Herbs...Ergogenic Erbs
The Newest Additives to Your Sports Supplements
Laura Frank, PhD, RD
Janine Baer, PhD, RD

Introduction

Many botanical products have been formulated into sports supplements. These herbs have been reported to be associated with enhancing aerobic performance or muscular hypertrophy and strength performance. Product manufacturers and dietary supplement retailers often times market herbal ergogenic aids absent from adequate substantiation of the herb’s clinical safety and efficacy. This article provides evaluative information for use by dietitians to counsel patients and clients on a variety of popular herbs that are considered to be ergogenic and are being consumed independently or as part of a sports supplement preparation.

The term ergogenic refers to that which generates energy in the body, either by stimulating the central nervous system, heart, neuromuscular or neuroendocrine responses and can therefore have a beneficial effect upon exercise performance. For a detailed review of selected herbals and their role in exercise performance, see Bucci. Bucci reviewed several herbs used as ergogenic aids including Chinese (panax ginseng) and Siberian ginseng (eleutherococcus senticosus), ma huang, ashwaganda, Rhodiola, Yohimbe, Cordyceps fungus, shilajit or mummio, ginsengs and ma huang with a discussion of the ginsenosides, may also be responsible for increasing endurance and alleviating fatigue. However, while being credited as a stimulant, the ginsenosides, may also be responsible for

The Ginsengs:
The active components of ginseng are ginsenosides, a diverse group of steroidal saponins. Standardized extracts contain approximately 4% ginsenosides. Ginseng has long been identified as potentiating the central nervous system (CNS), thus increasing endurance and alleviating fatigue. However, while being credited as a stimulant, the ginsenosides, may also be responsible for...
As we pass from the long days of winter to spring flowers and the warmth of the sunshine, our thoughts turn to exercise. For professional, competitive recreational athletes, and “weekend warriors”, the quest for exercise performance enhancement is never ending. This issue of the newsletter will provide updated information regarding what works and what doesn’t in the area of sports performance supplements.

The field of complementary nutrition is exciting and always changing. New ideas and approaches to treating and preventing disease are introduced to healthcare professionals and consumers each day. Some of these are sound, while others are questionable. It is the goal of this newsletter to provide you, our member and reader, with cutting edge information that is sound and useable in your own practice. We also like to feature those members who are “practicing what they preach” and want to share their successes with fellow NCC members. If you are one of those members, or know someone who is, please do not hesitate to let me know. As always, I welcome your ideas, comments and criticisms, as this is your newsletter.

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Sarah Harding Laidlaw, MS, RD, MPA

“Lights, CAM, Action” column (see p. 45)
She took her passion for nutrition and work in the field of oncology and formulated step-by-step nutrition actions plans for persons with cancer. Her new book, *Challenge Cancer and Win!*, is reviewed in the resource section of this issue.

Another member, Jennifer Workman, has just published a book entitled, *Stop Your Cravings*, in which she has brought together the basic principles of Ayurveda, Western medicine and sports nutrition in an attempt to help clients find balance in their lives and end the cycle of dieting. A review of her book is also in the resources section.

I am always looking for members who are practicing what they preach and want to share their successes and maybe what hasn’t worked so well) with fellow NCC members. If you are one of those members, or know someone who is, please do not hesitate to let me know. As always, I welcome your ideas, comments and criticisms, as this is your newsletter. If you are interested in helping with the newsletter, either as an author, reviewer or proofreader, please let me know. You may find my contact information, as well as information for other key NCC leaders, on the back page of the newsletter.
A Vision Coming True
Rebecca Ephraim, RD, CCN

The dynamic volunteer leaders of Nutrition in Complementary Care have created a vision statement that is the focus for all our members. It reads: NCC bridges conventional and emerging nutrition choices. Translation is that NCC wants to promote the best of what complementary nutrition has to offer by reaching out to not only our and the ADA’s membership at large, but to a number of other, what we call, customers. This includes other health care practitioners and businesses within the natural products industry with whom we want to support in building a new health paradigm in this country. In committing to that “outreach” responsibility, NCC leaders have developed a strategic plan to make all our dreams come true. I want to share with you a few details of NCC’s plans with an eye toward also luring you into joining our “movement” at a leadership level.

Thirteen of NCC’s “thought leaders” met in Anaheim in March for a strategic planning meeting. Our charge was to chart the future for this practice group, a process that had actually begun with our mid-year meeting in 2001. This is no small duty when you consider that we are laying the groundwork for what many believe is the future direction of nutrition and health care. For you as a member, this means that NCC continues to build a newsletter that is of unbeatable quality in the information it conveys. We are dedicated to expanding the NCC Web site and electronic mailing list (EML) that I call the “glue” between those four quarterly newsletters. Members are able to access NCC’s Web site member database, schedule of events, and CPE articles while exercising thoughtful and insightful dialogue on our EML. Those are the educational mainstays for NCC. But there is so much more in the works.

A major goal of NCC’s strategic plan is to provide a means to integrate complementary nutrition education into current educational venues for nutrition professionals, educators, and students. NCC proposes in the strategic plan to assist educators in obtaining credible teaching materials in the complementary nutrition area, develop continuing education materials, including workshops, for dietetics professionals in this area, and put together a speakers’ bureau that can talk on a wide range of complementary topics, not just nutrition therapy. In addition, we have produced and presented CPE workshops with NCC members who are extraordinarily adept at teaching complementary nutrition concepts. Other benefits in the works include tools to help members address their client needs better, such as guidelines for recognizing quality supplements, and fact cards on complementary nutrition as it relates to specific conditions.

To facilitate much of the NCC day-to-day business, the executive committee has brought on a paid staff administrative assistant, Kathy Bernard, MS, RD. Kathy is also in place to offer assistance to NCC members (NCCadmin@optonline.net). Kathy’s attentive presence has already allowed us to work “smarter”, allowing our volunteer leaders to focus on weighty matters leaving the administrative minutia (that is vital to keeping the daily gears grinding!) to Kathy.

Many of NCC’s plans, including a paid staff member, require funding beyond what NCC membership dues can support. In light of this, we have formed working relationships with high quality companies in the natural products industry. These relationships afford us the sponsorship that we need to propel NCC toward its higher goals. For instance, our March strategic planning meeting was supported in part by the supplement company Nutrilite – a Division of Access Business Group. They provided financial support and allowed us to conduct our business meeting in their Buena Park, CA facilities. Two outstanding raw supplement ingredients manufacturers, Cognis Corporation and Roche Vitamins, Inc, provided additional financial support for informative presentations on recent research. This coming together also included an opportunity for the executive committee to interact with scientists involved in supplement development and quality assurance, to see a manufacturing operation in practice, from growing the raw materials to the products, and arranged the timing so that we could attend the premier natural products exposition, Natural Products Expo West. What were we able to leave with was a strategic plan that will better serve our members, cutting edge information that we will be able to share with you throughout the year, and the potential for future collaborative and financial support for our DPG.

I am delighted to report that because of NCC’s many efforts at outreach, the natural products industry is responding and wants to embrace RDs. Moreover, I can report that our four-year-old practice group is in optimal fiscal health and ready for the rigors of vigorous growth and expansion. NCC’s where the action is! Please consider joining the action as a volunteer leader. NCC is an awesome DPG, we have a destination, a good map for getting us there, and we’re gaining speed—come get on our train!
Herbs...

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CNS depression, antioxidant activity, production of corticotropin, a hormone secreted by the anterior pituitary gland, which stimulates secretion of other hormones by the adrenal cortex and anabolic actions. Typical use of ginseng is 3-9 g/d of powdered root, and is often combined with other herbs and/or caffeine.

Panax ginseng (also referred to as Asian, Chinese or Korean ginseng) has been valued as a medicine in China for over 5,000 years. The ginsenosides are considered to be the energizing agents, and the panaxanes (hence, Panax) are considered to have immune boosting and glucose regulating activities. Panaxanes are polysaccharides isolated from the roots and culture of Panax ginseng. Panax ginseng is native to China, but is also cultivated in Korea, Japan, and Russia. Siberian ginseng (Eleutherococcus senticosus), despite its common name of ginseng, is not a true ginseng and is chemically different than other ginsengs but may still possess ergogenic properties.

