

NUTRITION AND SPORTS PERFORMANCE.

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INTRODUCTION:

“You are what you eat.” It may be a cliché, but this statement has considerable meaning for all athletes. Physical activity requires muscle contractions. Muscle contractions require adenosine triphosphate (ATP), which is the specific type of energy that powers these contractions. The breakdown of large nutrients from food yields ATP. These nutrients, often referred to as fuel or energy-yielding nutrients, are carbohydrates, proteins and fats. Their consumption can impact physical performance in a variety of ways.

ENERGY

Energy nutrients, measured in terms of kilocalories (kcal) are stored in the body differently. Fat, which is typically the largest energy reserve, is stored as adipose (fat) tissue and in the muscle cell. Carbohydrates are stored as glycogen, and these stores are confined to muscle and the liver. Protein stores are restricted to mostly muscle.

There is a limit to how much carbohydrate and protein can be stored in the body, while the storage capacity for fat is almost endless. The way athletes eat influences energy storage, which in turn can impact performance. Insufficient energy intake can lead to loss of muscle and bone density, irregular menses, and increased susceptibility to fatigue, illness, and injury. Because weight loss programs encourage energy deficits, coaches need to carefully evaluate the need for reduced body size before recommending dieting to their athletes.

CARBOHYDRATE

There are two types of carbohydrates: simple (sugars) and complex (grains, starchy vegetables). Both are good sources of energy. Although muscles primarily use carbohydrates (CHO) and fats for energy, there are some organs that can only use carbohydrates in the form of blood glucose. When a diet is deficient in energy and/or CHO, the body will use protein stores (muscle) to make glucose. Regardless of how much fat an individual has stored, he/she cannot make significant amounts of glucose from it. Therefore, extremely low kcal diets or low CHO diets can result in loss of muscle tissue.

High CHO diets can increase muscle glycogen levels. This is important for individuals who do prolonged, moderately high- to high-intensity aerobic exercise that is limited by low muscle

glycogen levels. Low glycogen levels can be related to fatigue in these activities. In addition, low glycogen levels may be responsible for fatigue in predominately anaerobic activities lasting three minutes or more. Studies also show that slower overall sprint speed, such as in the latter parts of prolonged athletic contests like soccer and ice hockey may be due to muscle glycogen depletion. Finally, low muscle glycogen stores may lead to a decrease in exercise intensity during training.

For most individuals water during exercise will be sufficient. However, for prolonged aerobic events (>

one hour), CHO (six to eight percent) solutions may delay fatigue. Athletes who participate in intermittent high-intensity exercise throughout the day (for example, a soccer tournament) may also benefit from these CHO sport beverages.

Individuals prone to hypoglycemia (low blood sugar) should not consume CHO within an hour of exercise. This may cause lightheadedness and needless fatigue. After a heavy workout, athletes should consume CHO and protein immediately for maximum glycogen replenishment.

PROTEIN AND FAT

Compared to the average individual, many athletes have a slightly higher protein requirement. However, most American athletes receive enough protein from their diet without the need for protein or amino acid supplements provided that their energy intake is sufficient. Those athletes potentially at risk for inadequate protein intake are those who are dieting or vegetarian.

Fat intake should be at a moderate level in an athlete's diet. High fat intakes are associated with performance deficits that are often due to the low carbohydrate content of these diets. Low fat intakes are often associated with low calorie diets which, as mentioned previously, are associated with fatigue.

TIMING OF MEALS

Pre-exercise food guidelines will vary from athlete to athlete depending on the sport/event. As a general guideline, meals that are high in CHO, low in fat and fiber, moderate in protein, with extra fluid and appropriate portions are best. This is similar to the basic diet plan recommended for most athletes: CHO 55 – 70 percent, protein 12 - 15 percent, fat 20 - 25 percent, adequate kcal, variety of foods and limited alcohol.

