect also show whey to be a superb protein source. One of these methods, the Protein Efficiency Ratio (PER), while it admittedly has limited applications for humans (PER measures the weight gain of experimental growing rats when being fed the test protein), still shows that whey protein ranks the highest, with a rating of 3.6 (soy protein has a rating of 2.1).

Another protein measurement is the Protein Digestibility Corrected Amino Acid Score (PDCAAS).

Nutritionists who disqualify the PER method for classifying protein quality (because it only references the amino acid requirements for lab rats) often will use the PDCAAS method for evaluating human protein requirements. According to this method, which utilizes an amino acid requirement profile derived from human subjects, an ideal protein is one that meets all of the essential amino acid requirements of humans. An ideal protein receives a rating of 1.0. Three protein sources—whey, soy, and egg—all have a 1.0 PDCAAS ranking.

One very important point about whey protein: for a supplement, make sure you use whey protein isolate, not whey protein concentrate. Whey protein isolate is virtually lactose and fat free; many lactose-intolerant people can still use whey protein isolate because it contains only a minuscule amount of lactose. Also, whey isolate checks in at a sturdy 90–97+% protein, whereas whey concentrate contains only 70–80% protein (and, unfortunately, oftentimes less). Simply put, whey protein isolate is a purer protein, and the best protein you can put into your body after a hard workout.

Hammer Whey and the whey protein used in Recoverite come from grass-fed cows that do not have antibiotics. Every load that is taken into the plant for processing is tested for antibiotics/hormones and rejected if it contains said contents. The end product is a pure un-denatured whey protein isolate of the highest quality. It is 97.7% pure, and virtually fat-free (0.5 g fat/100g), and carbohydrate-free (0.5 g lactose/100g). The whey protein isolate in Hammer Whey and Recoverite delivers rich immune-enhancing beta-lactoalbumins and alpha-lactalbumins. Hammer Whey has a unique profile of highly bioavailable protein with immune factors, potent branched chain amino acids (BCAAs), lactoferrin, and immunoglobulins. Independent laboratory tests show the PDCAAS (Protein Digestibility Corrected Amino Acid Score) for the whey protein isolate in Hammer Whey and Recoverite is a whopping 1.14, a score that exceeds all of those reported for egg, milk, caseinates, and soy protein.

Glutathione: The key to optimal immune system support & recovery

Glutathione is a tripeptide consisting of the amino acids glutamic acid, cysteine, and glycine. It is one of the three endogenous (naturally occurring in the body) antioxidants, the other two being catalase and superoxide dismutase. Many researchers rate glutathione as the number one antioxidant. Ward Dean, MD, a leading nutritional scientist, in his brilliant article "Glutathione: Life-Extending Master Antioxidant," addresses the importance of glutathione, stating that "Glutathione is present in nearly all living cells, and without it they can't survive& glutathione has major effects on health at the molecular, cellular and organ levels."

One of the most important steps we can take to improve our recovery is to enhance/optimize body levels of this important antioxidant, and one of the best ways to do that is by consuming whey protein. Whey protein contains excellent levels of all three of the amino acids that comprise glutathione, as well as high levels of the sulfur-containing amino acid methionine. The two sulfur-containing amino acids (cysteine being the other) are particularly important for proper immune system function and the body's production of glutathione. In addition, the amino acid glutamine has also been shown to help raise glutathione levels (both Hammer Nutrition whey protein products, Hammer Whey and Recoverite, contain high amounts of glutamine).

Bottom line: Adequate glutathione in the body will enhance your recovery and support optimal health.

Hammer Whey/Recoverite vs. Hammer Soy A comparison (approximate amounts per gram of protein) for glutathione production

Amino Acid	Whey Protein Isolate	Soy Protein
Cysteine	33 mg	9 mg
Methionine	17 mg	9 mg
Glutamic Acid	103 mg	138 mg

Glutamine	333 mg	10.5 mg
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Branched Chain Amino Acids (BCAAs) – Essential for muscle repair

Of the nearly two–dozen different amino acids required by humans, nine are classified as essential because they cannot be synthesized by the body and must be derived from external food sources. Among these nine essential amino acids are the branched chain amino acids leucine, isoleucine, and valine. The term "branched chain" refers to the molecular structure of these particular amino acids. Up to 75% of the body's muscle tissue is composed of these three amino acids, and they are directly involved in the tissue repair process. BCAAs are present in all protein–containing foods, with whey protein being the best source.