Studies reporting performance enhancement from ginseng are not consistent—in part due to variety of type and amount of ginseng used, aerobic or strength assessment, and training status of subjects and subject types (animals or humans). Animal studies show that Panax ginseng enhances stamina and physical capacity, but data from human clinical studies do not support it as ergogenic. Engels, et al. reported that consumption of 200 mg of standardized ginseng for six to ten weeks had no effect on work capacity or blood lactate levels in adult females. McNaughton, et al. investigated the effects of two forms of ginseng (Chinese and Siberian) versus placebo, on aerobic and anaerobic (strength) exercise performance in male (n=15) and female subjects (n=15). Maximum oxygen consumption (VO2 max) improved significantly with Chinese ginseng versus placebo (p<0.01). Siberian ginseng and Chinese ginseng significantly improved both pectoral strength (p<0.05, p<0.01, respectively) and quadriceps strength (p<0.05) compared to placebo. The authors concluded that Chinese ginseng was a more potent ergogenic aid than Siberian ginseng but that ginseng, in general, possessed ergogenic properties. In a review of literature on ginseng(s) and human exercise performance, Bucci noted that controlled studies of Chinese ginsengs reported improvements in exercise performance when most of the following conditions were true: use of standardized root extracts, study duration of at least eight weeks, dosage of >1 g dried root or equivalent daily dosage, and subject > 40 yrs of age.

Rhodiola rosea L. (golden root)

Rhodiola rosea L. (golden root) is representative of the Crassulaceae family and is a traditional tonic Chinese herb much like Panax ginseng. The active constituents found in golden root are cinnamyl-D-glycosides (rosavin, rosarin, and rosarin), o-mono- and o-dihydroxyphenols. Typically, Rhodiola rosea is found as an air-dried extract of rhizomes and roots from the intact plant. Typical dosages found in ergogenic formulas range from 100-300 mg/d. A 1.5 g/dose has been shown to decrease the onset of exhaustion during running and thus increase work capacity when compared with a placebo. Rhodiola is also suggested to increase mental alertness. In a double-blind study a standard extract of Rhodiola rosea was given to 56 physicians during a night shift. Using five tests to measure mental fatigue, there was a significant improvement in the treatment group's test scores. Rhodiola rosea extract (50 mg) also significantly improved physical fitness, mental fatigue, neuro-motoric tests (p<0.01), and improved overall well-being (p<0.05), compared to placebo in 40 male subjects.

Green Tea (Camellia sinensis, Chinese Tea)

Green tea has been used medicinally since approximately 3,000 BC. Green tea (Camellia sinensis) possesses antioxidant, anticarcinogenic, antitumorigenic, anticholesterolemic, antimicrobial, anticariogenic, and thermogenic effects and can, therefore, have a positive impact upon health. The mechanisms underlying the aforementioned actions are thought to be due to tea polyphenols (a flavonoid) such as catechins (30-42% extractable solids) and galloacatechins (including epigallocatechin gallate). Green tea also contains other constituents such as caffeine, theophylline, flavonols, chlorophyll and carotenoids.

The effects of green tea extract (50 mg caffeine and 90 mg EGCG), caffeine (50 mg), or placebo three times per day were investigated in 10 healthy men. The authors reported that compared to the placebo, treatment with the green tea extract significantly increased 24-hour energy expenditure (EE) and significantly decreased 24-hour respiratory quotient (RQ) (to represent greater fat oxidation). In addition, 24-hour urinary output of the catecholamine norepinephrine was higher. In contrast, there was no treatment effect for any variable in the caffeine treated group.

Excessive caffeine intake results in the associated side effects of irregular heartbeat, dizziness, GI spasms and diuresis. Of particular issue to athletes and other individuals who are at risk for dehydration, commercial green tea drinks often contain additional caffeine beyond which is provided from the tea alone.

Guarana (Paullinia cupana, Sapindaceae, Brazilian cocoa)

Guarana is a woody vine or sprawling shrub native to central South America. Guarana is coined as an energy-booster due to its chemical constituents. It contains high concentrations of saponins and tannins and is a natural source of theobromine, theophylline, and caffeine. The seeds of the guarana vine are used to prepare an oral extract.

Guarana supplementation in mice has been reported to slightly improve physical performance. Miura, et al. reported that in a dose-dependent manner (0, 0.2, 0.4, 0.6, 0.8, and 1.0 mg/kg), water extract of seeds of guarana (GW) produced a suppressive activity of exercise-induced hypoglycemia in mice. The authors concluded that guarana was useful as an energy supplement in mice.

The typical dose is one to two capsules or tablets containing 200-400 mg guarana extract each, not to exceed 3 g daily. This amount delivers up to 400 mg caffeine, which is approximately the amount of caffeine in one cup of strong coffee. Miura, et al. reported low toxicity levels of guarana (LD50> 500 mg/kg). Symptoms of toxicity include painful urination, abdominal spasms, vomiting, and adverse effects from caffeine overdose such as tachycardia and cardiac arrhythmias. Caution should be followed when ingesting large dosages, however, due to the high caffeine content (look for blood pressure response, heart rate response, GI distress, diuresis). The International Olympic Committee (IOC) permits caffeine content in the urine up to 12-15 mg/mL.

Ma Huang (Ephedra sinica)

Ephedra (Ephedra sinica) is well known in China where it is referred to as Tsaoimen-Ma Huang. The active constituents in ephedra include several alkaloids, namely (-) ephedrine, (+) pseudoephedrine, (-) methylephedrine, (-) norephedrine, and (+) norpseudoephedrine. Ephedra (ephedrine) is a beta-agonist, similar to caffeine, and can therefore produce stimulatory effects upon the CNS, increase rate and strength of heart contractions, and increase blood pressure response. Thus, it is very dangerous if taken in excessive amounts (doses >300 mg or exceeding 24 mg/d) or with caffeine. Over time, a tolerance develops and therefore a need for larger doses may occur, which exacerbates the risk for side effects. Moreover, ephedrine is a banned substance by the IOC.

Several researchers have reported a synergism between the thermogenic effects of ephedrine and caffeine. Bell, et al. reported that ephedrine (E) plus caffeine (C) significantly improved time-to-exhaustion during high intensity exercise in male subjects compared to either E or placebo. In another study, Bell, et al. showed that E, as well as E plus C, increased power output during the first 15 seconds of an anaerobic Wingate test (30 seconds all out sprint). These researchers also concluded that C and E plus C significantly improved time-to-exhaustion by 8% compared with the non-C trials (p<0.05).

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Caffeine and Athletic Performance: Mechanisms of Action, Effects, and Ethics

Melody Brown, MS

Caffeine is the most widely used drug in the world. Caffeine has been touted as an ergogenic aid, a claim given to products that enhance performance. It is well known that caffeine enhances athletic performance under the conditions of endurance exercise. However, the mechanisms by which caffeine exerts its effects are not clear. It is thought that caffeine enhances performance by increasing the force of muscle contractions, stimulating the central nervous system, and sparing muscle glycogen. This article will explore the most recent studies evaluating the mechanism of caffeine action, effects of caffeine use, sources of caffeine, and ethics of its use by athletes.

Mechanisms of Action

It is generally accepted that caffeine improves work output and time to exhaustion during endurance exercise by delaying fatigue and decreasing pain perception. One widely accepted theory proposes that caffeine increases the release of free fatty acids during exercise causing muscles to use fat as an energy source, thus sparing muscle glycogen. However, numerous recent studies have not shown a glycogen sparing effect during exercise following administration of caffeine. Additionally several researchers found that caffeine enhances performance under conditions of intense, short-term exercise when glycogen is not limiting. Therefore, other mechanisms besides glycogen sparing must contribute to performance enhancement.

Caffeine blocks the actions of adenosine in the body by binding to adenosine receptors causing an increase in free fatty acid levels, heart rate, and blood pressure. Jackman et al. proposes that caffeine affects the muscle itself via its actions on adenosine receptors. At the point where the nerve enters the muscle, acetylcholine is released to stimulate muscle contraction. At the same time, adenosine binds to specific receptors to inhibit further muscle contractions. When caffeine binds to the receptor instead of adenosine, muscle contraction is allowed to continue without inhibition.

Caffeine also accentuates the increase in epinephrine release during exercise. In a recent study, Laurent et al. hypothesized that caffeine causes extra beta-endorphin and epinephrine to be released during exercise, which may explain the decreased pain perception and delayed fatigue associated with caffeine.

While the actual mechanisms of caffeine action remain unclear, it is likely that several interacting direct and indirect physiological mechanisms are responsible for the effects of caffeine on performance enhancement.

Effects of Caffeine

Caffeine acts as a diuretic, increasing fluid, and electrolyte loss from the body. Since athletes require extra fluid during exercise, it seems counteractive to encourage caffeine consumption prior to and during exertion. Studies have shown, however, that while caffeine acts as a diuretic at rest, during exercise caffeine does not increase urinary fluid volume.

Because it is a central nervous system stimulant, caffeine can cause insomnia and sleep fragmentation. Additionally, the stimulant effect of caffeine can increase an athlete’s perceived energy level, but can also increase precompetition anxiety. Caffeine increases heart rate and blood pressure. Many athletes have experienced sudden fatigue at a point during an endurance activity when the majority of the caffeine dose has been catabolized. The delay in fatigue and perceived minimal energy expenditure induced by caffeine are suddenly gone and immediately the athlete feels exhausted.

