SpectraCell's

Nutritional Considerations of Sports Medicine

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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!

Abstract

Int J Sport Nutr Exerc Metab. 2006 Jun;16(3):270-80.

Effect of high dose vitamin C supplementation on muscle soreness, damage, function, and oxidative stress to eccentric exercise.

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OBJECTIVE: This study investigated if vitamin C supplementation before and after eccentric exercise could reduce muscle soreness (MS), oxidative stress, and muscle function.

METHODS: Eighteen healthy men randomly assigned to either a placebo (P) or vitamin C (VC) (3 g/d) treatment group took pills for 2 wk prior and 4 d after performing 70 eccentric elbow extensions with their non-dominant arm.

RESULTS: MS increased in both groups with significantly reduced MS for the first 24 h with VC. Range of motion was reduced equally in both groups after the exercise (P > or = 0.05). Muscle force declined equally and was unaffected by treatment. VC attenuated the creatine kinase (CK) increase at 48 h after exercise with similar CK after this time. Glutathione ratio (oxidized glutathione/total glutathione) was significantly increased at 4 and 24 h with P but VC prevented this change.

CONCLUSION: These data suggest that vitamin C pretreatment can reduce MS, delay CK increase, and prevent blood glutathione oxidation with little influence on muscle function loss.

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Abstract

Int J Adolesc Med Health. 2005 Jan-Mar;17(1):57-66.

Biochemical evaluation of antioxidant function after a controlled optimum physical exercise among adolescents.

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BACKGROUND: Sensible physical exercise is shown to prevent certain neurovascular problems. However, in recent times, non-traumatic sudden death in young athletes has been observed and the incidence level is always very disturbing, because of the spontaneous nature of the occurrence. It most commonly occurs fivefold more in male than female athletes. Although it is believed that congenital cardiovascular disease is the leading cause of non-traumatic sudden athletic death, however, sudden physical alteration in the biochemical composition of the body system may, at least in part, play an important role.

OBJECTIVE: The role of antioxidants in the general maintenance of homeostasis has already been established. In this study, total antioxidant function in athletes subjected to controlled physical exercise was evaluated to determine the extent to which intensive physical exercise could alter the health conditions if adequate actions are not taken to adjust the biochemistry of the body system.

METHODS: Ten male field-track athletes were exercised using a fixed workload treadmill test. Blood samples were drawn before and after the exercise. The subjects exercised almost to their maximum running distance at a higher "fatigue" workload for a maximum of 20 min each day for five days. The lymphocytes' total antioxidant function was measured by addition of a peroxide (oxidative stress) to complete the medium. Lymphocyte growth response with peroxide was reported as a percentile of growth responses from a reference range of apparently healthy individuals. Values below the 25th percentile indicate a deficient antioxidant function.

RESULTS: The results showed that although vitamin B3, B6, and B12 requirements were normal, there was a consistent low value in the total percentile of vitamins B1 (<79%), B2 (<54%), folate (<33%, and biotin (<70%). There was a dramatic decrease in the mean values of antioxidant function (38.1%) in all the subjects as opposed to the reference range of <75%.

CONCLUSION: Overall reduction antioxidant function indicates decreased ability to resist oxidative stress, or an increased oxidant load, suggesting increased antioxidant utilization and/or cellular "tear and wear" scenario. It is therefore suggested that after intensive physical exercise, antioxidant functions should be monitored and supplemented whenever necessary to maintain the integrity of the cellular function.

PMID: 15900812

Abstract

Int J Sport Nutr Exerc Metab. 2003 Mar;13(1):65-75.

Effect of aspartate and asparagine supplementation on fatigue determinants in intense exercise.

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PURPOSE: This study evaluated the effect of aspartate (ASP) and asparagine (ASG) supplementation on fatigue determinants in Wistar rats exercised to exhaustion by swimming.

METHODS: The animals were tested for anaerobic threshold (AT) determination and then supplemented with 350 mM ASP + 400 mM ASG x day(-1) (AA group, n = 16) or 2 ml x day(-1) of distillated water (PLC group, n = 16) for 7 days. On the 7th day of supplementation, the animals were divided into 4 new groups and killed at rest (RAA, n = 8; RPLC, n = 8), or immediately after the swimming exercise to exhaustion (EAA, n = 8; EPLC, n = 8).

RESULTS: No significant differences were observed between amino acids and placebo rest groups for muscle and liver glycogen, blood glucose, lactate, alanine, and glutamine concentrations. However, in the exhaustion groups, the EAA group showed higher exercise time (68.37 +/- 25.42 x 41.12 +/- 13.82 min, p <.05) and lower blood lactate concentration (8.57 +/- 1.92 x 11.28 +/- 2.61 mmol x L(-1), p <.05) than the EPLC group. Moreover, the ASP+ASG supplementation decreased the rate of glycogen degradation of gastrocnemius (1.00 +/- 0.51 x 3.43 +/- 0.99 microg x 100 mg of tissue sample(-1) x min(-1), extensor digitorius longus (5.70 +/- 2.35 x 8.11 +/- 3.97 microg. 100 mg of tissue sample(-1) x min(-1) and liver (0.51 +/- 0.34 x 3.37 +/- 2.31 microg x 100 mg of tissue sample(-1) x min(-1) for EAA.

CONCLUSION: These results suggest that ASP+ASG supplementation may increase the contribution of oxidative metabolism in energy production and delay fatigue during exercise performed above the AT.

PMID: 12660406

Abstract

Curr Opin Clin Nutr Metab Care. 2010 Jan;13(1):58-64.

Effect of physical activity on glutamine metabolism.

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PURPOSE OF REVIEW: Glutamine is largely synthesized in skeletal muscles and provides fuel to rapidly dividing cells of the immune system and precursors to gluconeogenesis in the liver. Physical exercise is known to affect glutamine synthesis and to modulate glutamine uptake. Overtraining is frequently associated with reduced availability of glutamine and decreased immunocompetence. Inactivity affects glutamine metabolism, but this subject was poorly investigated.

RECENT FINDINGS: Strenuous physical exercise as well as exhaustive training programs lead to glutamine depletion due to lowered synthesis and enhanced uptake by liver and immune cells. Evidence suggests that postexercise glutamine depletion is associated with immunodepression. Counterwise, moderate training leads to improved glutamine availability due to a positive balance between muscle synthesis and peripheral clearance. Physical inactivity, as investigated by experimental bed rest in healthy volunteers, reduced glutamine synthesis and availability.

SUMMARY: After exercise, a reduced glutamine availability may be considered as a marker of overtraining. An increased glutamine availability may contribute to decreased inflammation and health benefits associated with optimal training. Thus, glutamine supplementation may enhance immunocompetence after strenuous exercise. The potential of glutamine supplementation during physical inactivity needs to be explored.

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