The timing of the meals varies with intensity of exercise and personal tolerance to food. Suggestions include the following: large meals should be consumed four to six hours before exercise, lighter meals two to three hours before exercise and snacks half-hour to one hour before exercise. Eating breakfast and lunch is important! Athletes should try to avoid running out of fuel during the day.

SUPPLEMENTS

The American College of Sports Medicine (ACSM) has several publications on various sports nutrition topics. The following topics are a sample from ACSM publications. For more information, please refer to the ACSM Web site at <http://www.acsm.org>.

- **Vitamins and Minerals –**

Physical activity may increase the need for some vitamins and minerals; however, the increased requirement generally can be attained by consuming a balanced diet based on a variety of foods. Individuals at risk for low vitamin and/or mineral intake are those who consume a low energy diet for extended periods of time. These individuals are at risk of developing a marginal, subclinical (without obvious symptoms) nutrient deficiency.

Although vitamin and mineral supplementation may improve the nutritional status of an individual who consumes marginal amounts of nutrients and may enhance the physical performance of those athletes with obvious nutrient deficiencies, there is no scientific evidence to support the general use of vitamin and mineral supplements to improve athletic performance. The increased energy intake of physically active individuals should provide the additional vitamins and minerals needed if a wide variety of foods are included in the diet. Despite this recommendation, many athletes prefer to consume a vitamin/mineral supplement “just in case.” Individuals should realize that use of megadoses (large amounts) of vitamins and minerals is not recommended because of potential adverse interactions among nutrients and possible toxicity.

- **Creatine –**

Recent data indicates that creatine supplementation may enhance the physiological adaptations to resistance (strength) training in men and women, probably a result of being able to train more intensely. Athletes most likely to gain from creatine supplementation are those who participate

in short-term sports/events (intense bouts of exercise). Nearly all research examining creatine supplementation has been obtained in the laboratory.

There are few field studies documenting beneficial effects of creatine supplementation during specific sports and competitions. Athletes considering supplementation are encouraged to contact ACSM for more information.

- **Caffeine –**

Often referred to as a nutritional ergogenic aid (helps athletic performance), caffeine has no nutritional value. Ingested caffeine is quickly absorbed from the stomach and peaks in the blood in

one to two hours. Caffeine has the potential to affect all systems of the body, as it is absorbed by most tissues. It has been shown in some studies to increase performance during prolonged endurance exercise and short-term intense exercise lasting approximately five minutes. Athletes should be aware that there is an IOC allowable limit, and high doses of caffeine may result in the disqualification of an athlete from competition.

- **Fluids –**

To help prevent dehydration athletes should drink before they are thirsty, because exercise can diminish the thirst response. General guidelines include drinking two to three cups of water two to three hours before exercise, and 15 minutes before exercise drinking one to two cups of water. During every 15 to 20 minutes of exercise, one cup of water should be consumed. After exercise, the athlete should drink 16 ounces of water for every one pound of weight loss. Symptoms of dehydration are a dark urine color, small volume of urine, elevated heart rate, and headache. If any of these occur, you should increase your consumption of fluids. For most individuals, water is the best fluid. For more specific guidelines, see the ACSM Exercise and Fluid Replacement Position Stand at www.acsm.org.

Clearly the diet of an athlete is extremely important to his/her performance. The following sites have reliable information on nutrition: American Cancer Society, <http://www.cancer.org>; American Dietetic Association (ADA) Sports and Cardiovascular Nutritionists (SCAN), <http://www.eatright.org>; and the American Heart Association, <http://www.amhrt.org>.

REFERENCES:

Position Paper of the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and athletic performance. *J Am Diet Assoc.* 2000; 100:1543-1556.

Williams, Melvin. *Nutrition for Fitness and Sport*, fifth edition, 1999 WCN/McGraw-Hill.

<http://www.cancer.org>, <http://www.eatright.org>,

<http://www.amhrt.org>, <http://www.acsm.org>.