# SPORTS NUTRITION, SUPPLEMENTATION, AND ERGOGENIC AIDS

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In 1908, Baron Pierre de Coubertin, founder of the modern day Olympics stated "…the important thing in the Olympic games is not to win but to take part; the important thing n life is not to triumph but the struggle. The essential thing is not to have conquered but to have fought well". One would hope that philosophy is still applied in sports for all athletes. However, those were the days before college scholarships, free agency, and the commoditization of sports. Common headlines in the sports section of the news these days include reporting of high-profile athletes' use of drugs to enhance their performance in their sport. Is it possible to succeed "naturally"? Most experts believe that an athlete's performance is based on their genetic endowment, training regimen, and nutrition habits. Certainly, there are drugs that can give athletes an "unfair" advantage over drug-free athletes. Which drugs are these? The United States Olympic Committee updates their list of banned substances regularly. If it is on the list, it is there because there is a significant probability that the substance is an ergogenic aid. Use of the substance is referred to as "doping". "Doping" is defined as "the administration or use on any substance foreign to the body or any physiologic substance taken in abnormal quantitiy or taken by an abnormal route of entry into the body with the sole intention of increasing in unfair manner his or her performance in competition". The American College of Sports Medicine defines ergogenic aids as "physical, mechanical, nutritional, pharmacological substances or treatments that either directly improve physiological variables associated with exercise or remove subjective restraints that might limit physiologic capacity".

A simple approach to maximizing performance in sports, enhancing recovery from training, and minimizing injury begins with great sports nutrition. This includes the food and beverages consumed, what kinds, how much and at what times during a 24 hour period relative to time and type of training, practices, and games, and rest /recovery. Remember "garbage in, garbage out". Basic nutritional guidelines can be followed by athletes of all sports; however, there is some sports specific tweaking that should be done. A female cross-country runner does not have the exact same nutritional needs nor goals as a male offensive guard on the football team. Remember the food pyramid from grade school? That is where one should start. The pyramid has been modified such that the base or foundation is "fluids". This is followed by fruits and vegetables, then dairy products and meats, and at the top are fats, oils and desserts. The general breakdown is 15% protein, 20% fat, and 65% carbohydrate. Notice the focus on carbohydrates. Carbohydrates are necessary to provide fuel to muscles in the form of glycogen. Protein is needed to build those muscle cells. Fat is required to aid in the absorption of vitamins and the formation of certain hormones. Water and electrolytes are mandatory to keep our physiologic systems afloat. For instance, for an average height / weight basketball player, consumption of approximately 50 grams of fat per day for females and 75 grams of fat per day for males

(.2 .- .4 gm/lb of body weight) should be all that is needed. Daily protein requirements should average .6 grams of protein per pound of body weight. This amount keeps in mind that endurance athletes may need as little as .55 gm/lb/day whereas resistance-trained athletes require as much as .75 gm/lb/day. For carbohydrates and fluids, the following graph is helpful:

| | Carbohydrate (grams) | Fluid (cups) |
|---|---|---|
| High-Intensity Training | 3.2 – 4.5 gm/lb body weight per day | 10 – 12 cups/day plus fluids before, during and after exercise |
| Moderate-Intensity Training | 2.3 – 3.2 gm/lb body weight per day | 10-12 cups/day plus fluids before, during and after exercise |
| Before Exercise | .46 gm/lb body weight one hour before OR<br>.92 gm/lb body weight two hrs before OR<br>1.38 gm/lb body weight three hrs before OR<br>1.84 gm/lb body weight four hrs before exercise | 2 cups (16 oz) 2 hours before exercise |
| During Exercise | 30 – 60 grams per hour | At least 5 – 10 oz every 15 minutes to replace sweat losses |
| Recovery | .46 - .69 gm/lb body weight High glycemic carbohydrate beverages and foods immediately following exercise and every two hours after. Total carbohydrate intake over the next 24 hrs at 3.2 gm – 4.1gm/lb. | 3 cups per lb of body weight lost during exercise |

The “pre-game” meals should be eaten three to four hours before the game. Athletes should avoid high-fat and fries foods as they are not easily digested and may cause gastrointestinal discomfort and avoid high-fiber foods as they may cause abdominal cramping and gas. Immediately before the game or during the game, avoid solid foods as they are digested too slowly. Instead, select fluid-replacement sports drinks that contain carbohydrates (preferably 6%), water and electrolytes. Hydration cannot be emphasized enough in its importance. With dehydration comes mental and physical fatigue, cramping and slower recovery from exercise. Alcohol and caffeinated beverages should be avoided

as they contribute to dehydration. Specific food selections throughout the day are as follows: whole grain bread, rice and pasta – 6 to 11 servings / day; vegetables – 3 to 5 servings per day; fruit – 2 to 4 servings per day; milk yogurt and cheese – 2 to 3 / day; meat, poultry, fish, dried beans, eggs and nuts – 2 to 3 servings per day and sparing daily use of salad dressings, oils, butter, and desserts. Total caloric intake should vary among athletes based on gender, weight, sport and nutritional goals of weight loss, maintenance or gain. On average, this is approximately 20 to 27 kcal / lb body weight per day.

