1. **Do athletes and very physically active people have higher protein requirements?**

   Yes, athletes in heavy training require, on average, 50% more protein than casual athletes. Depending on exercise intensity, duration and frequency and protein quality, athletes need anywhere from 1.0-1.8 grams of protein per kilogram of body weight per day. The needs of some athletes may be even higher. Protein needs can be met by choosing 3 servings from the meat and meat substitute group and 3 servings from the milk and milk products group of the food pyramid. This would supply approximately 70 grams of protein. Recommended servings of grains, fruits and vegetables will provide an additional 40 grams of protein. Thus, such an eating pattern would provide a total of about 110 grams of protein, which for a 70 kg athlete comes out to about 1.57 grams of protein/kg of body weight. For taller and heavier athletes, an extra serving or two from the protein rich food groups will assure adequate protein intake.

   Ingested protein contains nitrogen which is a necessary constituent of the diet. If protein intake is questionable, deficiency is usually a function of a lack of total nitrogen rather than a deficiency in any of the essential amino acids. However, a chronic, incomplete balance of essential amino acids can contribute to a loss of nitrogen.

2. **What other factors determine protein requirements?**

   Total energy intake is important in determining protein needs. The body will meet its energy needs first, even if that means using protein for energy because other energy supplying nutrients are in short supply. For athletes trying to lose weight, it is especially important to maintain an adequate protein intake while reducing fat intake. Training status also influences protein requirements. A person just beginning an intense training regimen will have a higher requirement than a highly trained person. A trained body is able to burn more fat as fuel, sparing glycogen, and requiring protein for muscle tissue growth and repair. In the unfit, individual, more protein will be broken down and used as fuel since glycogen will be used up more quickly.

   Ambient temperature also affects protein utilization, as does training at high altitudes, and may increase protein requirements. In general, when glycogen is used up more quickly or is less available, there will be increased protein utilization, leading to an increased dietary requirement.

3. **Do athletes and very physically active people need to consume more protein?**

   Sometimes. The answer to this question depends on the athlete's diet. If the person is consuming a typical American diet where protein needs of a sedentary person are often met two-fold, then the answer is no. If the athlete gets most or all of their protein from vegetable sources or tends to eat very few animal products then the answer is yes.

4. **What are amino acids?**

   Amino acids are the molecules that make up protein. There are eight essential amino acids that the body cannot synthesize. There are four semi-essential amino acids, which, when present in the diet, reduce the need for an essential amino acid. Foods containing balanced amounts of essential amino acids are considered to have proteins that are "complete." If an essential amino acid is missing from the diet, or if the proportions of amino acids are unbalanced, protein synthesis is impaired.

5. **Which foods have the most complete proteins?**

   Animal protein has the best balance of amino acids, and eggs have the most complementary amino acid profile.

   The biological value of egg protein is 93.7%, higher than any other natural food. Biological value is a measurement of protein quality expressing the rate of efficiency with which protein is used for growth.

6. **What if I'm vegetarian?**

   Nearly all vegetable proteins from singular sources, except soy, are deficient in one or more of the essential amino acids. Vegetarian protein sources should be combined, such as legumes with either whole grains, nuts or seeds, to make the proteins more complementary. However, to meet a given protein need that is also complete, larger amounts (greater caloric value and volume) of vegetable protein sources need to be eaten compared to lowfat animal protein sources.

7. **Are there specific amino acids that need special attention?**

   Yes, although all 8 essential amino acids in appropriate amounts and combinations are important, there are three that are especially important in the athlete's diet. They are leucine, isoleucine, and valine, which are more often used as a source of energy than other essential amino acids, especially when glycogen levels are low. These amino acids are readily available in animal proteins. The average 70 kg male athlete needs about 3 grams of these branched chain amino acids per day. This can be met by a 3 oz. serving of meat, eggs (1.3 grams per large egg or 2.7 grams for one large egg and 2 egg whites), skim milk (1.3 grams per cup), or 1 cup of pasta in combination with 1 cup of cooked beans.

8. **Will my health or performance be affected if I'm deficient in these or other essential amino acids?**

   Yes, muscle wasting, suppression of the immune system, weakness, fatigue and moodiness can result.
How can I make sure I get adequate protein when training hard?

Eat a well balanced diet high in complex carbohydrates and adequate in protein. Three balanced meals a day should include adequate amounts of all 8 essential amino acids. This requires eating protein from animal sources and/or complementary vegetarian sources. The sample menu provides ample protein for a 70 kg athlete for a day.

**Breakfast** (sandwich) 1 egg + 2 egg whites, 1 oz. lowfat cheese, one 3 oz. bagel, 1/2 cup fruit salad w/ 2 tsp. of yogurt.

**Lunch** 1 cup beans (pinto, black, etc.), 1 cup brown rice, 5 whole grain crackers, 1 cup salad with garden vegetables, sunflower seeds and chik peas, 1 cup fruit yogurt.

**Dinner** 3 oz. meat (ham, turkey, tuna, etc.), a roll, 3/4 cup broccoli, 3/4 cup apple sauce, 3 small boiled red potatoes, 1 cup skim milk, 2 graham crackers w/ 1 tsp. peanut butter.

Does the timing of protein intake make a difference?

Yes, it all boils down to eating balanced meals throughout the day. Protein synthesis is optimal when all essential amino acids are present in a single meal. Thus, a good rule of thumb for any athlete is to include a lowfat source of complete protein at every meal.

It is important to spread out the daily protein that is ingested among at least three meals since protein cannot be "stored" for later use. In fact, if more protein is ingested at a particular meal than can be used for protein synthesis at that time, it will be used or stored as energy.

Are amino acid supplements necessary?

Under normal circumstances, the answer is no. If for some reason a person was unable to chew (as would be the case after dental or jaw surgery) and was unable to drink milk, then amino acid supplements in a beverage form may be of benefit. To ensure a balanced intake of the micronutrients—vitamins and minerals—it is best to rely on whole foods for protein needs. Any athlete who follows the recommendations discussed in this review will easily meet their protein needs from foods. However, if an athlete is a vegetarian (no animal foods of any sort) protein rich sports bars and other supplements may be of benefit.

As far as muscle development and strength are concerned, additional protein beyond the increased requirement, dictated by energy expenditure and tissue synthesis, will be of no benefit. Hard work and proper training techniques develop muscles and strength, not special amino acid supplements.

If you would like additional information on this topic, write to the Egg Nutrition Center for a more detailed review titled "What About Protein?"

**REFERENCES**