



# The Role of **MICRONUTRIENTS** In **SPORTS MEDICINE**

## **INDIVIDUALIZED NUTRITION for the ATHLETE**

From a nutritional standpoint, the athlete's focus should include both macronutrients – protein for muscle rebuilding, carbohydrates for energy renewal, fats for nerve function – as well as the critically important micronutrients – which are the vitamins, minerals, antioxidants and amino acids your body needs to function optimally every day and over a lifetime.

We are all biochemically unique, and several factors affect our personal micronutrient needs – age, lifestyle, intensity of physical training, prescription drug usage, past and present illnesses or injuries, absorption rate, genetics and more. The “normal” amount of each micronutrient varies from athlete to athlete, and even in the same athlete depending on circumstances in his or her life.

SpectraCell's micronutrient testing measures 33 vitamins and minerals in your body, but goes even further – it measures functional, long-term levels within the cell, which means SpectraCell's micronutrient testing evaluates how well your body actually utilizes each nutrient.

## **DEMAND, SYNERGY and BALANCE of MICRONUTRIENTS**

The athlete's need for micronutrients may fluctuate wildly depending on the intensity and duration of training. Even with a superb diet, deficiencies often exist. For example, higher levels of folate and vitamin B12 are needed to repair damaged cells as well as to synthesize new ones, especially red blood cells. Mineral depletion is common after strenuous activity.

Plus, micronutrients work synergistically – the status of one affects the function of another. Vitamin C replenishes the antioxidant glutathione. Vitamin A is better absorbed in the presence of oleic acid. Vitamin D and calcium only protect bones when both are present.

And although athletes may have higher requirements for some nutrients, a “more is better” approach can be dangerous when applied indiscriminately. Too much zinc ingestion can induce a copper deficiency, for example. Over-supplementation with antioxidants can actually have a pro-oxidant (harmful) effect. Nutrients need to be balanced. Targeted supplementation and personalized nutrition is key.

## **MUSCLE RECOVERY and FATIGUE**

The speed in which major muscles recover after an intense workout is largely dependent on the body's nutritional reserve. Supplementation with vitamin C can reduce post-exercise muscle soreness and decreases levels of an enzyme (creatine kinase) associated with damaged muscle. Supplementation with the amino acid carnitine yields similar results: less muscle soreness and fewer biochemical indications of tissue damage after physical exertion.

In addition to repairing muscle tissue post-workout, micronutrients also delay muscle fatigue during workouts. Supplementation with the amino acids asparagine and carnitine increase the capacity for muscles to utilize free fatty acids and spare glycogen, thus improving endurance. In one animal study, time to exhaustion was increased by 40% in the supplemented group.

Nutrients benefit more than skeletal muscle. A study on female runners demonstrated that folic acid improves vascular function. Clinically, this meant that folic acid improved the smooth muscle function of their arteries leading to better blood flow during training.

## **CELLULAR ENERGY PRODUCTION**

Inside every muscle cell there is a “cellular powerhouse” known to biologists as a mitochondrion, whose primary function is to generate energy. Although smaller than a cell, the mitochondria need copious amounts of micronutrients to power the muscles, nerves and heart. Lacking even a single micronutrient can compromise the efficiency with which the mitochondria fuel muscles. For the athlete, this means decreased endurance or strength.

Powerful nutrients like carnitine, lipoic acid and coenzyme Q10 are critical cofactors specific to mitochondrial function. Many B vitamins – biotin, B1, B2, B3, and B6 – directly impact energy pathways in the mitochondria. Vitamin E protects ATP (adenosine triphosphate), which is the energy “currency” of our bodies, while vitamin A maintains cellular equilibrium when energy production ramps up.

Vitamin K helps harness the energy once it is created. Clinical nutrition text and minerals such as magnesium are needed to activate the entire energy production process. The implication is clear: correct deficiencies to optimize energy metabolism. Ultimately, this improves gross motor function like muscle contraction and power.

### **MINIMIZING OXIDATIVE STRESS**

Intense physical training generates substantial oxidative stress. Maximizing antioxidant status in athletes is critical in order to heal post-workout damage. Antioxidants such as vitamin C and cysteine prevent exercise induced damage to cells. Vitamin E reduces lipid peroxidation (protects cell membranes) during strenuous exercise and decreases the amount of damaging compounds in the blood called isoprostanes, which are formed during times of high oxidative stress.

Antioxidants play multiple roles. A study on elite athletes showed that in addition to protecting cells from damage, supplementation with vitamin E influences mineral metabolism. Men who took 300mg of vitamin E daily maintained higher levels of chromium, manganese, copper, zinc and calcium after training than a similar but un-supplemented group.

SpectraCell's Spectrox™ test measures total antioxidant function giving the athlete a picture of how well his or her body is responding to the exercise-induced stress that occurs. When male runners were monitored using SpectraCell's Spectrox™ test, results showed a dramatic decrease in antioxidant function after running at max speed for 20 minutes daily. The Spectrox™ score enables the athlete to monitor cellular "wear and tear" and develop an appropriate supplementation regimen based on the results.

### **OMEGA-3 FATS for CONCUSSION PROTECTION**

For athletes, the threat of concussion is real. One particular nutrient – DHA – which is a type of fatty acid that is measured by the HS-Omega-3 Index®, protects against concussion. Although concussion is usually associated with swelling and bleeding in the brain, tearing of neurons and their connecting fibers is also a major component of traumatic brain injury that occurs so often in athletes. And although the moment of impact often causes much of the physical damage to nerve tissue, we now know that this damage also sets off a cascade of events in the brain that continues to damage nerve tissue after the initial trauma.

DHA stimulates growth of healthy neuronal tissue in response to injury. Omega-3 fats also decrease cell death in the brain, reduce oxidative stress caused by the injury and enhances the activity of antioxidant enzymes needed for healing. Clinically, this has been demonstrated in animal studies. After an induced brain injury, rats given DHA supplements had less evidence of tissue damage than did their non-supplemented counterparts.

The effects of omega-3 supplements for athletes go beyond concussion protection. Studies show omega-3 fats can improve lung capacity, reaction time and mood in athletes. In addition, muscle soreness is decreased in those with higher HS-Omega-3 Index® values. Given the link between oxidative stress and pain, these results are not unexpected, since omega-3 fats have powerful pain reducing effects in other tissues besides muscle.

### **IMMUNITY and HORMONE REGULATION in the ATHLETE**

The amino acid glutamine is synthesized in skeletal muscles. Evidence suggests that while moderate exercise is associated with improved glutamine function, exhaustive training programs induce glutamine deficiency, resulting in decreased immunity.

Nutrients affect hormone levels as well. A study on men during intensive weight training for two weeks showed that supplementation with a form of the amino acid serine (phosphatidylserine) decreased post-exercise cortisol levels, reduced muscle soreness and minimized psychological depression that often accompanies overtraining.

### **A COMPREHENSIVE APPROACH**

Since so many nutrients are needed to keep our amazingly complex bodies functioning properly, a comprehensive assessment of your nutritional status is key. SpectraCell's micronutrient testing evaluates every nutrient referenced here and more.

**SpectraCell's micronutrient tests measure 33 vitamins, minerals and antioxidants in your body and evaluates how well your body absorbs and utilizes each nutrient. Ask your doctor about SpectraCell's micronutrient testing today!**