ROLE OF NUTRITION IN SPORTS

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Abstract

Energy and macronutrient needs, especially carbohydrate and protein, must be met during times of high physical activity to maintain body weight, replenish glycogen stores and provide adequate protein to build and repair tissue. Fat intake should be sufficient to provide the essential fatty acids and fat-soluble vitamins, as well as contribute energy for weight maintenance. Although exercise performance can be affected by body weight and composition, these physical measures should not be a criterion for sports performance and daily weigh-ins are discouraged. Adequate food and fluid should be consumed before, during, and after exercise to help maintain blood glucose concentration during exercise, maximize exercise performance and improve recovery time. Athletes should be well hydrated before exercise and drink enough fluid during and after exercise to balance fluid losses. Sports beverages containing carbohydrates and electrolytes may be consumed before, during, and after exercise to help maintain blood glucose concentration, provide fuel for muscles and decrease risk of dehydration and hypernatremia. Vitamin and mineral supplements are not needed if adequate energy to maintain body weight is consumed from a variety of foods. However, athletes who restrict energy intake, use severe weight-loss practices, eliminate one or more food groups from their diet, or consume unbalanced diets with low micronutrient density, may require supplements. Because regulations specific to nutritional ergogenic aids are poorly enforced, they should be used with caution, and only after careful product evaluation for safety, efficacy, potency and legality.

Keywords *: Enzymes, Amino acids, , metabolic mechanism, proteins.*

Introduction

Most microorganisms and plants can biosynthesize all 20 standard amino acids, while animals (including humans) must obtain some of the amino acids from the diet. The amino

acids that an organism cannot synthesize on its own are referred to as essential amino acids. Key enzymes that synthesize certain amino acids are not present in animals — such as aspartokinase, which catalyses the first step in the synthesis of lysine, methionine, and threonine from aspartate. If amino acids are present in the environment, microorganisms can conserve energy by taking up the amino acids from their surroundings and down regulating their biosynthetic pathways.

In animals, amino acids are obtained through the consumption of foods containing protein. Ingested proteins are then broken down into amino acids through digestion, which typically involves denaturation of the protein through exposure to acid and hydrolysis by enzymes called proteases. Some ingested amino acids are used for protein biosynthesis, while others are converted to glucose through gluconeogenesis, or fed into the citric acid cycle. This use of protein as a fuel is particularly important under starvation conditions as it allows the body's own proteins to be used to support life, particularly those found in muscle. Amino acids are also an important dietary source of nitrogen.

Sports nutrition is the study and practice of nutrition and diet as it relates to athletic performance. It is concerned with the type and quantity of fluid and food taken by an athlete, and deals with nutrients such as vitamins, minerals, supplements and organic substances such as carbohydrates, proteins and fats. Although an important part of many sports training regimens, it is most commonly considered in strength sports (such as weight lifting and bodybuilding) and endurance sports (for example cycling, running, swimming).

Modern

The view of sports nutrition today has much evolved from the ancient Olympic gladiators' meal plan. Scientists are continually interested in learning more about this abiding subject. Research shows that the coupling of exercise and proper diet is what produces a healthy lifestyle that can maintain the "prevention/management of [chronic diseases such as] noninsulin-independent diabetes, hypertension, coronary heart disease, osteoporosis, obesity, mental health, colon cancers, stroke and back injury."[1] In 2008, US News reported that 65% of Americans exercised regularly by working out, playing sports, and/or other physical activities, [2] thus the importance of proper nutrition is of great interest to athletes and exercisers for optimal performance and long term benefits. In addition to diet, social and cultural influences, lifestyle habits, motivation and training determine successful athletic

performance (Maughan).[3] However, states Maughan, "without proper nutrition, the full potential of the athlete will not be realized, because performance will not be at its peak, training levels may not be sustained, recovery from injury will be slower, and the athlete may become more susceptible to injury and infection." Understanding sports nutrition leads to optimal athletic performance and lifetime health benefits and can thus be evaluated by the intake of certain nutrients and supplements when exercising, by learning the way the body utilizes these materials and how these practices complement future diet and exercise of the individual.