Hammer Whey/Recoverite vs. Hammer Soy A comparison (approximate amounts per gram of protein) of BCAAs (branched chain amino acids)

Amino Acid	Whey Protein Isolate	Soy Protein
Leucine	100 mg	59 mg
Isoleucine	51 mg	35 mg
Valine	36 mg	36 mg

Bottom line: Soy protein is certainly an excellent protein source for a variety of health benefits. However, when it comes to enhancing recovery between workouts—maximizing glycogen synthesis, supporting immune system function, and rebuilding lean muscle tissue—you simply won't find a better protein source than whey protein isolate. After your workouts, consume 10–30 grams of protein, preferably whey isolate, along with your complex carbohydrates. For more information about protein, see the article “The Importance of Protein For Endurance Athletes.”

Recoverite – The perfect carb/protein product

If you've read this far, you might be asking yourself, “That's all fine in theory, but how in the world do I get all those high quality carbohydrates and protein into my body after a workout?” Good question, and we have a good answer, because we've formulated a premier recovery–specific product called Recoverite. Recoverite is the easy way to take care of serious recovery needs for serious endurance athletes, providing the high quality complex carbohydrates and whey protein isolate you need. Additionally, Recoverite supplies a generous amount of glutamine, a couple of other recovery–specific micronutrients, and a full–spectrum electrolyte profile. It's the ideal post–workout fuel.

Why a 3:1 carbohydrate to protein ratio?

As mentioned earlier in the article, timely post–workout carbohydrate and protein replenishment helps optimize glycogen synthesis and rebuild muscle tissue. While other products use a 4:1 ratio of carbohydrates to protein, Recoverite supplies those two components in a 3:1 ratio, which we believe is the ideal ratio for enhanced recovery. Dr. Bill Misner explains:

Research supports the concept for utilizing four parts carbohydrate to one part protein during the [brief] window–of–opportunity in order to exogenously impact lean muscle mass growth and glycogen re–storage. Shortly after Ivy and Burke and several others specified results with a 4:1 ratio, a patented product was then marketed. Another research paper using elderly subjects in strength exercise (weights) found conclusively that when these

subjects lifted weights three days per week and consumed one part carbohydrate to one part protein, they positively achieved lean muscle mass growth gains. This later study skews the conclusion of the former, calling for the question of what carbohydrate to protein ratio best supports lean muscle mass growth and glycogen re-storage post-depletion workout. In other words, research is inconclusively leaning toward the 4:1 ratio, but has not excluded the 3:1 or 5:1 ratios, due to not having studied them as much as the patented 4:1 ratio. This leaves me with the opinion that as far as conclusive research data goes, the jury is still out, waiting for more papers to be published on other ratio values.

An endurance exercise session lasting more than three hours depletes muscle glycogen and likely cannibalizes around 50–60 grams of lean muscle proteins, and probably around 500–600 grams of glycogen, which should be replaced. The total dietary replacement ratio then is at least 10:1 carbohydrates: protein. Since the glycogen synthase enzyme released during glycogen depletion has a short half-life effective for 90–120 minutes, but most effectively available at 30 minutes post exercise, it behooves us (according to Colgan, Costill, Noakes, Hawley, Ivy, etc) to drive replacement proteins on the insulin-glycogen synthase “train” for effective maximal replacement. If you try to replace all of the glycogen in one or two meals, spaced an hour apart with all the protein, too much carbohydrate in one meal will produce excess adipose fatty acid storage. Cutting the carbs down to small doses will produce the insulin and provide maximum storage rates for the protein fraction delivery into the muscle cell for the lean muscle mass rebuilding process.

The 3:1 carbohydrate to protein post-exercise protocol is rational for the endurance athlete, especially if lean muscle mass recovery is the objective. Adding one more part carbohydrate raises the carbohydrate component (to 4:1) and may be beneficial for athletes who are free from carbohydrate-induced fat weight. Of the two ratios—3:1 or 4:1—the low-carb Recoverite appears to be favorable for endurance lean muscle gain than the 4:1 higher carb patented formula. Altering the formula in any direction toward more protein or more carbohydrate should be monitored by fat weight gain and lean muscle mass gain accordingly.

Since we saw the research that showed positive lean muscle mass growth in older subjects using 1:1 carbohydrate to protein recovery refueling, our opinion is that the lower carbohydrate version [3:1 ratio] is superior to the higher carbohydrate version.

Protein and ancillary nutrients

Regarding protein, Recoverite contains only whey protein isolate, which we discussed earlier. For rebuilding lean muscle tissue and immune system support, whey protein isolate has no peer; it's simply the purest form of whey protein available. In addition, each serving of Recoverite also supplies a potent, recovery-boosting three grams of l-glutamine. The benefits of l-glutamine are hard to overstate. Among other things, it plays a crucial role in preserving and rebuilding lean tissue as well as supporting the immune system following intense exercise. In addition, l-glutamine is vital for gastrointestinal health.