When the above guidelines are followed, rarely is there a need for dietary supplementation. Certainly, there are some clinical indications such as abnormal genetics, abnormal cellular function due to disease, or physical trauma that dictates the use of nutritional supplements. For the athlete, there may be scheduling issues or food availability problems that may require them to select alternate food choices. A good option is a sports energy shake that contains carbohydrates, protein, fat and water in a distribution that follow 65% carbohydrates, 15 – 20 % protein and not more than 25% fat. Sports energy bars may also be used but remember if it tastes like candy, it probably is candy. Vegetarian athletes need to pay particular attention to their food choices to ensure their diet meets daily requirements.

What about ergogenic aids? The International Olympic Committee has broken ergogenic aids down into groups that include stimulants (caffeine, cocaine, nicotine, and amphetamines), diuretics (increase urination), narcotics (pain medication), peptide hormones (growth hormones) and anabolic agents (testosterone and its derivatives). These should all be avoided since, in an healthy athlete with no systemic disease, the benefits in no way outweigh the risks associated with taking these substances. What about nutritional supplements? The over-the-counter supplements are not controlled by the FDA. Thus, for many supplements, whatever the company's product label says is in the bottle or the can, how much of the substance is really in there or what benefits may exist by consuming that product may or may not be true. Manufacturers that are certified with the Current Good Manufacturing Practices and are pharmaceutically registered are the most reliable when reporting the purity, content and quality of the dietary supplement in their product. There are so many supplements available that a textbook would be required to list them all and whether or not they have any benefits. For the most part, they do not have any benefits. To discuss a few, consider supplements such as carnitine, chromium and branched-chain amino acids. There are no sound clinical studies to support their use. The supplement HMB (beta-hydroxy-beta-methylbutyrate) has no significant effect on muscle mass. Some research suggests that there may possibly be a small decrease in muscle damage with exercise. Other studies show no benefits at all. Glycerol as a supplement has conflicting reports as to whether or not it has any benefit in endurance athletes. Some athletes claim improved endurance. Glycerol is sold theoretically to help limit increases in core body temperature – it does not. Baking soda theoretically may decrease lactic acid production and improve anaerobic performance such as sprinting. The research shows a perception of decreased exertion but no clear improvement in performance. The gastrointestinal upset and diarrhea associated with its consumption probably limit the athlete's time on the field. Chinese ginseng, popular herbs yohimbine and wild yams, and ephedra sinica have no solid evidence to support an

improvement in athletic performance or muscle mass. Ephedrine-containing products can in fact result in serious side effects including death. These products are being pulled off the market shelves and banned. Anti-oxidants (vitamins A, C, and E, betacarotene, and minerals such as selenium, manganese and zinc) do not have an ergogenic effect. Research shows they decrease the "free-radical" effect and thus may protect the body's cells from destructive oxidation. Mega-doses should be avoided of the vitamins A and E since, along with vitamins D and K, they are fat-soluble not water soluble and thus deleterious side effects can occur if too much is consumed.

Lastly, what about creatine ? Creatine is an energy compound containing nitrogen that is made in the liver, pancreas, and the kidney from amino acids glycine, arginine and methionine. Also found in the diet, it is absorbed from the intestines into the blood and transported to muscle. Approximately 95% of it is located in skeletal muscle, especially fast-twitch type II fibers) in the form of creatine and creatine phosphate. Creatine phosphate provides a phosphate molecule to help form ATP, the primary fuel for muscle. Creatine phosphate stores are depleted in the first 6 to 10 seconds of exercise. There is an upper limit of muscle total creatine concentration (i.e. the muscle cells cannot hold anymore) that is usually met if an athlete consumes .75 grams of protein / lb of body weight per day. A normal typical mixed foods diet provides a minimum of 1 gram of creatine per day. The daily requirement / daily turnover of creatine is1 to 2 grams depending on the athlete. Foods with the highest creatine content are herring, pork, beef, salmon, tuna and cod. With over-the counter creatine supplementation, an athlete may experience an increase in body weight. This may be due to an increase in muscle cell water content and lean body mass. There is no research to support an actual increase in muscle protein within the muscle cells. Some research has shown an increase in peak power output and strength in resistance training especially one-rep max lifts or in a short 30 second all-out stationary cycling in the lab setting. No research has shown an improvement in overall athletic performance in game situations. There are concerns that the gain in body weight (water weight) may affect a decrease in performance due to an increased energy demand to propel increased body mass during weight bearing activities, especially those lasting more than a few minutes. Consuming more creatine than the body requires or can absorb has been associated with side effects such as stomach upset and diarrhea. Cramping and muscle spasms and sprains have also been reported in athletes taking creatine as a supplement. There are also concerns that creatine supplementation may be deleterious in the athlete with abnormal kidney function.

In summary, healthy athletes may achieve their maximal performance in their sport through excellent training and work-out regimens, a smart nutrition and hydration plan, adequate rest and avoidance of caffeine, alcohol and smoking. Supplements are rarely necessary and some may be dangerous.

An excellent source of information is the Gatorade Sorts Science Institute's website at www.gssiweb.com. Please feel free to visit our website at www.premierorthosurgery.com.