

Supplementation Recommendations: what works and doesn't work

By Dr. Trent Stellingwerff, Honors BSc, PhD

*****NOTE-** The vast majority of training and competition load and recovery is achieved through proper diet and recovery practices (such as recovery nutrition immediately post-training, quality sleep, afternoon naps, low surrounding external stresses and paramedical support). To aid in this process, athletes have looked towards supplements. However, only a hand-full of supplements have been shown to possibly aid in this process during very intense training and competition schedules. The majority of supplement's have no scientific support, and just result in added and unwarranted expenses to an athlete. However, there are a few supplements that do have scientific support, which can be utilized by an athlete already exercising good general nutrition and recovery practices--- this needs to be taken care of first! A poor diet and recovery practices cannot be compensated for by a supplementation regime. Further, regular blood analysis should be completed to check for any abnormalities. Finally, it cannot be stressed enough that when purchasing supplements the athlete needs to be extremely cautious regarding potential inadvertent doping. Look for 100% pure-products from reputable companies that have also been certified by either NSF:

http://www.nsf.org/consumer/athletic_banned_substances/index.asp?program=AthleticBanSub
or Informed Choice: <http://www.informed-choice.org/>

When in any doubt, do not take!

Any comprehensive supplementation regime is based on several assumptions:

- 1) Only using supplements that have good scientific support via well done research, and thus are 'proven' to be effective.
- 2) Supplements that are going to be effective for the specific task (ie. taking creatine, which helps explosive strength, will do nothing for a marathon runner).
- 3) The proper amounts/doses taken over the right duration to show a positive effect
- 4) The idea that cycling nutrition and supplements should occur throughout the year and according to training loads, just like the cycling of training stimuli
- 5) In most situations not using any supplements for the 2 to 5 days leading into and during an event (except for recovery supplements and recovery nutrition during and after events).

β-HMB

Beta-hydroxymethylbutyric acid (β-HMB) is a metabolite of the amino acid leucine, and like leucine has been showing to stimulate protein synthesis and also decreases post-exercise protein breakdown (some studies have found decreased creatine kinase blood measures). This metabolite can also be found in food, such as fish, but not in the levels required for an effective dose. More scientific research support for β-HMB is found in the clinical arena (promoting better protein balance in hospitalized burn and HIV type patients), although some evidence also exists for promoting recovery for athletes. Some have suggested that taken in combination with creatine might result in somewhat of an additive effect. The main effect of β-HMB also appears to be via optimized body composition and leanness (increased muscle to body fat ratio).

Effective dose: Research studies (n=9) that have shown the most promising results have used an acute dose of ~ 3g/day.

When to take: Although not yet examined scientifically, it appears best to cycle and take acutely during really hard training blocks as a way to enhance recovery. You can split the ~3g/day dose

into 2 doses per day and take immediately after your 2 x daily training in conjunction with your recovery nutrition. (ie. if the morning session is harder, take ~2g after morning training and ~1g after afternoon session or vice versa).

Side effects: none reported in the scientific literature or anecdotally

CLA

Conjugated linoleic acid (CLA) are a family of at least 13 isomers of linoleic acid found especially in the meat and dairy products. Although CLA is a trans fat, it is not harmful, and in some studies has been shown to be beneficial on long-term body composition in losing fat mass (not weight). A recent analysis suggested that CLA can help reduce body fat by about 0.09 kg/week.

At this point, there is only moderate scientific evidence to suggest athletes, who are already very lean, would benefit from CLA supplementation during the period when athletes are trying to lose fat mass and maintain lean muscle mass leading into championship season. Conversely, there appears to be no negative data and thus could be experimented with on a per-athlete basis.

Effective dose: Research studies (n=18) that have shown the most promising results have used an acute dose of at least 3.5 g/day over at least 10wks and of which the purified *trans*-10, *cis*-12 isomers of CLA are used (read the label!). It should be noted, that most of studies have examined obese people looking to lose fat mass, and there are only a handful of studies in serious athletes. More information is needed.