It is possible to develop a tolerance to caffeine. This results in an up-regulation of adenosine receptors and a subsequent decrease in the effects of caffeine on performance. Caffeine dependency is a related concern. Dependency is characterized by a continuous craving for caffeine and a constant desire to increase the dose to get the desired effect. Caffeine withdrawal is accompanied by headache, irritability, anxiety, drowsiness, and fatigue. In moderate doses caffeine does not pose a major health risk to athletes; however, the above side effects of caffeine can work together to inhibit optimum performance.

Effectiveness of Caffeine from Various Sources

The main sources of caffeine in the American diet are coffee, tea, and soft drinks. Beverage manufacturers are developing drinks containing a combination of carbohydrates, electrolytes, and caffeine, and marketing them as energy drinks.

Several studies suggest that the addition of caffeine to a carbohydrate solution and to a carbohydrate electrolyte solution may be more beneficial to performance than carbohydrate or carbohydrate electrolyte solutions alone. According to a study performed by Kovacs and colleagues, the combination of caffeine and carbohydrate electrolyte solution enhanced performance of a set amount of cycling work more than the carbohydrate electrolyte solution alone. Studies comparing caffeine to caffeinated coffee are inconclusive. It appears that caffeine in a supplemental form is a better ergogenic aid than caffeinated coffee.

Responsibility of the Nutrition Professional

The American Dietetic Association urges nutrition professionals to evaluate the scientific validity of ergogenic claims, to evaluate the quality of research supporting the use of the ergogenic aids and to evaluate the safety and legality of ergogenic aids. What should we as nutrition professionals tell clients about using caffeine use to enhance athletic performance? Stephens adapted the mnemonic SOLE (Safety, outcomes, legal, ethical) to assist physicians in counseling patients about safety and appropriate use of ergogenic aids. We can use this to explore the appropriateness of caffeine supplementation.

Is it Safe? Numerous well-controlled caffeine supplementation studies have been carried out with some negative, but not life-threatening effects.

What is the Outcome? A mass of scientific research backs up the claim that caffeine enhances athletic performance.

Is it Legal? The International Olympic Committee (IOC) has banned the use of caffeine that results in a urine concentration of >12 mg/mL. Caffeine begins to exert ergogenic effects at a dose of 3 mg/kg, but does not exceed the IOC limit until the dose is upwards of 9 mg/kg. Six mg/kg caffeine is similar to two to three cups of drip brewed coffee.

Is it Ethical? Taking caffeine for the express purpose of increasing performance violates the Olympic Movement Anti-doping Code, which states that “the use of a physiological substance taken in abnormal quantity...with the intention of increasing [performance] in an artificial and unfair manner is to be regarded as doping.” According to the IOC, doping is “the use of an expedient (substance or method), which is potentially harmful to athletes’ health and/or capable of enhancing their performance, or the presence in the athlete’s body of a Prohibited Substance…”

Take Home Message

Though there is plenty of credible scientific evidence to support the ergogenic claims of caffeine and its risks are generally minor, a balanced diet, appropriate hydration, and proper training are the best recipe for athletic success. The slight edge given to athletes by caffeine use cannot make up for skill and adequate preparation for competition. Though it is easy to consume enough caffeine to enhance athletic performance, nutrition professionals should not encourage athletes to consume caffeine for its performance enhancement quality.

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One popular mixture of herbs for their combined thermogenic effects is *Ephedra*, caffeine (oftentimes from guarana), and white willow bark (*Salix alba*). White willow bark is the herbal source of aspirin and has been reported to potentiate the thermogenic effects of ephedrine (E) and caffeine (C). Many athletes oftentimes refer to this combination as the “stack”. To the present authors’ knowledge, however, there have been no published studies, to date, examining the combined thermogenic effects of ephedra, guarana, and white willow bark. Horton and Geissler studied the post-prandial thermogenesis of E (30 mg), C (100 mg) and aspirin (300 mg) in lean (n=10), pre-disposed obese (n=10) and obese (n=10) women. Subjects either received a 1050 kJ liquid meal; meal (M) plus E and C; or M plus E, C, and aspirin. It was concluded that aspirin did not potentiate the acute thermic effect of E, C, or E plus C when taken along with a meal. In contrast, other researchers have reported that aspirin (note–not white willow bark) did promote the thermogenic action of either E plus C combinations, or E alone. The mechanism of action of the three herb combination is still unclear. Dulloo, et al. have theorized that both E and C stimulate the sympathetic nervous system by promoting norepinephrine (NE) release from the sympathetic nerve terminals. Prostaglandins (PG) and adenosine, released from the synapses of these nerve terminals, are potential inhibitory modulators that may produce a negative feedback on NE release. Aspirin, by interfering with PG synthesis, and caffeine, by blocking the adenosine receptor, may remove this potential inhibitory modification and therefore potentiate ephedrine’s action.

**Yohimbe (Pausinystalia yohimbe, Corynanthe yohimbe)**

Yohimbe is a tall evergreen indigenous to West Africa. Yohimbe bark contains up to 6% total indole alkaloids, of which yohimbine is the most prevalent. Yohimbine, not yohimbe, is an approved drug by the Food & Drug Administration for the treatment of male erectile dysfunction. Some supplement manufacturers claim that yohimbe can increase libido, energy, and testosterone levels. However, to date, there are no independent reports evaluating the efficacy of yohimbe on exercise performance. In fact, pharmacokinetic studies have largely examined the efficacy and safety of yohimbine and not yohimbe.

Yohimbe is believed to selectively inhibit alpha-2 adrenergic receptors, thereby increasing the activity of the Sympathetic Nervous System and the neurotransmitter, NE. NE concentrations are also increased due to yohimbe’s ability to act as a monoamine oxidase (MAO) inhibitor, and taking MAO inhibitors concomitantly with yohimbe supplements containing high levels of yohimbine may potentiate the toxicity of yohimbine. Side effects from yohimbe and yohimbine intake have included headache, anxiety, nausea, dizziness, insomnia, excessive sweating, increased frequency of urination, heart palpitations, increased blood pressure and hallucinations. Betz et al determined the quantities of yohimbine and other alkaloids in authentic yohimbe bark and in 26 commercial products containing yohimbe extract by using gas chromatographic/mass spectrometric techniques. Compared to authentic yohimbe bark (where yohimbine alkaloid was found in concentrations up to 7089 ppm), the commercial products contained anywhere from <0.1 to 489 ppm. Furthermore, of the 26 products analyzed, nine were found to contain “no quantitatable” yohimbine, and eight only contained trace amounts (0.1–1 ppm). No other alkaloids were found in the 26 commercial products. Absence of alkaloids in these products may have been due to the fact that the original extraction was aqueous (the alkaloids are largely lipid soluble), the extract was extremely diluted, or no yohimbe bark was used to prepare the product. According to Betz, et al., the low concentrations of yohimbine alkaloids found in the products examined in this study would likely pose little health risk to the consumer, especially if the products were used in accordance to the directions on the label.

**Trifolius (Trifolius terrestris)**

Trifolius has been purported to increase plasma testosterone concentrations and promote skeletal muscle hypertrophy. The effects of *Trifolius* (3.21 mg/kg/d of body weight/d) versus placebo on body composition and exercise performance in resistant-trained males (n=15) were studied. Body weight, body composition, maximal strength, dietary intake, and mood states were assessed pre- and post-eight weeks of exercise (periodized resistant training) and supplementation (*Trifolius* versus placebo). The researchers did not find any changes in subjects’ body weight, percentage of body fat, total body water, dietary intake, or mood status. Maximal number of repetitions at 100-200% body weight for the placebo group for both the bench press and leg press exercises (p<0.05) increased. The *Trifolius* group experienced an increase in leg press strength only (p<0.05).

**Take Home Message**

Athletes, whether aerobically or anaerobically trained, are often times looking for that competitive edge. There are several herbs that have been touted as or utilized as ergogenic aids. The safety and efficacy of these herbs, or combination of herbs, continues to be unsubstantiated. Lack of (continued from page 40)

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**References:**

Carnitine, Sodium Bicarbonate, and Glycerol to Enhance Exercise Performance?
Karen Raden, MS

Introduction
Many supplements are on the markets today that are touted as exercise performance enhancers. Whether or not this is valid is still unknown. Following is a review of the supplements carnitine, sodium bicarbonate, and glycerol.

Carnitine
The concept of increasing utilization of fat as an energy source has long been seen as the panacea that athletes have been searching for. If athletes can better rely on their fat stores for energy, the resulting benefits could be lower body fat percentages as well as prolonged athletic performance before burn out. Carnitine is an accessory nutrient that is required for the shuttling of long chain fatty acids into the mitochondrion for aerobic energy production. It is synthesized de novo in the liver and kidneys and can also be supplied through the diet. Carnitine is found naturally in the highest quantities among foods from animal origins, meat and dairy, and at the lowest amounts in foods from plant origins.1,2 Concentration of carnitine is primarily in the muscle, with ample quantities found in the heart. Biosynthesis occurs from the essential amino acid lysine and requires S-adenosylmethionine (SAMe), niacin, iron, and vitamin C as cofactors. Exercise has been shown to deplete muscle carnitine significantly.

