Endurance Performance and Protein Ingestion? What all endurance athletes need to know.

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This off-season I have had many questions from endurance athlete patients regarding nutrition and specifically if the inclusion of protein supplementation would be helpful for them?

Well as many of you should know, endurance exercise performance is contingent on delaying fatigue, which in turn is dependent on adequate fuel. Athletes competing in an endurance event will be able to perform at their trained intensity and duration until they deplete their glycogen stores, or become dehydrated at which time the athlete must decrease their intensity or risk the inability to continue. Increasing the intensity of an exercise increases the contribution of carbohydrate to the energy pool while the source may shift from muscle glycogen to circulating blood glucose, once fuel levels can no longer be maintained the athlete may find themselves in the unenviable predicament of 'bonking'.

Protein also contributes to the energy pool to a lesser degree than carbohydrate (and of course fat), however if the exercise is long enough and intense enough, even a small percentage of a large usage will represent a significant amount of protein used for fuel. In fed individuals protein is purported to contribute 1-8% to the energy expended depending on the sex and the duration of the athletic competition.

Exercising for 1 hour at approximately 70% VO_{2max} requires approximately 1,000 kcal for a male and 600-700 kcal for a female (1). Considering the 10-40 hours that endurance athletes typically train per week, and the numerous competitions they may partake in over the course of a season, the energy demands of an endurance athlete just to maintain balance is rather impressive indeed.

The fuel used during exercise depends upon the athlete's sex, their nutritional status and the intensity / duration of the exercise. The core of a nutritional plan for any athlete revolves around the intake of the three macronutrients carbohydrates, fats and proteins. The recommended nutrient intake for Canadians is 55-58% of energy from carbohydrate, 12-15% from protein, and 25-30 % from fat. When energy intake is appropriate to restore balance in the athlete, these recommendations are more than reasonable to provide the necessary macronutrients. Still the prevailing wisdom for energy intake for the athletic population is 7-8 g/kg of carbohydrate and 1.2-1.7 g/kg of protein per day (2). The international society of sports nutrition has even suggested that protein levels as high as 2.0 g/kg are not only safe but may further training adaptations to exercise (3).

Protein requirements of the endurance athlete?

Protein requirements for athletes differ depending on the type of sport the athlete engages in. Resistance type athletes (weightlifters) or intermittent activity athletes (soccer players) are thought to require more protein than endurance type athletes (3).

The consensus on recommending protein for endurance athletes is to consume 1.2-1.4 g/kg per day (2).

Research has clearly shown that ingesting carbohydrate and an electrolyte fluid improves prolonged exercise by providing fuel and minimizing the effects of dehydration. The general recommendations for carbohydrate and fluid during competition is to consume 1 cup of a dilute sports drink (~15 g carbohydrate) every 15 minute during exercise and then to consume 1.2-1.5 g/kg body weight of carbohydrate every 15-30 minutes and 150% of the water lost during exercise over the two hours immediately after exercise (1). Recently protein or amino acids have been added to sports drinks (Accelerade and Amino Vital) in a typical 1:4 ratio to carbohydrates (Accelerade) and as such many of the studies investigating the effects of protein ingestion in the endurance athlete utilize beverages to investigate this scenario.

Protein and endurance performance?

While the inclusion of protein with carbohydrate has not been adequately shown in research of a practical sporting sense, the research does suggest that if carbohydrate is not sufficient, protein will improve time to fatigue.

Protein for muscle glycogen synthesis?

The results of these types of studies although interesting only show that if an athlete consumes less than an ideal amount of carbohydrate (absolute amount or timing of delivery) than the addition of protein is useful for glycogen resynthesis. Thus implications for athletes wishing to control body weight, or limit their carbohydrate intake are apparent, however the ultimate determinant of glycogen synthesis remains, carbohydrate.

Protein for muscle protein synthesis?

Protein supplementation to promote muscle hypertrophy has been well documented but the effect of protein intake on adaptations to endurance exercise is still in question. While strenuous exercise causes both degradation and synthesis of protein, it is the amount and timing of nutrient intake that ultimately determines protein balance. A rise in insulin increases muscle amino acid uptake and protein synthesis, thus carbohydrate supplementation effects both protein and glycogen resynthesis. However, it appears that carbohydrate ingestion has more of an effect on limiting the protein breakdown rather than increasing the synthesis of protein. It is clear that protein ingestion stimulates muscle protein accretion following endurance exercise. Increased amino acid availability (especially Leucine) in the blood is the stimulus for increased protein synthesis and this has an additive effect to the exercise induced synthesis. Although it may be more practical for endurance athletes to consume protein post exercise, it is interesting to note that recent research has shown that the response of protein synthesis to 6 grams of amino acid and 35 grams of sucrose immediately before resistance exercise was greater before the exercise than after.

Protein to minimize muscle damage?

Endurance exercise of even low to moderate intensity can lead to considerable muscle soreness and damage. High intensity, high load or eccentric type exercise

causes a marked increase in exercise induced muscle soreness with the eccentric contractions (downhill running) even being linked to impaired muscle glycogen resynthesis. Previous research does document the attenuation of markers of muscle damage, and less perceived muscle soreness with a carbohydrate-protein supplement however this does not appear to be consistently shown. Repeated studies that utilize beverages with similar calories and combine better outcome measures with strength would be useful to truly determine if there is a more profound effect than subjective pain.

So what does it all mean?

As noted by many authors who study the needs of endurance athletes, most athletes (myself included) habitually consume protein beyond the recommended levels. Certainly by consuming a mixed diet which includes meat, milk/cheese/yogurt, egg, beans, and even tofu it is easy to consume protein. Additionally, many athletes consume drinks, supplements and protein powders popular in the sporting community. In recent years several sports beverages have added protein to carbohydrate in attempts to further the ergogenic effects, and staples like chocolate milk have launched entire ad campaigns on the purported effective of milk as a recovery beverage. The reality is, that many of the sports drinks available today (including milk) have similar caloric values and have similar nutritional constituents of carbohydrate, sodium and in some instances protein that do in fact help endurance athletes perform, synthesize glycogen, synthesize protein and aid in recovery.

The overriding message to any endurance athlete, is that replenishment of muscle glycogen stores, protein stores and the subsequent tissue repair and adaptation is paramount to improving performance. The consumption of carbohydrate and perhaps some protein before and during competition enhances performance and consumption immediately after and frequently after exercise best facilitates recovery and allows for future performance gains. Considering the research on protein, it remains debatable whether supplementation is really necessary. No data currently exists that demonstrates that inadequate protein will impair performance the way that carbohydrate and fluid most certainly do. That being said, there are no contraindication for using protein or amino acids and depending on the nutritional status of the athlete it can be useful in the quest to enhance performance. Certainly if sufficient carbohydrate intake is not achieved, the addition of protein to meet caloric needs is just as good and may have additional benefits.

If you have questions regarding your nutrition this year consult with one of the specialists at Sports Performance Centres www.sportsperformancecentres.com

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