Protein Needs for Athletes

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Introduction

How much protein do athletes need on a daily basis? What sources of protein are the best? Are the times that protein is ingested important for gaining lean muscle mass and strength? These are the most pertinent questions that athletes, coaches, and trainers ask on a consistent basis in relation to protein intake. While carbohydrates are the key nutrient for fueling intense training, protein is the key nutrient for maximizing training adaptations (i.e., maintaining and improving muscular strength, endurance, and power) (2, 3). In addition to facilitating training adaptations, proteins are essential components of muscle, cell membranes, hormones, antibodies, enzymes, and many other body tissues and components. The following article will discuss protein needs, sources of dietary protein, and the relatively new science of protein timing as it applies to athletic populations.

Protein Needs

Protein ingestion is associated with the following functions (2, 6, 7, 10, 13, 14, 21):

- Increased rates of protein synthesis
- Increased lean muscle mass accretion
- Improved strength
- Improved recovery from exercise
- Improved immunity
- Decreased musculoskeletal injuries

The health and performance of an athlete is directly related to each of these factors. Therefore, the fact that athletes need dietary protein is not the question, but rather, the pertinent question is related to the quantity of protein that should be ingested on a daily basis for athletes training at a high intensity (such as those engaging in sport-specific practices and resistance exercise programs which can easily accumulate to over 10 hours of intense activity on a weekly basis). The adequacy of dietary protein intake is typically assessed using the nitrogen balance technique. Nitrogen balance is a laboratory technique by which both consumption and excretion of all nitrogen is quantified and the net difference calculated. The amount of protein necessary to elicit balance (when intake equals excretion) is thought to be the dietary requirement (16).

Currently, the RDA for protein in healthy adults is 0.8 g/kg body weight per day (11). The purpose of this recommendation was to account for individual differences in protein metabolism, variations in the biological value of protein, and nitrogen losses in the urine and feces. However, many factors should be considered when determining an optimal amount of dietary protein for training athletes, such as (1):

- Protein quality
- Energy intake
- Carbohydrate intake
- Mode and intensity of exercise
- Timing of protein intake

The current recommended level of protein intake (0.8 g/kg/day) is estimated to be sufficient to meet the needs of nearly all (97.5%) healthy men and women age 19 years and older. This amount of protein intake may be appropriate for non-athletes, but it is likely not sufficient to offset the oxidation of protein/amino acids during exercise training (approximately 1 – 5% of the total energy cost of exercise) nor is it sufficient to provide substrate for lean tissue accretion or for the repair of exercise induced muscle damage (12, 22). In fact, some of the leading research organizations serving athletes have published recommendations that exceed the 0.8 g/kg/day threshold (1, 12, 20).

The National Strength and Conditioning Association recommends athletes consume 1.5 to 2.0 g/kg of body weight of protein to ensure adequate protein intake (20). Athletes involved in moderate amounts of intense training (2 – 3 times per week for 30 – 45 minutes per session) should consume levels at the lower end of this range (110 – 130 grams/day for a 75kg athlete) while athletes involved in high volume intense training should consume levels at the upper end of this range (130 – 150 grams/day for a 75kg athlete) (1). There has not been an abundance of scientific studies investigating the optimal amount of dietary protein intakes for athletes. Of the few well-controlled studies that exist, there is a consistent observation that 0.8 g//kg of body weight is not sufficient for supporting whole body protein synthesis or inducing a positive net protein balance (8, 9, 17 – 19, 23).

Sources

As mentioned above, protein quality is one of the primary factors to consider when considering which types of protein to ingest. When looking at the quality of a protein, the amino acid composition of a protein must be considered. Proteins are primarily classified as complete or incomplete depending on whether or not the protein contains adequate amounts of the essential amino acids. Of the twenty amino acids used to make proteins (skeletal muscle proteins, antibodies, hormones, enzymes, etc.) in the body, eleven are considered nonessential, meaning that the body is able to adequately synthesize them, and 9 are essential, meaning that the body is unable to adequately synthesize them. These essential amino acids, therefore, must be supplied through the diet.

The quality of protein depends on the level at which it provides the essential amino acids needed for overall body health, maintenance, and growth. Animal proteins, such as eggs, cheese, milk, meat, and fish, are considered high-quality, or complete, proteins because they provide sufficient amounts of the essential amino acids in addition to the nonessential amino acids. Plant proteins, such as grain, nuts, corn, and vegetables are lower-quality proteins because many plant proteins lack one or more of the essential amino acids, even though they may contain all of the nonessential amino acids.

An internationally used method known as the protein digestibility corrected amino acids score (PDCAAS) is recognized as the best method of comparing proteins for humans (4). A protein with a PDCAAS of 1.0 indicates that the protein exceeds the essential amino acid requirements of the body and is therefore an excellent source of protein. This method of determining protein quality reveals that soy, egg, and milk proteins (casein and whey) are classified as high-quality proteins. Because these sources of proteins are of the highest quality, it is recommended that athletes consume a majority of their protein from these sources. An attempt should be made to obtain protein requirements from whole foods, but supplemental protein is a safe and convenient method of ingesting high quality dietary protein.

Table 1. Classification of Amino Acids

Essential Amino Acids	Non-Essential Amino Acids
Histidine*	Alanine
Isoleucine	Arginine*
Leucine	Asparagine
Lysine	Aspartic Acid
Methionine	Cysteine
Phenylalanine	Cystine
Threonine	Glutamic Acid
Tryptophan	Glutamine
Valine	Glycine
	Proline
	Serine
	Tyrosine

** Essential in certain cases*

Protein Timing

Over the past 10 – 15 years, there has been a growing body of scientific literature that has consistently demonstrated the importance of ingesting protein soon after resistance exercise in order to maximize protein synthesis rates and lean mass (3, 5, 24 – 26). In a study conducted on United States Marines during basic military training, a post-exercise protein supplement was compared to a non-protein containing supplement (7). At the end of the 54-day trial, researchers reported that the recruits ingesting the protein supplement had an average of 33% fewer total medical visits, including 28% less visits due to bacterial or viral infections, 37% less orthopedic related visits, and 83% less visits due to heat exhaustion. In addition, post-exercise muscle soreness was significantly reduced in subjects ingesting protein when compared to the control groups. It is important to note that most of the scientific investigations have studied protein intake in beverage form rather than in whole food form. Protein digestion and absorption are more rapid in the liquid state. For these digestive reasons and for applying the data that is in the published literature, it is recommended that athletes ingest their protein in beverage form, if possible.

Summary

Protein intake for athletes continues to be an area of active research. The amount and type of protein intake is continually debated by athletes, nutritionists, trainers and coaches. The National Strength and Conditioning Association recommends athletes ingest between 1.5 to 2.0 g/kg of body weight of protein on a daily basis. The exact amount of protein intake is influenced by many factors, including total energy intake, protein quality, carbohydrate intake, mode and intensity of training, and the timing of the protein intake. The types of protein that athletes should attempt to derive their intakes are complete, high-quality proteins. These types of proteins are found in animal proteins (chicken, egg, beef, fish). The proteins found in milk (whey and casein) are two of the most scientifically studied proteins in supplemental form and are of the highest quality. Lastly, the timing of protein intake is also an important consideration for the athlete. Athletes should attempt to ingest high-quality proteins in liquid form as soon as possible following training and/or competition.

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