Carnitine has a critical function in the supply of energy to the muscle by controlling the quantities of fatty acids shuttled into the mitochondria where energy is produced aerobically. The mitochondria is where aerobic energy and ATP are formed via beta-oxidation and the Kreb cycle. Simply put, carnitine has the role of carrying fatty acids into the mitochondrion for the production of aerobic energy (ATP).3 The theory supporting carnitine supplementation for enhancing exercise performance is that, with additional carnitine available, more fatty acids may enter the mitochondrion and be utilized to create greater amounts of energy, thus driving the Kreb cycle.4 Because of an increased source of carnitine through supplementation, it is proposed that there would be an increase in fatty acid oxidation for energy, and thus a glycogen sparing effect.5

Investigators have utilized varying levels of L-carnitine dosages in their research design, which makes it difficult to form comparisons. One to eight grams of L-carnitine per day have been routinely administered in various studies with uncertain levels of success. This is a considerable amount of supplementation that is costly and may not produce favorable outcomes. In addition, bioavailability of L-carnitine via oral supplementation has been found to be as low as 5-15%, with excesses eliminated through urine.6 No known toxicities have been reported when using L-carnitine. However at levels of 15 g/day, a fishy odor on the breath or diarrhea was noted in some individuals.7

The verdict is still out concerning L-carnitine’s ability to enhance exercise performance. It appears that carnitine stores and availability in the body prior to exercise may be related to whether or not there is a beneficial role from oral supplementation. In carnitine deficient individuals, research indicates that supplementation with this nutrient prior to exercise may produce some benefits of enhanced athletic performance. In one study, seven carnitine deficient marathon runners had an increase in peak treadmill running speed of 5.68% after being supplemented with carnitine.8 In contrast, individuals with adequate carnitine stores prior to exercise did not show the same benefits making the generalizations of the previous study rather limited.9 Also, it appears that carnitine supplementation may have a greater effect during long duration, lower intensity aerobic exercise versus high intensity, short duration anaerobic exercise due to greater fat utilization.10

Whether or not exercise performance is enhanced by L-carnitine supplementation has not been conclusively decided at this point via research. Prolonged exercise at a lower intensity in carnitine depleted individuals appears to be the best usage for this supplement. It should be noted that supplementation might be the optimal way to increase carnitine stores in deficient individuals rather than increase consumption of high carnitine foods (red meat) due to their saturated fat and cholesterol content. If one is to supplement with this nutrient, L-carnitine, the active form, should always be chosen over the potentially toxic D form. The L form may also be found bound to either acetic or propionic acid.11

Sodium Bicarbonate
Another supplement that is thought to enhance exercise performance is sodium bicarbonate. Short-term strenuous exercise often leads to the build up of lactic acid, which manifests as a burning sensation in the muscle and ultimately, fatigue and exercise cessation. Sodium bicarbonate supplementation has been thought to reduce the signs and symptoms of fatigue by offsetting lactic acidosis in favor of alkalosis.12 During short term, high intensity strenuous exercise, fatigue and exhaustion are but a few of the limiting factors that may decrease exercise performance. Lactic acid is a recognized byproduct of anaerobic metabolism (glycolysis) that causes pain and fatigue when reaching near maximum heart rate.13 One key component of fatigue and decreased exercise performance is the presence of intracellular acidosis. With strenuous exercise, lactate accumulates in the muscle and a decrease in pH occurs in both the blood and muscle resulting in acidosis. This condition leads to an increase in hydrogen ion concentration intracellularly in addition to decreased glycolytic enzyme activity that may impair exercise performance. As exercise continues, endogenous buffering mechanisms, including sodium bicarbonate, act to neutralize this effect. Eventually, the intracellular buffering capacity cannot compensate for the increasing acidosis and lactic acid accumulates while glycolysis is inhibited. In human studies, ingestion of sodium bicarbonate has been shown to reverse signs and symptoms of acidosis while creating a more alkaline environment.

Convincing research has shown that ingestion of at least 300 mg/kg is the appropriate dosage to help decrease muscle fatigue and enhance exercise recovery. Ingestion of this quantity resulted in increased quadriceps torques in isometric contractions in bicycle riders.13 In those studies that have shown no effects from sodium bicarbonate supplementation it should be noted that timing of ingestion was most likely the limiting factor. Appropriate time for ingestion of sodium bicarbonate prior to a sporting event is necessary to achieve alkalosis. Supplementation between 100-120 minutes prior to exercise has been shown to prolong high intensity exercise with a duration ranging between 60 seconds and seven minutes.14-16

Sodium bicarbonate to enhance exercise performance is sodium bicarbonate. It is recommended to ingest sodium bicarbonate prior to a sporting event is necessary to achieve alkalosis. Supplementation between 100-120 minutes prior to exercise has been shown to prolong high intensity exercise with a duration ranging between 60 seconds and seven minutes.14-16

The practicality of ingesting the quantity of sodium bicarbonate necessary to provide the alkalizing effects should be mentioned. In an average 63 kg woman, 19 g of sodium bicarbonate would need to be ingested (300 mg/kg). This equates to almost five teaspoons of sodium bicarbonate. Consumption of this quantity may create nausea, diarrhea, and vomiting. Recent research utilizing sodium citrate as a buffering agent is indicating potentially fewer gastrointestinal side effects. It is worth mentioning that if an individual has hypertension or is watching their sodium intake, this supplement may not be recommended. Five teaspoons of sodium bicarbonate would provide 4105 mg of sodium (821 mg sodium per teaspoon). In conclusion, ingestion of sodium bicarbonate has shown some beneficial effects in reducing lactic acid build-up for short term, strenuous exercise. However, this is not a supplement that is recommended for sodium sensitive individuals.
Glycerol

Dehydration is a serious condition that many endurance athletes will encounter when they exercise heavily for extended periods of time with a limited water supply. This condition may be exacerbated with excessive sweating and increased environmental temperatures. Dehydration defined simply is when fluid loss exceeds intake. As little as 1% loss of body weight caused by dehydration has been shown to reduce work capacity. Dehydration has been reported to impair overall physical fitness, reduce tolerance for acceleration, increase body temperature, increase heart rate, decrease blood flow to the skin, and decrease sweat rate. Attempts to hyperhydrate through the use of excessive fluid consumption alone have had limited success. Not only will this cause mild discomfort to consume large quantities of water at a given time, but also the kidneys will compensate with the diuretic response of increased urination.

Glycerol as an ergogenic aid to stave off dehydration has been researched in recent years. Glycerol is a natural metabolite that is rapidly absorbed from the gastrointestinal tract. It has been deemed safe by the FDA and can be found on the GRAS list. The majority of studies looking at glycerol ingestion have utilized 1g/kg body weight of glycerol in conjunction with approximately two liters of water as their study dosage protocol.

Overwhelmingly, the complexity of this issue has been demonstrated. Timing of hyperhydration prior to exercise, environmental temperature, and hydration status prior to commencement of exercise are but a few of the confounding variables reflected in numerous studies. Several researchers have looked at hyperhydration status in resting, climate controlled environments. In a study by Riedesel et al., sedentary subjects consumed either a placebo fluid solution or fluid glycerol mixture at 0.5, 1.0, and 1.5 g/kg body weight over a four hour time period. In the 1.0 and 1.5 g/kg glycerol groups, statistical significance was found in reducing urine volume during the second and third hour after glycerol ingestion, indicative of water retention. In a similar study, sedentary individuals ingested 1 g/kg of glycerol over a 49-hour time frame with a resulting difference and retention in urine volume of 700 ml in the glycerol group versus placebo. Researchers indicate that these results may be reflective of increased intracellular water. In both of these studies, exercise was not taken into account, which limits application to sports performance.

In a study looking at exercise performance conducted by Hitchins, competitive cyclists underwent hyperhydration 2.5 hours prior to exercise with glycerol versus a control of water (1g/kg). Results indicated a 600 ml increase in total body water prior to exercise with the glycerol group. In addition, statistical significance was found in the glycerol group with a 2.4% greater work performance over the placebo group. No statistically significant differences were found in rectal temperature, sweat rate, or cardiac frequency between the groups.

Glycerol as an agent to promote hyperhydration can be done effectively. However, whether or not it will enhance exercise performance is dependent on various factors. Studies have shown that approximately three hours prior to exercise, glycerol-induced hyperhydration may allow for greater water body volume at onset of exercise, approximately 600 ml, over individuals using water for hyperhydration. However, in controlled studies, researchers have found that if euhydration is maintained throughout exercise via ample water consumption, no significant benefits have been found from the induction of hyperhydration prior to exercise, either with water or glycerol. In conclusion, if continual fluid intake during prolonged exercise sessions is a concern, then glycerol hyperhydration three hours prior to exercise may have the added benefit of delaying dehydration and thus may improve athletic performance.