When to take: Although not yet examined scientifically in athletes, it would appear that one would target the use of this supplement leading into championship season when optimal body composition is desired (5 to 10wks prior to target championship). However, there is data lacking in elite athletes and specifically the effects of CLA when in negative energy balance (weight loss) or in conjunction with exercise programs.

Side effects: none reported in the scientific literature or anecdotally in young healthy individuals.

Creatine

Creatine is a guanidino compound that is synthesized in the liver and kidneys and consumed in meat containing products, although to achieve an active dose one needs to supplement. Skeletal muscle contains approximately 130 to 150 mmol per kilogram of dry muscle weight (~60% is stored in the form of phosphocreatine) of creatine, and can be increased 15 to 20% with the oral administration of creatine monohydrate. Chronic creatine intake leads to increases in the skeletal muscle stores of creatine, allowing for an enhancement of repeated explosive contractions.

Effective dose: Creatine needs to be taken chronically over time to slowly build-up the muscles (not acutely for recovery). There are 2 ways to do this, depending on how quickly you want your muscle creatine augmented.

- 1) Loading phase of ~20g/day for 5 days (taken in 4 x 5g doses spread throughout the day) followed by a maintenance phase of ~2 to 3 g per day
- 2) 2 to 3g per day for 30 days

When to take: Cycling throughout the year, emphasis of intake starting prior to and during key intense and explosive training periods and prior to key competitions. Should come off the creatine about 2 to 5 days prior to major competition to minimize any possible fluid retention effects, but still realize the benefit of having extra creatine in the muscles.

Side effects: Some individuals experience some water retention and peripheral bloating with creatine intake. Although not shown in the scientific literature, some also complain of possible increased cramping. Others see no such side effects. The 'wash-out' rate of creatine from the muscles is not well-studied, but would certainly be on the order of days to 1-2 weeks. If you feel that you respond to creatine intake with some water retention, it could be suggested to stop supplementing creatine 2 to 3 days prior to any major competitions. In theory this should eliminate any water retention/bloating issues, while still having the positive benefits of increased muscle creatine.

Glucosamine sulfate, glucosamine HCl and chondroitin sulphate

These ingredients have had substantial scientific research on efficacy regarding they can reduce joint pain and cartilage pain. A very good recent review suggests that only people, who experience significant joint and cartilage pain, or injury, may benefit.—and these people suffer from clinical osteoarthritis. Currently, there is not good evidence that it will help healthy athletes. However, athletes with chronic joint pain should certainly try the recommendations below, according to the dosing rates, for at least a month to see if it helps.

- Glucosamine HCl has no demonstrated effects on joint pain, mobility or disease progression. Its use is NOT recommended.
- 1500 mg of glucosamine sulfate a day were shown to reduce joint pain and/or improve mobility in multiple trials and meta-analyses. The same dose was also shown to decrease cartilage destruction (i.e. slow down disease progression) in 2 trials.
- 800 and 1200 mg of chondroitin sulfate a day were shown to reduce joint pain and/or improve mobility in multiple trials and meta-analyses. 800 mg was also shown to decrease cartilage destruction (i.e. slow down disease progression) in 2 trials.
- There is currently no added value in using glucosamine sulfate and chondroitin sulfate in combination.

Effective dose:

1500 mg of glucosamine sulfate a day

OR

800 and 1200 mg of chondroitin sulfate

When to take:

daily, for at least a month, to potential feel benefits

Side effects:

none reported.

Beta-Alanine (Note- see full attached document for more details)

Beta-alanine (β -alanine) is an amino acid di-peptide. Everyone has a certain amount of natural muscle beta-alanine/carnosine, which can be naturally found and consumed in the meat of animals where acidosis may limit their performance, such as whale meat and migratory birds. It has been shown to buffer the intra-muscular lactate and acidosis that limits performance, primarily in events from 400m to 1500m. Favorable performance results have been found, without any problems related to the problematic stomach side-effects, of which were found with sodium bicarbonate loading. Further, a recent study showed that any training where there are large build-ups of lactate may benefit from β -alanine supplementation to enhance training load and quality during these types of sessions.