Supplements

Many athletes consider taking dietary supplements because they are looking for the "magic ingredient" to increase performance.[4] In the extreme case of performance-enhancing supplements, athletes (particularly bodybuilders may choose to use illegal substances such as anabolic steroids, compounds which are related to the hormone testosterone, which can quickly build mass and strength, but have many adverse effects such as high blood pressure and negative gender specific effects. Blood doping, another illegal cryogenic, was discovered in the 1940s when it was used by World War II pilots.[5]

Dietary protein began to be consumed in the 1940s and muscle building results were found in resistance and strength training athletes.[6] Protein intake is a part of the nutrient requirements for the regular athlete and is an important component of exercise training, because it can also aid in performance and recovery. Dietary protein intake for well-trained athletes should occur before, during and after physical activity as it is advantageous in gaining muscle mass and strength.[7] However, if too much protein and amino acid supplements are consumed (especially by the Average Joe exerciser), it can be more harmful than beneficial; health risks include: "dehydration, gout, calcium loss, liver, and renal damage [and] gastrointestinal side effects include diarrhea, bloating, and water loss" (Lawrence). A bountiful protein diet must be paired with a healthy, well-rounded meal plan and regular resistance exercise. Yet, characteristics such as the type of exercise, intensity, duration, the carbohydrate values of diet, the individual's sex and age and also the amount of background training and training environment.[8]

Creatine may be helpful for well-trained athletes to increase exercise performance and strength in concordance with their dietary regimen.[9] Also, the substance glutamine, found in

whey protein supplements, is the most abundant free amino acid found in the human body.[10] For well-trained and well-nourished athletes it is considered that glutamine may have a possible role in stimulated anabolic processes such muscle glycogen and protein synthesis.[11] Other popular supplements studies done include androstenedione, chromium, and ephedra. The findings show that there are no substantial benefits from the extra intake of these supplements, yet higher health risks and costs.[12]

High energy supplements have shown to increase the performance of physical activity. A study done at the University of Texas saw a 4.7% increase of performance in 83% of participants after drinking Red Bull Energy Drink which was more intense than the compared placebo. The energy drink most dominantly increased the epinephrine and noreprinephrine (adrenaline and its precursor) levels and beta-endorphins in the blood than before consumption. Caffeine, carbohydrates and Vitamin B are factors that may have favored performance increase with no change in perceived exertion.[13]

Caffeine has been known since the 1900s and became popularly used since the 1970s when its power of masking fatigue became highly recognized.[14] Similarly, the caffeine found in energy drinks shows an increased reaction performance and increased good feelings of energy, focus and alertness in quickness and reaction anaerobic power tests. In other words, consuming an energy drink with caffeine increases short time/rapid exercise performance (like short full-speed sprints and heavy power weight lifting.)[15]

Post-exercise nutrition is just as important, if not more important than pre-exercise nutrition as it pertains to recovery. Traditionally, sports drinks such as Gatorade and PowerAde are consumed during and after exercise because they effectively rehydrate the body by refueling the body with minerals and electrolytes. Gatorade was founded in the 1960s, when the University of Florida, Gainesville Gators improved their performance with "Gator Aid." A drink was made of glucose and sucrose in water and helped the football players' performance. And by the 1970s, many other sports drinks of its kind had been manufactured.[16] However, sports drinks lack protein.

New studies in 2008 have found milk, especially skim milk and chocolate milk may be the new sports drink, as milk leads to protein the synthesis which boosts net muscle protein balance. Milk naturally contains many electrolytes, nutrients and other properties that help to make it a great post-exercise beverage.