Take Home Message

Supplementation may be an effective way to help increase exercise performance when used properly and at the appropriate dosage levels. Controversy remains, however, with regard to carnitine-deficiency appears to be the main reason to supplement with this nutrient if aerobic exercise is to be performed. As for fat loss, although in theory it appears that supplementation would provide beneficial results, research does not support this mechanism action. Promising evidence suggests that sodium bicarbonate may produce positive effects in its ability to create a more alkaline environment in the body. Symptom reduction related to acidosis during short term, strenuous exercise has been shown. Sodium sensitive individuals should be wary, however. Lastly, it has been demonstrated that hyperhydration with glycerol can provide greater body water stores over hyperhydration through water consumption alone. This may be beneficial to stave off dehydration during the course of extended exercise. It should be noted that hyperhydration techniques should not be used in lieu of proper hydration throughout exercise but seen as a way to maximize adequate water stores.

Karen Raden received a MS in nutrition from Bastyr University. Currently, she is completing Loyola University-Chicago’s dietetic internship to become a registered dietitian. Contact Karen at 916 Judson unit # 3, Evanston, Illinois 60202 or 847-733-0529

References:

An Interview with Kim Dalzell, PhD, RD, CNS
Robyn Cotler

Kim Dalzell, PhD, RD, CNS, exemplifies the enthusiasm and knowledge necessary for nutrition professionals in private practice to educate and inform patients about complementary nutrition therapies. Kim is an NCC member who became interested in helping cancer patients beyond the traditional hospital support. Frustrated with basic nutrition support, Kim decided to take the extra step. Writing Challenge Cancer and Win! helped Kim provide the extra step often needed in nutritional therapy of the cancer patient. Kim’s following interview presents insight into her vision and journey of incorporating adjuvant nutritional therapy.

How did you become interested in complementary care?

Perhaps others can relate to my story of professional frustration. I had been an oncology nutritionist for five years and one day I said to myself, there has to be more I can do to help these patients. Inherently, I knew that pushing a diet high in sugar and fat to maintain calorie intake was not the answer to cancer recovery, but at that point I didn’t have any alternative suggestions to give my patients. That mental turning point led to my interest in complementary and alternative medicine, and I began to slowly integrate adjuvant nutritional therapies into my practice. A fortunate set of circumstances landed me in a job as a clinical oncology nutritionist for Cancer Treatment Centers of America, a national cancer treatment organization that embraces integrated patient care. Working in an organization of like-minded individuals who are open to the possibility that natural healing modalities can be beneficial to patients has made all the difference in my professional growth as a complementary care nutritionist.

What do you see as the biggest challenge in the field of complementary care?

I like how you put that question. Challenge . . . not obstacle. I believe that developing a can-do attitude about changing your career focus (from conventional dietetics to complementary care nutritional therapy) is the foremost challenge dietitians face. I remember opening my first Journal of Natural Medicine and thinking about how much I needed to learn and wondering if I had what it took to commit to this growing, but somewhat uncharted health care field. It takes a tremendous amount of time and commitment to reeducate and open yourself up to the vast healing potential of natural medicine. But once this commitment is made, and you see for yourself how you can significantly help someone who is unwell, continuing your efforts to expand your knowledge base becomes a moral imperative.

How do you work with the challenges?

An attitude about anything can change, if given an impetus and a rationale. My impetus was simple; I became interested in CAM because I wanted another way (or maybe just an effective way!) to help my patients. The rationale came more slowly as I read evidence-based information and collaborated with professionals in the CAM field. I believe that nutrition professionals must ascertain from the literature itself, as well as from historical and patient perspectives, the validity of various nutritional therapies in an effort to achieve a balanced view of treatments. At times I find myself foregoing traditional scientific canon in favor of clinical observation. Just because we don’t have overwhelming scientific proof do not mean we should automatically discount the possibility of some treatment, provided we know it’s safe.

You recently completed a book, Challenge Cancer and Win! What motivated you to write it?

There are many kinds of cancer and battling them nutritionally is not a one-size-fits-all solution. Oncology patients want reliable, safe, practical and evidence-based information and they need help putting it all together. I wrote Challenge Cancer and Win!, a book that provides nutrition action plans specific to sixteen different cancers, so that patients can most effectively fight their disease. I’ve also included natural therapies for gastrointestinal tract symptoms and dosage and safety information about vitamins and other natural supplements used in cancer care. This book provides self-assessment tools and lifestyle strategies to encourage cancer patients to become proactive participants in their cancer treatment and recovery.

What did you learn from writing the book?

You might laugh at my response . . . I learned that just when I thought it couldn’t get any harder, it always did! Writing Challenge Cancer and Win! took me two years. Besides learning how to more effectively manage my time, I learned a great deal about the step-by-step publication process, from sending out query letters, to drafting book proposals, to coordinating with editors, text layout designers and graphic artists. I read five books on publishing and writing before I ever began to write my book! I chose to be involved at every step, because I had a very clear vision for my book. As I look back, I am convinced that my can-do attitude helped get me past the rough times and persevere. Challenge Cancer and Win! has been out three months now, and I have already received innumerable, unsolicited comments from cancer patients about how helpful it is. This makes me feel that my time and energy have been well spent.

How do you incorporate the information learned from writing the book into clinical practice?

I’m always striving to find new and exciting ways to present nutritional research findings in a practical, exciting way so that I can motivate others to change their eating habits for the better. During my research phase, I was exposed to many new publications that helped round out my knowledge base. I believe my patients have benefited from my time spent reading about Chinese and botanical medicine and psychoneuroimmunology. I think that I’ve demonstrated how empowering education can be and that it is the obvious action that will take a can-do attitude from concept to fruition.

Challenge Cancer and Win! is available exclusively through BookMasters, 1-800-247-6553.

Robyn Cotler, MS, RD Associate NCC Newsletter Editor, is in private practice in Long Island, New York specializing in oncology, consults with and speaks to local companies and schools. Contact Robyn at racotler@yahoo.com or (516) 496-9496.

NCC Help Wanted:
Workload Varies and Rewards are Great...

The nominating committee is starting to look for members interested in becoming more involved with the dynamic NCC leadership team. Elected positions for the next year, 2003-2004, include NCC chair-elect (three year commitment), secretary (two year commitment) and nominating committee, which includes a chair elect (two year commitment) and a committee member (one year commitment). Most of these individuals will be asked to attend FNCE and a mid-year meeting to work on NCC strategic initiatives and projects.

Additional opportunities to volunteer exist that involve a variety of topic areas and time commitments. Please contact Kathryn Hamilton at 201-825-4485 or kathryn.k.hamilton@verizon.net, or Rita Batheja at 516-868-0605 if you are interested in learning more.
Herbs…

(continued from page 42)

empirical data for both the safety and efficacy of these herbs warrants further research. Dietetic professionals need to be aware of the physiological effects of ergogenic herbas, the combined effects of herbas with other substances (such as herb-herb interactions), the herb-drug interactions, and the safety of these products. More specifically, during the interview process, dietetic professionals should obtain information from their clients regarding the products consumed, the concentrations of the botanicals, active constituents and added excipients, answer specific questions regarding dosing practices or stacking practices, and compare these dosages to existing studies addressing efficacy and safety.

Laura Frank, PhD, RD is director of research at the American Institute for Biosocial and Medical Research (AIBMR). She is former faculty at Bastyr University, and former supervisor at the Bastyr Natural Health Clinic as a nutrition consultant. Laura can be reached at AIBMR at 4117 S. Meridian, Puyallup, WA 98373.

Janine Baer, PhD, RD is an Associate Professor of Nutrition in the Dept. of Health and Sports Science at the University of Dayton, Ohio, where she teaches Nutrition for Health and Sport Performance and Alternative and Complementary Nutrition Practices. Contact Janine at 937-229-2157, FAX 937-229-4244 or email: Janine.Baer@notes.udayton.edu.

References:

Sports Nutrition Resources

Following are some resources that provide credible sports nutrition information.

WEBSITES:
www.nutrifit.org Sports, Cardiovascular, and Wellness Nutritionists, a Dietetic Practice Group of the American Dietetic Association.

BOOKS:

Compiled by Rene’ Norman who is in private practice with Nutrition Consultants of Tulsa. Contact Rene’ at RntheRD@hotmail.com or 918-749-9077.
Resources Review...

Challenge Cancer and Win! • Kim Dalzell, PhD, RD. Round Lake, IL 60073, email nutriquest@att.net; NutriQuest Press, 2002, Softcover; $22.95; ISBN 0-9712-5887-3.

Challenge Cancer and Win! is a no nonsense and innovative approach to nutrition therapy that answers the question, “what can I do nutritionally to fight my kind of cancer?” Section one of the book begins with easy to understand information about cancer and how healthy cells become cancerous. Readers are asked if they are doing everything to beat their cancer and then provided six steps to success, which are detailed in the chapter entitled, “Strategies for Success.”

