

Sports Nutrition: An Evolved Multidisciplinary Field for Athletes

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Sports nutrition, also known as exercise nutrition, is a multidisciplinary approach for athletes and physically active individuals - with the objectives of improved training, recovery and performance. It is a field that involves dietitians, biochemists, exercise physiologists, cell and molecular biologists, and occasionally psychotherapists. It utilizes basic scientific knowledge that includes the understanding the body's use of nutrients during athletic competition and the appropriate application of nutrition and dietary supplements to enhance endurance and performance of athletes. As this field has evolved over the years, a brief historical background about its evolution and the nowadays prevalent aspects are explored herein.

The relationship between optimal nutrition, physical activity and athletic performance has been recognized since ancient times. There have been different nutritional approaches for athletes of different cultures. Nearly 500-400 BC, dietary practices of athletes and warriors involved consuming deer liver and lion hearts that were believed to enhance bravery, speed and strength. Ancient Greeks and Romans followed a diet that was mainly vegetarian and included cereals, fruits, vegetables, legumes and drinking wine - with consuming meats sparingly. Meanwhile, inhabitants of the many countries of the Arabian Peninsula relied on a diet that consisted mainly of dates, wheat, barley, rice, meats and yoghurt products. Throughout history, many competitive and Olympic Games were held and the field of sports became diverse. Throughout time, athletes have always been advised and guided on what to eat. The academic field of sports nutrition began at exercise physiology laboratories in the late 1930s in Sweden. In the late 1960s, Scandinavian scientists studied muscle glycogen use and repair (storage/loading) after prolonged exercise. Many exercise physiology laboratories were established in many universities world-wide during the 1970s. The 1980s marked further developments for sports nutrition, when diet for endurance athletes focused on carbohydrate consumption while that for strength athletes focused on protein intake.

Keeping in mind that that motto: "eating to win" has been an ancient tradition, the field of sports nutrition strives to fulfill several basic purposes in regard to:

1. Preparing athletes before performance or training.
2. Maintaining an acceptable level of performance during competition or training,
3. Helping the athlete's body recover after training or athletic competition,
4. Providing sound information about healthy dietary practices and use of supplements,
5. Monitoring athletes for signs of eating disorders, doping, supplement abuse, or other unhealthful nutritional practices.

Additionally, sports nutrition includes: providing specialized nutritional advice to athletes who follow vegetarian, vegan, or other special diets - and also monitor special nutritional needs of persons with disabilities who participate in athletic activities and programs.

Many advances in the knowledge and application of aspects of sports nutrition have been achieved throughout the years. One of the significant concepts that developed is known as the "nutrient timing system". It is a system of exercise nutrition that allows one to build more strength and lean muscle mass in a shorter time than the usual and can benefit many individuals from children to the elderly and from beginning exercisers to professional bodybuilders and power lifters. Nutrient timing is claimed to be the fruit of cutting-edge scientific insights into exercise metabolism, physiology and nutrition. Protein intake was emphasized and carbohydrate intake was de-emphasized; thus, the former has been the mantra among those involved in resistance training for the last fifteen years. Nutrients timing involves

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the knowledge that during a muscle's twenty-four-hour growth cycle, there are periods when the muscle is actively involved in producing energy, periods when it is recovering, and periods when it is growing. For the metabolic machinery of the muscle to function at its best during each of these periods, the appropriate amounts and types of nutrients need to be consumed at the appropriate times. Depending on its metabolic needs at any given time, the muscle can be directed to produce and replenish muscle glycogen or synthesize muscle protein. Each of these processes requires different types of nutrients, and if the body-builder is able to deliver the right nutrient mixture to the muscle at the right time, one can greatly enhance recovery from exercise and improve muscle growth, strength, and

Briefly, the current understanding and application of the nutrient timing system involves three phases, which are:

The energy phase: This coincides with one's workout. The primary metabolic objective of the muscle during this phase is to release sufficient energy to drive muscle contraction. Most athletes recognize the importance of consuming carbohydrates during exercise both to prevent the depletion of muscle glycogen stores and maintain blood glucose levels, which helps in delaying fatigue. Nutrient Timing, however, entails more than just consuming carbohydrates during exercise. Research has shown that when carbohydrates, protein, specific amino acids and vitamins are consumed during this phase, muscle glycogen can be spared and muscles achieve greater effort. This practice can blunt the rise in the catabolic hormone cortisol (thereby reducing muscle damage), and helps in preparing one's muscle enzymes for a faster recovery following the workout.

The anabolic phase: This phase is a 45-minute window following a workout in which one's muscle machinery, in the presence of the right combination of nutrients, initiates the repair of damaged muscle protein and replenishes muscle glycogen stores. Immediately after exercise, muscle cells are extremely sensitive to the anabolic effects of the hormone insulin. However, this sensitivity declines rapidly and after several hours muscles may even become insulin resistant. Insulin resistance is a condition that dramatically slows muscle glycogen recovery, repair of existing muscles, and synthesis of new muscles.

The growth phase: This phase extends from the end of the anabolic phase to the beginning of the next workout. It is the time when the muscle enzymes are involved in increasing the number of contractile proteins and the size of muscle fibers, as well as in helping the muscle fully replenish muscle glycogen depleted during the energy phase. During the growth phase, consumption of carbohydrate and protein is essential to maintain optimal muscle growth. A recent research shows that a high intake of protein can be of significant benefit to the strength athlete if protein is consumed at the correct time. By following the Nutrient Timing System, one will be able to maintain a high anabolic state and restore muscle glycogen, repair muscle tissue damage, and synthesize new muscle.

There are nutritional recommendations for each of the three phases of this nutrition timing system. Highlights of such recommendations are generally as follows:

For the energy phase, intake of carbohydrates of high glycemic index such as sucrose and glucose and whey protein (as it contains all essential amino acids with high percentages of leucine and glutamine). A carbohydrate to protein ratio of 3-4:1 is recommended. Enough fluids containing electrolytes such as sodium, potassium and magnesium and vitamins C and E should be consumed. For the anabolic phase: similar recommendations to those of the energy phase are made. However, emphasis is made on intake of lactose-free whey protein and inclusion of antioxidant vitamins such as C and E. For the growth phase, the concept of metabolic sensitivity is illustrated clearly in the nutrient recommendations for this phase. A carbohydrate and protein supplement is necessary to maintain the anabolic state and heightened level of insulin sensitivity in the 4-hour period after one works out. However, once the insulin pump has been primed, less carbohydrate is needed to maintain elevated insulin levels. Supplementation during this phase can rely on a much lower carbohydrate to protein ratio. In fact, a ratio of 1 gram of high-glycemic carbohydrate to 5-8 grams of whey protein and casein is recommended.

Current guidelines regarding energy intake and balance emphasize that an athlete's diet should be in positive caloric balance for muscle repair and growth to be optimized. The magnitude of a positive caloric balance will depend on the athlete's goal. If the athlete is just trying to gain strength without trying to gain much weight, then the caloric intake should only exceed the athlete's caloric expenditure by 50-100 calories per day. If the athlete is trying to increase body mass, then intake of energy should exceed their caloric

expenditure by several hundred calories per day. However, if the athlete is a body-builder in preparation for a competition, then a negative caloric balance should be followed for several weeks leading up to the competition in order to reduce body fat. During this time, the athlete should reduce carbohydrate intake and increase protein intake.

As noted herein, nutrition of athletes and individuals who are physically active is not just a random practice. It is an exact science that explores optimal nutritional needs and timing for a variety of sports. Although many strides have been achieved already in this field, continued research may devise more nutritional guidelines for improved athletic vigor and performance in the years to come.

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