When compared to plain water or sports drinks, research suggests that chocolate milk is more effective at replacing fluids lost as sweat and maintaining normal body fluid levels. Athletes drinking chocolate milk following exercise-induced dehydration had fluid levels about 2 percent higher (on initial body mass) than those using other post-exercise recovery beverages, allowing for prolonged performance, especially in repeated bouts of exercise or training.[17]

Nutritional Requirements

Differing conditions and objectives suggest the need for athletes to ensure that their sports nutritional approach is appropriate for their situation. Factors that may affect an athlete's nutritional needs include type of activity (aerobic vs. anaerobic), gender, weight, height, body mass index, workout or activity stage (pre-workout, intra-workout, recovery), and time of day (e.g. some nutrients are utilized by the body more effectively during sleep than while awake). Most culprits that get in the way of performance are fatigue, injury and soreness. A proper diet will reduce these disturbances in performance. The key is to get a variety of food, to get all the macronutrients, vitamins, and minerals. According to Eblere's article (2008), it is optimal to choose raw, unprocessed foods such as oranges instead of orange juice. Eating foods that are natural means the athlete is getting the most nutritional value out of the food. When foods are processed it normally means that nutritional value is reduced. [18]

Anaerobic Exercise

During anaerobic exercise, the process of glycolysis breaks down the sugars from carbohydrates for energy without the use of oxygen. This type of exercise occurs in physical activity such as power sprints, strength resistances and quick explosive movement where the muscles are being used for power and speed, with short time energy use. After this type of exercise, there is a need to refill glycogen storage sites in the body (the long simple sugar chains in the body that store energy), although they are not likely fully depleted.

To compensate for this glycogen reduction, athletes will often take in a large amount of carbohydrates in the period immediately following exercise. Typically, high glycaemic index carbohydrates are preferred for their ability to rapidly raise blood glucose levels. For the purpose of protein synthesis, protein or individual amino acids are ingested as well. Branched-chain amino acids are important since they are most responsible for protein

synthesis. According to Lemon et al. (1995) female endurance runners have the hardest time getting enough protein in their diet. Endurance athletes in general need more protein in their diet than the sedentary person. Research has shown that endurance athletes are recommended to have 1.2 to 1.4 g of protein per kg of body weight in order to repair damaged tissue. If the athlete consumes too few calories for the body's needs, lean tissue will be broken down for energy and repair. Protein deficiency can cause many problems such as early and extreme fatigue, particularly long recovery, and poor wound healing. Complete proteins such as meat, eggs, and soy provide the athlete with all essential amino acids for synthesising new tissues. However, vegetarian and vegan athletes frequently combine legumes with a whole grain to provide the body with a complete protein across the day's food intake.[19] A popular example is rice and beans. [20]

The following information on the types of carbohydrates comes from Spada's research on endurance sports nutrition (2000). He advises carbohydrates to be unprocessed and/or whole grains for optimal performance while training. This is because these carbohydrates offer the most fuel, nutritional value, and satiety. Fruits and vegetables contribute important carbohydrate foundation for an athlete's diet. They both provide vitamins and minerals that are lost through exercise and need to be replenished. Both fruits and vegetables improve healing, aid in recovery, and reduce risks of cancer, high blood pressure, and constipation. Vegetables offer a little more nutritional value than fruits for the amount of calories; therefore an athlete should strive to eat more vegetables than fruits. It is also important to look at the certain types of vegetables and fruits. Dark colored vegetables usually have more nutritional value than pale colored ones. A general rule is the darker the color the more nutrient dense it is. Like all foods, it is very important to have a variety. To get the most nutritional value out of fruits and vegetables it is important to eat those in their natural, unprocessed form with no other nutrient (sugar) added. [21]

Often in the continuation of this anaerobic exercise, the product from this metabolic mechanism builds up in what is called lactic acid fermentation. Lactate is produced more quickly than it is being removed and it serves to regenerate NAD^+ to the cells where it's needed. During intense exercise when oxygen is not being used, a high amount of ATP is produced and pH levels fall causing acidosis or more specifically lactic acidosis. Lactic acid build up can be treated by staying well-hydrated throughout and especially after the workout, having good cool down routine and good post-workout stretching.[22]

Intense activity can cause significant damage to bodily tissues. In order to repair, vitamin E and other antioxidants are needed to protect muscle damage. Oxidative damage and muscle tissue breakdown happens all the time in endurance running so athletes need to eat foods high in protein in order to repair these muscle tissues. It is important for female endurance runners to consume proper nutrients in their diet that will repair, fuel, and minimize fatigue and injury. To keep a female runner's body performing at its best, ten nutrients need to be essential in diets.

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