Recoverite also supplies two other recovery-enhancing nutrients – ChromeMate™ brand chromium polynicotinate and l-carnosine.

The trace mineral chromium helps regulate carbohydrate metabolism. This has profound effects on athletic performance and, especially, recovery. Studies suggest athletes who consume chromium polynicotinate (along with ample carbohydrates) within two hours of completion of exercise will experience a 300% increase in the rate of glycogen synthesis compared to no supplementation. In addition to the chromium provided in a serving of Recoverite, an additional 200 mcg of ChromeMate™

is an excellent recovery–boosting strategy.

L–carnosine, also known simply as carnosine, is one of the most versatile and beneficial nutrients that you can put in your body. During exercise it's a great lactic acid buffer, and afterwards it continues to offer antioxidant and antiglycation properties.

Antiglycation is a process that may play a substantial role in preventing age–related physiological decline. One theory of aging focuses on the damage done to the cells by free radicals, which antioxidants help neutralize. Another theory points to irreversible damage to the body's proteins caused by a process called glycation. A simple definition of glycation is the cross–linking of proteins and sugars to form nonfunctioning structures in the body. Glycation is cited as an underlying cause of age–related problems including neurologic (brain), vascular (circulatory), and ocular (eye) disorders. Carnosine has been shown to help prevent glycation.

Recoverite also contains a full–spectrum electrolyte profile, which helps replenish depleted essential electrolytes.

Bottom line: Recoverite provides unsurpassed nutritional support to ensure that you obtain the maximum value from your workouts and complete recovery after each training session and race.

Micronutrient replenishment

To enhance recovery, it's important to replenish basic vitamins and minerals depleted during exercise. Additionally, it's extremely important to provide the body with a variety of antioxidants. You may have noticed that we have not mentioned Recoverite's vitamin profile. That's because it contains none. Yes, vitamins are indeed important in recovery, but most, if not all, recovery products contain only a limited number of vitamins and/or insignificant amounts of whatever vitamins they do provide. To completely replenish vitamins and minerals lost during exercise, use a product that provides adequate amounts of the full spectrum of necessary vitamins and minerals. For satisfying this important aspect of recovery, Premium Insurance Caps, a potent, complete vitamin/mineral supplement, is ideal.

Bottom line: While recovery drinks may provide some of the basic vitamins and minerals, they're either lacking in certain ones and/or contain only token amounts. To fulfill your basic vitamin/mineral requirements more completely, don't rely on what a recovery drink provides; use Premium Insurance Caps.

Antioxidants – Your body's protection against free radicals

Our bodies need antioxidants to protect us from the damaging effects of free radicals. Free radicals (of which there are several types) are unstable atoms or molecules, usually of oxygen, containing at least one unpaired electron. Left unchecked, free radicals seek out and literally steal electrons from whole atoms or molecules, creating a destructive chain reaction. Excess free radicals, in the words of one nutritional scientist, “are capable of damaging virtually any biomolecule, including proteins, sugars, fatty acids, and nucleic acids.” Dr. Bill Misner writes:

Oxygen has the capacity to be both friend and foe. When energy fuels are metabolized in the presence of O₂, 5% of them create molecules that contain an odd number of electrons. If free radicals are not neutralized by on–site antioxidant body stores immediately, tissue damage occurs to absolutely every cell membrane touched by these imbalanced molecular wrecking machines. Some theorize soreness and stiffness result because free radicals and waste metabolites build up during either prolonged or intense exercise. The more volume oxygen that passes into our physiology for energy fuel metabolism, the more increased free radical–fatigue symptoms may be experienced.

Those words should sound the alarm bells loud and clear, because as an athlete you consume huge amounts of oxygen and metabolize far greater amounts of calories than a sedentary person does. This

means that you're generating free radicals on the order of 12–20 times more than non-athletes! During periods of peak training and racing stress, free radical production increases even more. While the benefits of exercise far outweigh the potential negatives caused by free radicals, excess free radical production and accumulation, if not properly resolved, may very well be the endurance athlete's worst foe. The human body can oxidize and decay, like rusting steel, from excess free radical production. Not only can this negate everything that you've worked so hard to achieve in your training, but it can also result in severe consequences to your overall health.

