THE SCIENCE OF PROTEIN FOR ATHLETES

This document provides an overview of the scientific literature related to the protein needs of athletes, including why and when to eat protein, what type to consume and the appropriate amount.

INTRODUCTION

Proteins are molecules composed of amino acids, the overall structure of which is determined by the chemical interactions between the individual amino acid components. The amino acid profile of a protein also contributes to properties such as digestion rate. After the protein is digested and amino acids absorbed, some amino acids will act as signaling molecules in the body, and some can enter metabolic pathways. However, the primary role of amino acids is to provide the building blocks to create new protein structures in the body. Examples are the contractile proteins in skeletal muscle, enzymes, hormones and transport proteins in the blood.

Each of the protein structures in the body requires a specific set of amino acids. Certain amino acids cannot be made by the body and need to be consumed in the diet; these are referred to as the essential amino acids. Dietary proteins are considered "complete" if all of the essential amino acids are found in the protein source. Examples of complete proteins are dairy foods, meat, fish, poultry and soy. Quinoa is the only grain that is also a complete protein.

The amino acid profile and speed of digestion and absorption are important considerations when choosing dietary protein sources to meet the sports nutrition needs of athletes.

DAILY PROTEIN INTAKE

The recommended dietary allowance (RDA) for protein intake for healthy adults is 0.8 g/kg/day. Athletes need slightly more protein in their diet, the amount based on their sport and goals (see Table 1).[7,9-10] These recommendations should be met by eating complete protein sources spread evenly throughout the day.

Table 1: Daily Protein Recommendations for Athletes [7,9-10]

TYPE OF ATHLETE	RECOMMENDED INTAKE (G/KG/D)
Team Sport	1.2-1.7
Endurance	1.2-1.4
Strength	1.6-1.7
Power	1.5-1.7

THE ROLE OF PROTEIN FOR SPORTS NUTRITION

Protein Before and During Exercise

The potential benefit to consuming protein before or during exercise depends on the goal of the athlete. If an athlete is looking to promote muscle protein synthesis and gain lean mass as a result of strength training, a small amount of protein before and during a training session may be beneficial.[12] The actual amount of protein to consume during this time has not been defined. It would be practical for the athlete to choose a source of protein that is easily digested in an amount that does not cause stomach upset.

If the athlete's goal is to improve endurance performance, the research in this area has yielded mixed results. At this time, there is not a clear benefit to consuming protein before or during endurance training or racing.[12] Research has not been conducted to determine if protein intake before or during exercise can help improve the performance of team sport athletes.

For more information on this topic, please see Sports Science Exchange #109 "Is There a Need for Protein Ingestion During Exercise?" (click to view) by Dr. Luc van Loon, found at www.gssiweb.org.[12]

Protein After Exercise for Recovery

Protein structures in the body are constantly turning over, breaking down and rebuilding with new amino acids from the diet. Referring specifically to protein structures in the muscle, the terms Muscle Protein Synthesis (MPS) and Muscle Protein Breakdown (MPB) describe the ongoing process of breaking down existing structures and building new structures. Exercise will result in an increase in MPB; however, the more significant impact of exercise on the muscle is to increase MPS. The type of exercise determines which protein fraction of the muscle will be impacted. For example, resistance exercise results in increased MPS for the contractile proteins of the muscle, while MPS of the mitochondrial proteins is stimulated with endurance exercise. Regardless, protein consumption following exercise is necessary to fully take advantage of this benefit.[7] While this process of building new proteins begins immediately, the benefit will only become apparent after a period of time when enough new proteins have been created. Therefore, regular protein consumption following exercise is a good habit for athletes to adopt.

Timing: Despite popular theories, an exact window of time in which protein should be consumed following exercise has not been determined. Therefore, athletes should eat shortly after finishing a workout or competition, as soon as their stomach will tolerate food.[7] Choosing a liquid form of protein over a solid may help athletes consume their recovery nutrients shortly following exercise.

Recovery continues after the immediate post-exercise period, and athletes should strive to maintain a positive net protein balance throughout the day. This can be achieved by ingestion of about 20 g of protein in a regular pattern throughout the day, about every 3 hours, beyond the initial recovery snack.[5]

MORE IS NOT BETTER: eating more than about 20 g of protein at one time does not result in creating more muscle. The extra amino acids are oxidized or burned as fuel.[4] To gain muscle a better practice is to eat about 20 g of protein about every 3 hours throughout the day.[5]

SUMMARY OF RECOVERY PROTEIN CONSIDERATIONS:
Timing: As soon as possible after exercise
Type: Most complete protein sources are adequate, however the best sources are whey or milk proteins.
Amount: ~20g, or 0.25-0.30 g/kg

Amount: To determine the amount of protein athletes should eat after exercise, researchers at McMaster University conducted a dose-response study where individuals consumed different amounts of egg protein following resistance exercise.[4] MPS was measured in response to each of the protein doses. Consuming 20 g of protein following resistance exercise resulted in a 93% increase in MPS as compared to not eating. Doubling the amount of protein to 40 g had little to no impact on the rate of new muscle generated and resulted in increased protein oxidation. These results were confirmed in a different study using whey protein.[14] Therefore about 20 g is the right amount of protein for athletes to consume after exercise. Larger athletes may need a little more, smaller athletes a little less. To determine exact protein needs after exercise, the recommendation is 0.25-0.30 g/kg of body weight.[8]

Type: A recovery meal or product should contain a complete protein that is quickly digested and absorbed and rich in the amino acid leucine. A greater and quicker rise of leucine in the blood triggers a greater increase in MPS.[1,8,11]

Whey and soy proteins are both quickly digested at a rate greater than casein.[6] However, whey and casein both have a higher leucine content than soy.[6,11] While soy is a good choice as a protein source throughout the day, research clearly shows whey and milk protein (a blend of whey and casein) are superior to soy in promoting post-exercise muscle protein synthesis[6,13] and result in greater muscle hypertrophy with training.[3] For vegetarian athletes, soy is certainly a better choice than not consuming protein for recovery.

For more information on this topic, please see Sports Science Exchange #107 "Protein Consumption and Resistance Exercise: Maximizing Anabolic Potential" (click to view) by Dr. Stuart Phillips, found at www.gssiweb.org.[8]

Recovery Protein and Training

Regular intake of recovery protein can help improve the results of a training program. A meta-analysis was conducted with 22 randomized controlled trials (680 subjects total).[2] The studies that were included were training programs of at least six weeks using healthy individuals and compared a protein intervention to a placebo control. Compared to the placebo, post-exercise protein consumption during resistance training in young subjects increased fat free mass, cross-sectional area of the type I (slow twitch) and type II (fast twitch) muscle fibers and increased strength measured by 1-repetition maximum leg press. Overall, the benefits of protein consumption for recovery are realized over time in relation to the type of training.

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