One of the major problems in patients with cancer is malnutrition. Readers are encouraged to evaluate their diet to determine the steps they can take to improve their food intake. The digestive track is explored and ideas are given for improving digestion, reducing reflux, and treating the GI tract that has been exposed to antibiotics that destroy beneficial bacteria.

In section two, “Get Set”, the author reviews some basic concepts of nutrition in the chapter entitled “Nutrition 101,” including major nutrients. Chapters on hot topics such as soy, fat, fiber, sugar, plant-based diets and dietary supplements are included with information on myths and realities about their use. The last chapter in this section, “Cooling Off”, addresses environmental concerns such as contaminants, toxins, food safety, additives and pollutants that may be carcinogenic. Included are ideas for detoxifying the body safely by gradually eliminating and/or reducing foods in the diet that are highly processed and refined to those that are more whole or natural. Rather than a fad diet that advocates eliminating food groups, this plan provides an easy-to-follow chart that outlines “Dietary Hurdles For Eating Well.”

Section Three “Go!” provides step-by-step nutrition action plans for specific cancers. Included in these steps are quick reference guides for eating right, meal plans, food selection guides, and information about what dietary supplements may be helpful in the conditions. Although readers are told they should consult their health care provider about supplement use, this may not always happen. Therefore, some interaction and/or adverse reaction information would be helpful when discussing supplements.

The appendices provide important information about laboratory tests, diets for special conditions, calorie and protein requirements, and commonly associated chemotherapy side effects.

This book provides an easy-to-read resource for cancer patients and nutrition professionals who counsel them.

Reviewed by Sarah Harding Laidlaw, MS, RD, MPA. Contact Sarah at newsletter@ComplementaryNutrition.org or 970-241-5529.


Eat, Drink, and Be Healthy is intended to educate the public with evidence-based guidelines for healthy eating, which has resulted from several decades of nutrition research data.

Dr. Walter Willett holds a degree in food science, is an MD, and completed his public health doctorate at Harvard School of Public Health where he has been a professor of epidemiology and nutrition and is the current department chair. He also teaches at Harvard Medical School. Willett has authored over 650 articles focusing on lifestyle risk factors for heart disease and cancer. He wrote the textbook, Nutritional Epidemiology, 2nd edition.

In Eat, Drink and Be Healthy, Willett makes a good case against the USDA Food Guide Pyramid, charging, “At best, the USDA Pyramid offers wishy-washy, scientifically unfounded advice on an absolutely vital topic – what to eat.” Willett states that the problem with the USDA pyramid is that “it ignores the evidence that has been carefully assembled over the past forty years” by giving the impression that all fats are bad, all complex carbohydrates are good, protein is protein, dairy products are essential, and provides no guidance on weight, exercise, alcohol, and vitamins.

Willett offers his own Healthy Eating Pyramid, which specifies whole grain foods instead of bread, cereal, rice and pasta; moves plant oils to the base of the pyramid; puts nuts and legumes into their own section; relegates red meat, butter, and high glycemic index carbohydrates to the tip of the pyramid; reorders what is left of the protein section to fish, poultry, eggs; and suggests a calcium supplement or one to two servings of dairy. Additionally, his pyramid suggests multiple vitamins for most people and alcohol in moderation unless contraindicated. Willett devotes a chapter of information to support each section of his Healthy Eating Pyramid.

Willett’s Healthy Eating Pyramid can be viewed at http://www.hsph.harvard.edu/now/aug24/.

In the chapter on “Healthy Weight”, Willett recommends; “if your weight is in the ‘healthy’ range, keep it there. If you are overweight, do your best to avoid adding any more pounds and lose some if you can.” However, he also makes it clear that excess weight is a real health risk by referring to the American Cancer Society’s mega study of over 300,000 adults, which found a dose-response relationship between BMI and death rates.

No book on diet is complete without recipes; thus Willett ends with 88 pages of recipes and menus, which were created with the assistance of food writer, Maureen Callahan, RD.

Dr. Willett writes with a wonderful sense of humor, but doesn’t mince words, while bravely challenging the status quo. Willett’s recommendations are sure to upset some major food manufacturers as well as the meat and dairy industries although there’s little to surprise professionals that stay abreast of the research in nutritional epidemiology.

Reviewed by Dorene Robinson, RD, director of Nutrition and Health Education for Beyond Fitness. An NCC founding member and author, she is a graduate student in nutrition at Bastyr University. Contact Dorene at 800-574-4400 or by e-mail to beyondfitRD@yahoo.com.


Stop Your Cravings provides a different approach to non-diet weight loss and weight management. Using the basic principles of the ancient Eastern healing philosophy of Ayurveda accompanied by the best of cutting edge Western medicine and sports nutrition, the author offers the reader a customized program for weight loss and optimum health. The book endeavors to help readers restore the natural balance to their body and help fight fatigue, gastrointestinal complaints, weight gain, premenstrual, and menopausal symptoms.

The Ayurvedic principles are discussed in detail in terms that help the reader understand their importance to daily life. The principles help in the battle against obesity, poor health, and chronic dieting. They are: the theory of the five elements; the theory of the three constitutional types; the theory of the six tastes; and the theory of the six qualities of food. A self-test to determine constitutional type sets the stage for understanding why the body craves particular foods and how to stop cravings by eating foods that fuel that type healthfully. Certain foods, including commonly known herbs and spices, can have a favorable effect on weight loss, digestion, and over-all health.

A chapter on protein, fats, and nongluten carbohydrates provides a basic understanding of how quality food choices are important to health. Fats and protein are not avoided, but healthy choices are emphasized. Balance is the key and the author emphasizes that no (continued on page 50)
reported that the CHO, protein, and fat content stated on the labels did not match what was actually found within the bar. The major labeling problems encountered were that CHO, sugar and sodium levels were understated. The products most likely to under report CHO were the high protein, low CHO bars with one bar containing 10 times the amount of CHO stated on the label. The study has been criticized by the manufacturers because of the small sample size, but the variance from values stated on the labels were larger than acceptable batch to batch deviations.

Evaluating Performance Claims

Most of the sports bar labels contain claims for functions as performance enhancers. Under DSHEA, the manufacturer is responsible for interpretation of the scientific literature to evaluate the safety and effectiveness of the product. When the manufacturer reports a structure/function claim to FDA, it is not required to document the evidence. However, FDA does deny structure/function statements on a regular basis. Under these circumstances the nutrition professional would be well advised to evaluate the effectiveness of the claims before recommending the product. Performance claims can be evaluated using the following general criteria; first, there should be a biochemical or physiological mechanism that provides the rationale for the claim; second, the claim must be supported by scientific research.

To evaluate the research study design, ask the following questions:

1) Is the study a randomly assigned, double blind, placebo controlled trial? A cross-over design can help to minimize variance but is not absolutely essential to a quality study.

2) Is the study population appropriate (gender, training level, age)? A study conducted in young elite athletes may not yield the same results in middle aged individuals engaged in recreational activities.

3) Is the effect physiologically relevant? Although the difference between winning a gold and silver medal in the Olympics may be hundredths of a second, this would make little difference to the average athlete.

4) Did the study use an appropriate number of subjects? Since individual variation is large and the effects are usually small, the study needs to use a large enough number of subjects to achieve the statistical power to detect a significant difference.

5) Is the exercise and diet protocol appropriate? Is the study a field trial or a laboratory protocol? If a laboratory protocol, is there a familiarization trial? Is the intensity and duration appropriate to test the desired effect? For example, if carbohydrate is claimed to improve endurance performance, is the exercise protocol at least 60 minutes long?

6) Are there biochemical or metabolic measurements to explain the mechanism for the effect?

Even if the experimental design meets all these criteria, it would be unwise to base recommendations on the results of a single study. The results must be confirmed in subsequent reports. This, unfortunately, is not the case with most performance studies. Most tests of nutritional ergogenic aids yield mixed results. A multitude of problems inherent in performance studies, such as small sample size, differences in exercise and feeding protocols, and differences in response measures, make comparisons difficult.

Performance Claims Generally Supported By Scientific Evidence

The provision of CHO before, during, and after exercise at moderate intensity for 60 minutes or more is well documented and generally accepted. A joint position statement on nutrition and athletic performance from the American Dietetic Association and Canadian Dietetic Association recommended a meal providing 4-5 gm CHO/kg body weight, three to four hours before exercise. For a 70 kg athlete this represents 300 gm of CHO and about 1200 calories. This is a substantial amount of food and the use of a sports bar or beverage could be a convenient way to obtain this goal. During exercise of 60 minutes or more, 15-20 gm CHO every 15-20 minutes is recommended. The form that is most convenient is a sports drink with a CHO concentration of 5-10%, which would meet energy and fluid requirements simultaneously. A solid or semi-solid CHO would be acceptable based upon individual preferences but must be consumed with water to prevent GI disturbance from increased osmolarity as well as to meet nutritional and fluid needs.