Antioxidant roster of Hammer Nutrition products

Recoverite – Cysteine*, Methionine*, Glutamic Acid*, Glutamine*, Carnosine

Premium Insurance Caps – Beta Carotene, Vitamin C*, Vitamin E, Zinc, Selenium*, Manganese

Race Caps Supreme – Coenzyme Q10, Idebenone, Vitamin E, Trimethylglycine

Mito Caps – Vitamin C (as ascorbyl palmitate)*, Vitamin E, Acetyl L-carnitine, R-alpha Lipoic Acid*, DMAE (Dimethylaminoethanol), PABA (Para Amino Benzoic Acid)

AO Booster – Gamma E Tocopherol Complex, Tocomin½ Full-Spectrum Natural Tocotrienol Complex, Lutein, Astaxanthin

Super Antioxidant – Enteric Coated Super Oxide Dismutase, Grape Seed Extract*, L-Glutathione*, Ginkgo biloba, Gotu kola, Vinpocetine

**Glutathione precursors and/or glutathione boosting nutrients*

Clearly, the necessity of neutralizing excess free radicals cannot be overstated, which is why we recommend supplementation with a variety of antioxidants. We'll go over some specifics regarding the above-mentioned products as well as provide suggested dosages in a bit, but these are the salient points to keep in mind:

- Antioxidants are a group of micronutrients that are desperately needed post-workout.
- You need a wide spectrum of antioxidants because prolonged exercise produces many different types of free radicals. Each antioxidant targets different free radicals, so don't make the mistake of thinking that any one antioxidant, say vitamin E, will protect you from all of the ravages of free radical production.
- Consuming antioxidant-rich foods and taking antioxidant supplements throughout the day—targeting primary intake post-workout—is an ideal way to support enhanced immune system health.

Putting it all together – Recovery nutrition recommendations

After extensive training sessions or races, in addition to Recoverite or Hammer Whey + carbohydrates (suggested doses listed below), we recommend the following supplements and suggest the following doses. As always, please consider our doses as guidelines only. Each athlete must design an individualized supplement program to meet his or her particular bodily demands and performance goals. Start with these figures and adjust to your particulars.

Premium Insurance Caps to help replenish the body's stores of essential vitamins and minerals, including some vital antioxidants. There's no doubt that your body will have depleted its stores of vitamins and minerals, and quick replenishment will enhance recovery and protect the immune system. Several capsules also provide a substantial dose of chromium polynicotinate, which, as mentioned earlier, is a vital micronutrient involved in the glycogen re-supply process. After exceptionally difficult and/or lengthy workouts, an additional 200-mcg capsule of ChromeMate™ should also be considered.

Race Caps Supreme for its three very powerful antioxidants - Coenzyme Q10, idebenone, and

vitamin E. Not only does it support enhanced energy production during exercise (from those nutrients plus other key substrates), it also supports enhanced recovery after your workouts. Additionally, all three nutrients play key roles in maintaining optimal cardiovascular health.

Mito Caps, arguably the most potent supplement you can take for recovery and overall health. The combination of acetyl L-carnitine (ALC) and r-alpha lipoic acid (r-ALA) has many extraordinary benefits; to list them all would fill a book. These two powerful nutrients provide immune system support, lean muscle tissue preservation via decreased levels of excess cortisol, and optimal functioning of the mitochondria, your body's energy producing "furnaces." The r-ALA component is especially beneficial in that it extends the usable life of antioxidants such as vitamin C, vitamin E, and glutathione.

AO Booster - If there were only one or two types of free radicals negatively affecting our bodies, we'd be able to get by with one, maybe two, antioxidants such as vitamin C and vitamin E. The truth, however, is that there are a number of free radicals, both water-soluble and fat-soluble, which is why a wide variety of antioxidants is necessary. With AO Booster you have an arsenal of powerful fat-soluble antioxidants to provide even more immune system-boosting power to the water-soluble ones provided in the three above-mentioned products and Super Antioxidant (discussed next). In addition, with AO Booster you'll also notice benefits for your eyes and skin, as well as reduced muscle soreness and inflammation.

Super Antioxidant, perhaps the strongest non-vitamin antioxidant formula available. As mentioned earlier, because athletes exchange several hundred times more oxygen than sedentary people do, free radical production is a certainty. Left unchecked, free radicals can damage cell membranes, suppress the immune system, and delay recovery. To protect the body's cells and to promote accelerated recovery, sufficient antioxidant intake is critical. Super Antioxidant perfectly complements the antioxidants found in the earlier-mentioned four products. In addition, several of the nutrients in the product provide additional recovery-enhancing benefits via their effects on increasing circulation. Lastly, the grape seed extract component in Super Antioxidant, in addition to providing substantial free radical neutralizing benefits, is believed to aid in strengthening and repairing connective tissue while also providing anti-inflammation support.