Effective dose:

Most ideal dose or severing size: 2 tablets (800mg each) = 1.6g of β -alanine

Dosing per day: 2 to 3 doses (2 tablets per dose for a total of 4 to 6 tablets per day) taken with food.

Length of chronic supplementation needed for increase in muscle carnosine: ~4 weeks (but may start to have some effects already after several weeks)

When to take: After 4wks of supplementation, there does not appear to be any adverse side-effects on muscle function, or water retention etc. Therefore, I would suggest cycling β -alanine supplementation in conjunction with the periodized training program, for at least 4 to 6 weeks before any major championship, and discontinuing use during the 'off-season'.

Side effects: No reported side-effects, other than some minor skin flushing (but not if one purchases slow-release β -alanine and takes with food).

Glutamine

Glutamine is an amino acid used as a nutritional supplement by athletes to hopefully maintain or boost immune function and/or to maintain muscle protein levels during periods of intensive training. It is an important fuel source for immune cells and, in theory, additional supplementation may prevent or lessen the severity of illness. Currently, there is insufficient evidence demonstrating that glutamine will alter immune function and prevent illness in healthy athletes who consume adequate levels of protein. In hospitalized patients (clinical) there is some positive supporting evidence that glutamine plays a major role in protein metabolism; in that it may have an antiproteolytic effect in athletes by offsetting the catabolic effects of glucocorticoid hormones.

Studies in the early 1990's identified lowered plasma glutamine levels as a possible marker of over training and fatigue in athletes, but a consensus has not yet been reached on how to best use this information, as some athletes have large drops in plasma glutamine with no over-training symptoms, while other athletes have small drops with adverse over-training symptoms.

At this point, there is not convincingly strong evidence to suggest athletes, who regularly eat meat, should go on a glutamine supplement (as a typical diet including meat results in a daily dietary glutamine intake of 4 to 7 g/day).

Effective dose: Studies suggest an acute oral ingestion in the range 0.1 to 0.3 g glutamine per kg body weight per day (e.g. 7-21 g glutamine for a 70 kg individual) is absorbed safely and shows no evidence of clinical toxicity after several weeks. "If" glutamine is felt to be effective, and one already takes in 4 to 7g/day in their diet (if a meat eater) than a much lower dose of 2 to 3 g/day might be just as effective.

Side effects: no adverse report side-effects.

DHA and EPA

Omega 3 fish oils such as docosahexaenoic acid (DHA) and eicosapentaenoic Acid (EPA) have not been extensively researched in athlete populations, but instead only in clinical disease state populations. However, there has been some talk that taking large amounts of these fish-oils "may" help sickness prone athletes to stay healthier. None of this has been confirmed yet by well-controlled studies. Also, if an athlete tends to not get at least 1.5 g of fat per kg body weight per day (or is somewhat fat phobic) then one might also consider supplementing the diet with this very healthy fat source as well.

At this point, there is not convincingly strong evidence to suggest athletes, who regularly have fat intake in their diet or do not get overly sick throughout their training season, should go on a EPA/DHA supplement. However, for those 'brittle' athletes, who continually break-down and get sick, starting a daily EPA/DHA supplementation protocol during intense training periods could be warranted.

Effective dose: EPA:DHA ratio of ~2:1 and daily intakes of ~2g EPA and 1g DHA.

Multi-vitamins

In general, if an athlete is getting greater than >7 fruits and veggies servings per day, and (in North America) also regularly consumes fortified cereals, than there probably is not much need for added daily multi-vitamin supplementation. However, if in doubt of having a well-balanced diet, then adding a multi-vitamin will certainly not cause any harm.