Performance Claims Not Well Supported By Scientific Evidence

Carbohydrates consumed less than one hour before exercise have been suggested to:
1) enhance performance by topping off liver glycogen stores and maintaining high levels of CHO oxidation or, 2) impair performance by stimulating insulin release which inhibits fatty acid release and increases reliance upon muscle glycogen and hence accelerates muscle glycogen depletion. The form (solid versus liquid) and type of CHO consumed have been the basis of many product claims. In the pre-exercise period, glucose polymer drinks or low glycemic index (GI) foods and digestion resistant starches have been recommended. These recommendations are controversial and not well supported by the scientific evidence.

Solid vs. Liquid

Based upon the theory that, at rest, solid foods are more slowly emptied from the stomach than liquids, solids taken in the pre-
exercise period might provide for sustained release of glucose and a decreased insulin response. Few studies have examined this claim. An early study by Neuf, et al. provided 45 gm CHO as a solid or liquid five minutes before exercise on a cycle ergometer at 77% VO2-max followed by a performance trial. Both solid and liquid supplements improved performance compared to placebo but there were no differences attributable to the form of CHO.

Rauch, et al. examined the effect of a solid bar providing CHO, protein, and fat versus an equal amount of CHO as a glucose polymer beverage during cycling exercise for 5.5 hours followed by a high-intensity performance trial in an open cross-over design. Consumption of the bar impaired performance and decreased CHO oxidation during the high intensity trial.

Glycemic Index (GI)

The principle of glycemic index (GI) has recently been incorporated into the design of some sports bars. The theory is that low GI carbohydrates are more slowly digested and absorbed, which would decrease the blood glucose peak and insulin response in the pre-exercise period. The subject of GI has been recently reviewed by Burke. The trials of GI and performance have produced inconclusive results. The recommendation for athletes to consume low GI foods prior to exercise is based mostly on an early study by Thomas and colleagues who were the first to apply the principle of GI to exercise performance. Consumption of 1g CHO/kg body weight of a low GI food (lentils) versus a high GI food (potatoes) one hour prior to cycling at 66% VO2 max resulted in a longer time to exhaustion following the low GI meal. The proposed mechanism was that the low GI meal increased the availability of endogenous glucose and free fatty acids as substrate and thus spared muscle glycogen, although muscle glycogen was not measured. Later support for this theory was provided by their follow-up study in 1994. Although performance was not measured, delayed oxidation of CHO as substrate was observed in a two hour cycling trial. However, subsequent studies in well trained triathletes and cyclists by Feibraii and colleagues found higher glucose and insulin responses to high GI meals but failed to show any differences in exercise performance.

A similar trial in moderately trained college males in our Colorado State University laboratory examined the effect of a high GI (comflakes) versus a moderate GI (oatmeal) breakfast and failed to show differences in work output during a performance trial after one hour of cycling at 66% VO2-max, although the high GI feeding produced a nadir in blood glucose after 15 minutes of exercise and attenuated the rise in serum free fatty acids. There are several reasons why the utility of the GI is limited in athletes. Well-trained athletes have increased insulin sensitivity that attenuates insulin release in response to blood glucose peaks. Also, exercise inhibits insulin release. Although the synergistic effect of insulin and exercise increases muscle uptake of glucose in early exercise causing a nadir in blood glucose during the first 15 minutes of exercise, the effect is short lived and results in no difference in blood glucose levels at the end of 60 minutes of exercise. In one study, a high GI meal was actually found to maintain higher blood glucose levels during two hours of cycling at 70% VO2-max and higher (respiratory exchange ratio) RER during a subsequent performance trial at 100% VO2-max.

Resistant Starch

Modifications in starch content have been used to formulate sports bars with slow-release glucose that, in theory, would attenuate the blood glucose peak and insulin response, and provide a sustained source of glucose for exercise. Amylose (straight chain) starch is more resistant to digestion compared to amylpectin (branched chain). The proportion of amylose:amylopectin in most dietary starch is 1:4. Waxy maize starch (70% amylose, 30% amylpectin) has a lower GI than conventional starches and has been examined as a pre-exercise CHO. Goodpaster tested high amylose starch versus 100% amylopectin and against glucose plus placebo in 10 competitive male cyclists. When one CHO g/kg was administered 30 minutes prior to exercise for 90 minutes at 66% VO2 max followed by an isokinetic performance trial, higher CHO oxidation and more work output occurred in all CHO treatments compared to placebo but there were no differences among the types of CHO. Although glucose ingestion resulted in the highest rise in blood glucose at rest, there were no differences in blood glucose, insulin, C-peptide or glucagon in response to the type of CHO during exercise.

Application

• A sports bar or sports drink could be of benefit for exercise over 60 minutes. These products may be used as a convenient snack three to four hours before exercise. Choices might be 16 oz of a sports drink (30 g CHO), an energy bar (20-50 g CHO) or one packet of a sports gel (20-30 g CHO). If the pre-exercise snack occurs two to three hours before a liquid form may be preferable since it is more readily digested and absorbed.

• During exercise lasting over 90 minutes, one to two bites of a sports bar every 10-15 minutes plus 4 oz water or one to two packs of gel/hour plus 8 oz of water (not to be taken with a sports drink which would increase osmolality) may be used as a replacement for sports drinks.

• During recovery, sports beverages can contribute to fluid replacement and restoration of muscle glycogen. Studies have shown that CHO consumed in the immediate post-exercise period, when muscle glucose uptake is enhanced, results in a greater repletion of muscle glycogen. Since meals are unlikely to be acceptable following exhaustive exercise, sports bars or CHO repletion drinks may be of real benefit. Bars and liquids have been shown to be equally effective in restoring muscle glycogen levels.

Conclusions

• Sports bars should be used as a supplement and not as a replacement for a well balanced diet.

• Sports bars can be a convenient and cost-effective source of energy and carbohydrate, but special effects beyond these benefits are unlikely.

• Some additives such as caffeine and ephedra may result in illegal blood levels in drug free competitions.

• Individual response must be considered when selecting a sports supplement.

• A sports supplement cannot take the place of practice nor can a sports supplement turn an average athlete into an elite athlete.

Since sports bars are a concentrated source of calories they should not be used as a snack for inactive individuals.

Mary Harris, PhD, RD is Associate Professor of Nutrition and Internship/DPD Director at Colorado State University in Fort Collins, CO. Contact Dr. Harris at: 970-491-7462 or fax at 970-491-7252.

References:
13. Reed MJ, Bronzini, Lee MC, Ivy JL. Muscle glycogen
Resources Review...

(continued from page 11)

food group should be eliminated lest the body will eventually begin craving that food. She also acknowledges that restrictions do not work and if foods do not taste good and are not satisfying, the program will not work. Digestion is an integral part of Ayurvedic principles and is considered the “very root of health”. One chapter is devoted to the discussion of digestion’s importance for overall health. Another chapter explores food sensitivities, blood type, and cultural background as factors in food choices.

Dietary supplements most familiar to Ayurvedic practices are reviewed. Excellent resources for more information on foods, exercise choices, and additional reading are presented in the book and appendices. All of the concepts are pulled together and provide suggested food choices and menus. Recipes from chefs like Rick Bayless and Alice Waters are offered as well as quick and easy recipes that incorporate Ayurvedic principles from cooking schools in the Denver/Boulder, CO area. An aisle-by-aisle guide to making healthy choices in the grocery store helps solve the problem of “What do I need to make healthy meals and snacks?”

Stop Your Cravings provides an innovative and different approach to eliminating the trend of increasing obesity and diseases related to a sedentary lifestyle. It offers an option that is not traditional to the Western trained nutrition professional but is certainly worth considering.

Reviewed by Sarah Harding Laidlaw, MS, RD, MFA. Contact Sarah at newsletter@ComplementaryNutrition.org or 970-241-5529.

Evidence-Based Herbal Medicine.

Evidence-Based Herbal Medicine provides an excellent overview of quality data available from clinical trials on almost 65 herbal medicines. With increased pressures from patients and consumers, it is essential that nutrition professionals become informed about herbal medicines. The purpose of this reference is to provide health care practitioners with credible sources of evidence in the field of herbal medicine. This reference provides important information on the use of herbal medicines and their potential for helping or harming those who use them. It includes an overview of practices in the US, including Ayurvedic, Chinese and Mexican herbs, and clinically tested European products that are marketed here in the US.

Dosing of herbal medicines is discussed in detail in understandable terms for the practitioner. The chemistry of herbal medicines covers the numerous compounds and chemicals that contribute to the herb’s biological activity including antioxidants and phytochemicals. An important chapter reviews the reported versus potential drug-herb interactions providing excellent information for those who counsel patients using herbal medicines. Tables provide general information at a glance. Readers are provided specific information on uses, pharmacology, clinical trials, adverse effects, interactions, cautions, preparations, and doses as well as an extensive bibliography.