Xobaline for its influence on the resynthesis of RNA, the basis for cellular reproduction. Research suggests that improving RNA "status" within the body results in gains in lean muscle mass, increased mitochondrial resynthesis, and other benefits. When this occurs, the athlete may expect increased energy, improved metabolism, and enhanced recovery after exercise. In addition, the folic acid/vitamin B12 combination is vital for healthy red blood cell production and cardiovascular health, via the reduction of elevated homocysteine levels.

General Dosage Suggestions

DAYS WITH WORKOUTS LESS THAN 90 MINUTES

Premium Insurance Caps:

- Athletes weighing 150 lbs/68 kg or under, or any athlete under the age 20: 4 capsules after workout with Recoverite or food. 1-3 capsules at another time during the day with food.
- Athletes weighing more than 150 lbs/68 kg: 4 capsules after workout with Recoverite or food. 3 capsules at another time during the day with food.

Race Caps Supreme: 1 capsule after workout with Recoverite or food.

Mito Caps: 2 capsules after workout with Recoverite or food. 1 capsule may be taken with dinner.

AO Booster: 1 capsule after workout with Recoverite or food. 1 capsule at another time during the day with food.

Super Antioxidant: 1 capsule after workout with Recoverite or food.

Recoverite: 1–2 scoops, depending on your body weight and severity of the workout. This provides 85 to 170 calories.

- **Alternate Choice:** 30 grams of carbohydrates (fruit, frozen fruit) + ½ scoop of [Hammer Whey](#) (9 grams protein) mixed with cold water in a blender

DAYS WITH WORKOUTS 90 MINUTES OR LONGER

Premium Insurance Caps:

- Athletes weighing 150 lbs/68 kg or under, or any athlete under the age 20: 4–7 capsules (the amount dependent on the duration/intensity of the training session) after workout with Recoverite or food. 3 capsules at another time during the day with food.
- Athletes weighing more than 150 lbs/68 kg: 7 capsules after workout with Recoverite or food. 7 capsules, divided into 2 doses at other times during the day with food.

Race Caps Supreme:

- Athletes weighing less than 150 lbs/68 kg or any athlete under the age of 20: 1 capsule after workout with Recoverite or food.
- Athletes weighing more than 150 lbs/68 kg: 1–2 capsules capsule after workout (the amount dependent on the duration/intensity of the training session) with Recoverite or food.

Mito Caps: 2 capsules after workout with Recoverite or food. 1 capsule may be taken with dinner.

AO Booster: 1 capsule after workout with Recoverite or food. 1 capsule at another time during the day with food.

Super Antioxidant: 2 capsules after workout with Recoverite or food.

ChromeMate™: 1 capsule after workout with Recoverite or food.

Xobaline: 1 tablet dissolved sublingually (under the tongue)

Recoverite:

- Up to 120 lbs (Up to 54.5 kg) – 1.5 to 2 scoops. This provides 127.5–170 calories.
- 120–190 lbs (54.5–86 kg) – 2 to 2.5 scoops. This provides 170–212.5 calories.
- 190+ lbs (86+ kg) – 3 or more scoops. This provides 255 or more calories.

Note that these are suggested amounts and may differ for each person.

Alternate possibilities:

- Mix 1.25 scoops of Hammer Whey with 3 servings of Hammer Gel in 4–8 ounces of water. This provides approximately 370 calories from roughly 22.5 grams of protein and 69 grams of carbohydrates.
- Mix 3 scoops of HEED with 1.5 scoops of Whey in 4–8 ounces of water. This provides 435 calories from approximately 27 grams of protein and 81 grams of carbohydrates.

Summary

Always remember that how well you recover today greatly determines how well you'll perform tomorrow. The fact is that athletes who attend to the recovery process as much as they do to active training have a distinct advantage over athletes who disregard or neglect it. Therefore, if you want to reap the benefits out of all the time and energy you put into your training, as soon as possible after you finish your workout—ideally within the first 30–60 minutes—it's crucial for you to replenish your body with adequate amounts of complex carbohydrates, whey protein isolate, and supplementary vitamins, minerals, and a wide variety of antioxidants (recommended products and suggested amounts listed earlier).

If you will follow these simple recommendations consistently, you will unquestionably see noticeable improvements in the quality of your workouts as well as better race results. Additionally, via the nutritional support you're providing your body, your overall health will benefit as well.