Iron

Reduced iron status is a potential problem in some athletes (mainly female) when dietary intake fails to meet iron requirements and daily losses. There is now evidence that supplementation of female athletes, who are not anaemic but who have serum ferritin levels less than 16 or 20 ng/ml, may cause improvements in some performance related parameters. Thus, getting serum ferritin regularly checked is extremely important to circumvent a drop in iron stores to this level. However, if one does not have low iron stores (serum ferritin) and regularly consumes meat, than supplementing with additional iron is not needed.

Effective dose: If anemic, work with a sport doctor to find an ideal supplement. Many athletes find liquid iron, such as Palafer, which contains >100 mg Fe easy to take on the stomach. Best taken with 500 mg of vitamin C for 2-3 months or until review with sports doctor. Supplement should be taken on an empty stomach - e.g. before bed.

Side effects: With iron intake, many can suffer from some stomach upset and dark black stool samples and bowel irregularities.

Causes of iron-deficiency anemia:

- Poorly balanced vegetarian diets, chronic low-energy diets, and other dietary patterns which see infrequent intake of red meat and inadequate substitution with other foods/combinations providing bioavailable iron.
- Increased iron requirements; female athletes (menses), adolescent athletes undergoing growth spurts, pregnant athletes, athletes adapting to altitude or heat training.
- Increased iron losses due to gastrointestinal bleeding (e.g. ulcers, some non-steroidal anti-inflammatory drugs (NSAIDs)), excessive haemolysis due to increased training stress (e.g. footstrike haemolysis in runners), and other blood losses (e.g. surgery, nosebleeds, contact sports).

Antioxidants

There isn't probably an area of research that has changed as much, or has as much conflicting and confusing information on whether athletes should be taking an anti-oxidant or not, and the general consensus among experts has changed over the past 5 years or so, and I think will continue to change due to a couple of recent studies. Below is a summary of some of the recent information regarding anti-oxidant supplementation and athletes. With this new information I would currently not recommend taking any specific anti-oxidant supplements as an athlete, other than the antioxidants complexes (along with polyphenols and flavoids and other great ingredients) that are found in natural fruit. Therefore, athletes should just focus on getting more fruits and vegetables instead of over-supplementing with anti-oxidants. When in doubt, a mutli-vitamin can ensure that all required vitamins and mineral daily requirements are being meet.

- 1) When you exercise hard you produce free radicals and oxidative stress. Ten years ago it was thought that all free radicals were very bad and would harm your body and your cells, and could lead to things such as muscular damage, soreness and even in extreme cases cancer. Thus, it was thought that all athletes, that are breathing and exercising heavily should supplement with antioxidants (such as Vit. C and Vit E) to prevent free radicals from being formed.
- 2) However, over the last 5 years we have clearly learned that when you train hard, these free radicals actually send 'signals' to your muscle and your body to effectively 'adapt' to a higher level from your training (ie. get more out of your hard training). And it appears that if you always are taking an antioxidant supplement, you prevent free radical formation, you might actually limit some of the positive training effects! This has already been shown in training rats, and, now just recently, in a study in humans as well. It's like training at altitude...you actually take something away from your body (oxygen) to force your body to adapt to a higher level from the training (training is harder, but you get more out of it).

- 3) It appears that it is much, much better to get your vitamins and minerals from natural food sources, than from any supplements. Natural food sources contain so many other positive elements other than just a single vitamin. I.e. an orange has lots of Vit. C, but also other vitamins, minerals, phytochemicals, polyphenols, flavanoids etc.

- 4) I have read enough in the scientific literature to suggest that if you feel a cold coming on, it might then be worthwhile to take a vit. C supplement just at this moment and throughout the cold. It appears the Vit. C will reduce the symptoms and the duration of the cold, but chronic Vit. C supplementation will not reduce the number of colds one might get throughout the year. Thus, you should not take Vit. C supplement all the time with the idea that you are preventing colds, as then you may be preventing training adaptation (see point #2).