Individual herbal evaluations provide a benefit and safety rating as well as information on pharmacology, reported clinical trials, adverse effects, preparations and doses, and a summary evaluation. Aromatherapy and the placebo effect of herbs is reviewed with a compilation of what has been learned from the gathering of information on herbal medicines including reasons for use of herbal medicines and a summarized evaluation of herbal medicine claims. The appendix lists sources for information on medicinal herbs including books, web sites, newsletters and organizations.

Evidence-Based Herbal Medicine is a must for anyone who is practicing complementary nutrition and incorporating the use of herbal medicines in their practice or those who are considering it. It is valuable for those who have patients or consumers who are interested in more information on using herbal medicine for health promotion and disease prevention and treatment. This book is well timed with an indispensable offering of information passed down from generation to generation in the oral tradition as well as providing evidence-based practice to the field.

Announcing … NCC Executive Committee 2002-2003

Chair: Rosalyn Franta Kulik
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CPE Activity...

Nutritional Supplements for Athletes – Quiz

Katharine K. Grunewald, PhD, RD

INSTRUCTIONS: The Nutritional Supplements for Athletes Web site (http://www.cznet.ksu.edu/nutrition/supplements.htm) provides links to over 700 scientific articles and abstracts for 24 different categories of supplements. The questions below are taken from seven articles selected to represent supplements that are timely and of current interest. To answer the questions first go to the supplement category, and then find the author/article from the list. You will need to correct three out of 30 in order to pass at 70%.

A. Creatine

Questions 1-5 taken from the following article: Juhn MS. Oral creatine supplementation: Separating fact from hype. The Physician and Sportsmedicine. 1999;27(5).

1. Creatine supplementation is postulated to be ergogenic for all the following reasons EXCEPT:
a) promote higher phosphocreatine concentrations in skeletal muscle
b) enhanced muscle accretion or development
b) reduced urinary excretion of its metabolite

d) enhanced phosphocreatine resynthesis during recovery after exercise

2. Typically creatine supplementation involves an initial “loading” dose of 20g/day for several days followed by smaller maintenance doses. However Hultman, et al (J Appl Physiol 81:232-237, 1996) found that without the initial loading period, ___ g/day for 28 days resulted in muscle creatine concentrations similar to five days of loading.
a) 3
b) 5
c) 10

3. If creatine supplementation is discontinued, how long does it take muscle concentrations of creatine and phosphocreatine to return to normal?
a) 1 week
b) 1 month
c) 3 months
d) 6 months

4. Ergogenic effects of creatine supplementation are most strongly supported for which type of activity?
a) single bout of running/sprinting
b) repeated bouts of cycling
c) endurance running

B. Protein

Questions 5-8 taken from the following article: Wolfe RR. Protein supplements and exercise. Amer J Clin Nutr. 2001;72:551S-7S.

5. The most commonly used endpoint to evaluate the utility of protein or amino acid supplements in exercising individuals:
a) nitrogen balance
b) lean body mass
c) 3-methylhistidine excretion

6. The study by Gontzea, et al (Nut Rep Int. 1975;11:231-6) found that normal individuals who began an exercise program were in nitrogen balance during the initial two weeks of exercise.
a) positive
b) negative
c) zero

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CPE Activity...

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7. If exercising individuals do not meet their caloric requirements and are in negative energy balance, their need for dietary protein/amino acids is likely to be:
   a) increased
   b) decreased
   c) unaffected

8. How are muscle protein synthesis and breakdown affected by weight training exercise:
   a) both synthesis and breakdown are decreased
   b) both synthesis and breakdown are increased
   c) synthesis is decreased; breakdown increased
   d) synthesis is increased; breakdown is decreased

C. Androstenedione

Questions 9-13 taken from the following article:

9. "Prohormones" such as androstenedione and DHEA are either converted to or mimic the action of:
   a) testosterone
   b) growth hormone
   c) pituitary hormone
   d) thyroid

10. What was the effect of DHEA supplementation in resistance/weight trained young men in the two studies discussed in this article?
   a) Increased serum androstenedione levels
   b) Increased strength
   c) Increased testosterone levels
   d) Increased muscle mass

11. Current research indicates that 300 mg/day androstenedione supplementation increases:
   a) serum testosterone
   b) strength
   c) muscle mass
   d) heart mass

12. The prohormone that is most likely to give a false positive urine test for nandrolone is:
   a) DHEA
   b) androstenedione
   c) 19-norandrostenedione
   d) Delta-5 metabolites

13. The overall message of this article can be summarized as stating that prohormones:
   a) do not affect strength, muscle mass, or protein synthesis
   b) may convert to more active components such as testosterone
   c) are absorbed into the bloodstream, thus escaping digestive losses
   d) all of the above

D. Carnitine

Questions 14-18 taken from the following article:

14. The primary function of carnitine is to:
   a) facilitate muscular contraction
   b) enhance protein synthesis in muscle cells
   c) transport fatty acids through the mitochondrial membrane
   d) enhance anaerobic performance

15. The highest concentration of carnitine in the body is in the:
   a) plasma
   b) liver
   c) skeletal muscle
   d) adipose tissue

16. After an acute administration of large doses of carnitine, most of the dose is rapidly recovered in:
   a) urine
   b) muscle
   c) liver
   d) intracellular fluid

17. Most studies do not show any benefit of carnitine supplementation on maximal oxygen uptake (VO2max) or performance when given one month or less:
   a) true
   b) false

18. How is muscle carnitine concentration affected by carnitine supplementation?
   a) very little effect
   b) it is reduced since there is less endogenous production
   c) it is increased proportional to intake

E. Ginseng and Other Herbals

Questions 19-24 taken from the following article:

19. According to the Dietary Supplement Health and Education Act (DSHEA) of 1994, herbs and other botanicals and their extracts or concentrates classified as "dietary supplements" are subject to the following labeling guideline(s):
   a) the statement "dietary supplement" must appear on the principal display panel
   b) if claims of structure or function are made, they must be based on the manufacturer’s interpretation of the scientific literature
   c) if claims are made the label must include a disclaimer that the FDA has not evaluated the claims
   d) all of these are correct

20. The term “ginseng” usually refers to the species _______, also known as Chinese or Korean ginseng:
   a) Panax ginseng
   b) Eleutherococcus senticosus
   c) Acanthopanax senticosus

21. According to this review article, the amount of ginseng root powder (or an equivalent amount of root extract with standardized ginsenoside content) that may increase muscular strength or aerobic work capacity if given > eight weeks is:
   a) 2 g/d
   b) 10 g/d
   c) 12-14 g/d
   d) 20 g/d

22. Chinese ephedra (“ma huang”) has been used for centuries to treat:
   a) mental illness
   b) poor growth
   c) respiratory ailments
   d) stress

23. Typical guidelines issued by trade associations for sale of ephedrine alkaloids limit intake to no more than ______ per unit dose and no more than ______ mg total ephedrine alkaloids daily.
   a) 5, 25
   b) 10, 50
   c) 25, 100
   d) 50, 200

24. Generally, individual ephedrine alkaloids at doses greater than those found in herbal extract products result in no enhancement of physical performance.
   a) true
   b) false

F. Chromium

Questions 25-27 taken from the following article:

25. The strongest evidence that suggests that chromium needs may be increased by endurance exercise is:
   a) increased urinary losses
   b) increased sweat losses
   c) lowered intestinal absorption

26. Studies of chromium supplementation in livestock have centered largely on:
   a) carbohydrate metabolism
   b) body composition
   c) shipping stress

27. Although early human studies of chromium picolinate supplementation on body composition were equivocal, most recent studies have not shown beneficial effects on body composition or strength.
   a) true
   b) false

G. IOC Banned Substances.

Questions 28-30 come from this Web site – the IOC Banned Substances category (requires Adobe Acrobat Reader):  
http://www.wada-ama.org

28. Is creatine (or creatine monohydrate) on the IOC Prohibited list?
   a) yes
   b) no

29. Is androstenedione on the IOC Prohibited list?
   a) yes
   b) no

30. Is DHEA (dehydroepiandrosterone) on the IOC Prohibited list?
   a) yes
   b) no

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Nutritional Supplements for Athletes (Spring 2002)

After reading each question/statement, please circle the best answer.

1. a b c d

2. a b c d

3. a b c d

4. a b c d

5. a b c d

6. a b c d

7. a b c d

8. a b c d

9. a b c d

10. a b c d

11. a b c d

12. a b c d

13. a b c d

14. a b c d

15. a b c d

16. a b c d

17. a b c d

18. a b c d

19. a b c d

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21. a b c d

22. a b c d

23. a b c d

24. a b c d

25. a b c d

26. a b c d

27. a b c d

28. a b c d

29. a b c d

30. a b c d

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