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Protein Requirements for Athletes

A well-designed diet for an athlete is a combination of proper energy intake, proper timing, along with proper training. An energy deficient diet during training may lead to loss of muscle mass and strength, increased susceptibility to illness, and increased prevalence of overreaching and/or overtraining (7). People who follow a general fitness program can generally meet their nutritional needs with a healthy, well-balanced diet. However, the caloric and protein needs of a highly trained athlete are different and will be discussed here.

Considerable debate ensues regarding the proper intake of protein for athletes. 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 (2). This amount of protein intake may be appropriate for non-exercising individuals, but it is "likely not sufficient to offset the oxidation of protein/amino acids during exercise (approximately 1 – 5% of the total energy cost of exercise)" (2). If an athlete does not ingest sufficient amounts of protein, he or she will maintain a negative nitrogen balance, which can increase protein catabolism and slow recovery (7). Nitrogen balance is quantified by calculating the total amount of dietary protein that enters the body and the total amount of the nitrogen that is excreted (9). Table 1 provides general guidelines for protein and caloric intake based on the level of activity.

It is important to remember that not all protein is the same. Proteins differ based on the source, the amino acid profile and the methods of isolating the protein (7). Great dietary sources of low-fat, high-quality protein are skinless chicken, fish, egg whites and skim milk while the highest quality supplemental sources are whey, colostrum, casein, milk proteins and egg protein (7). The Food and Agriculture Organization (FAO) established a method for determining the quality of a protein source by "utilizing the amino acid composition of a test protein relative to a reference amino acid pattern and then correcting for differences in protein digestibility," (4).

Two of the most widely used protein supplements are casein and whey, which can both be found in milk products. Research has demonstrated that "whey protein elicits a sharp, rapid increase of plasma amino acids following ingestion, while the consumption of casein induces a moderate, prolonged increase in plasma amino acids that was sustained over a 7-hour postprandial time period," (1). The International Society of Sports Nutrition (ISSN) recommends that athletes obtain protein through whole foods, and when supplements are ingested they should contain both casein and whey "due to their ability to increase muscle protein accretion," (2).

While casein and whey have been found to be beneficial, other research exists to support the benefits of leucine. Approximately one third of skeletal muscle protein is made up of the branched-chain amino acids (BCAA) leucine, isoleucine and valine (8). Research suggests that of these three, leucine plays the most significant role in stimulating protein synthesis (5). Therefore, supplementation of branched-chain amino acids may be beneficial to athletes.

Researchers at the Department of Human Biology at Maastricht University in the Netherlands, conducted a study to determine post-exercise muscle protein synthesis and whole body protein balance following the combined ingestion of carbohydrates with or without protein and/or free leucine (6). Eight male subjects were randomly assigned to three trials in which they consumed drinks containing carbohydrates, carbohydrates/protein, or carbohydrates/protein/leucine following 45mins of resistance exercise. Results of the study showed that whole body protein breakdown rates were lower, and whole body protein synthesis rates were higher in the carbohydrate/protein and carbohydrates/protein/leucine trials compared with the carbohydrate trial. The addition of leucine resulted in a lower protein oxidation rate compared with the carbohydrate/protein trial. The study concluded that co-ingestion of protein and leucine stimulates muscle

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Table 1. Caloric and Protein Intake Guidelines

Activity Level	Caloric intake	Protein intake
General activity	25 – 35 kcals/kg/day	0.8 – 1.0 g/kg/day
Strength training athletes	50 – 80 kcals/kg/day	1.4 – 1.8+ g/kg/day
Endurance athletes	150 – 200 kcals/kg/day	1.2 –1.4 g/kg/day

Source: The Position Statement from the Dietitians of Canada, the American Dietetic Association, and the American College of Sports Medicine, Canadian Journal of Dietetic Practice and Research in the Winter of 2000, 61(4):176-192 (3).

protein synthesis and optimizes whole body protein balance compared with the intake of carbohydrates only (6).

BCAA supplementation has been shown to be particularly beneficial during aerobic exercise because of an increase in the free tryptophan/BCAA ratio (5). During prolonged aerobic exercise, the amount of free tryptophan increases and therefore the amount of tryptophan entering the brain increases, resulting in fatigue (5). BCAAs are transported to the brain through the same carrier as tryptophan, so when BCAAs are present in the plasma, in significant amounts, they may decrease the amount of tryptophan reaching the brain, therefore decreasing feelings of fatigue (2). It has been suggested that the recommended daily allowance (RDA) for leucine alone should be 45 mg/kg/day for sedentary individuals, and even higher for active individuals (8). A deficiency in BCAA intake from whole foods can be supplemented by consuming whey protein (2).

In conclusion, major organizations recommend athletes consume more than the RDA for protein, approximately 1.4 – 2.0 g/kg of body weight/d (2,4). Every attempt to obtain protein from whole foods is ideal; however supplementation is a safe way of obtaining the needed amounts of protein when necessary. ■

References

1. Boirie Y, Dangin M, Gachon P, Vasson MP, Maubois JL, and Beaufrere, B. Slow and fast dietary proteins differently modulate postprandial protein accretion. Proceedings of the National Academy of Sciences of the United States of America 94(26): 14930 – 5, 1997.

2. Campbell, B, Kredier, R, Ziegenfuss, T. et al. International Society of Sports Nutrition position stand: Protein and exercise. *Journal of the International Society of Sports Nutrition* 4(8), 2007.

3. The Position Statement from the Dietitians of Canada, the American Dietetic Association, and the American College of Sports Medicine. *Canadian Journal of Dietetic Practice and Research* 61(4): 176 – 192, 2000.

4. Darragh, A, and Hodgkinson, S. Quantifying the digestibility of dietary protein. *The Journal of Nutrition* 130: 1850S – 1856S, 2000.

5. Kimball, SR, and Jefferson, LS. Signaling pathways and molecular mechanisms through which branched-chain amino acids mediate translational control of protein synthesis. *Journal of Nutrition* 136(1 Suppl): 227S – 31S, 2006.

6. Koopman R, Wagenmakers AJ, et al. Combined ingestion of protein and free leucine with carbohydrate increases post-exercise muscle protein synthesis in vivo in male subjects. *American Journal of Physiology Endocrinology and Metabolism* 288(4): E645 – 53, 2005.

7. Kreider, RB, Wilborn, CD, Taylor, L, Cambpell, B, et al. ISSN exercise & sport nutrition review: Research & recommendations. *Journal of the International Society of Sports Nutrition* 7(7.2), 2010.

8. Leucine supplementation and intensive training. *Sports Medicine*. 27(6): 347 – 58, 1999.

9. Rand WM, Pellett, PL, and Young, VR. Meta-analysis of nitrogen balance studies for estimating protein requirements in healthy adults. *American Journal of Clinical Nutrition* 77(1): 109 – 27, 2003.