



The Triathlete's Ultimate Guide to Protein

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Protein's popularity is at an all-time high. Many athletes have implemented high protein diets as means to shed excess body fat and thereby improve performance. Other athletes have increased protein intake with the thought that the additional protein will help build strength and power. Will protein help aid performance? Some studies suggest that protein does, in fact, help aid performance if utilized correctly. This article will explore the proper quantities of protein and dosing patterns needed to help optimize health and enhance triathlon performance.

What is Protein?

In Greek, protein means "to take first place," a feat many of us in the triathlon world would like to accomplish. Scientifically speaking, proteins are large, complex molecules that make up 20% of our body weight in the form of muscle, bone, cartilage, skin, as well as other tissues and body fluids. During digestion, protein is broken down into at least 100 individual chemical building blocks known as amino acids that form a little pool within our liver and are used to build muscle, skin, hair, nails, eyes, hormones, enzymes, antibodies, and nerve chemicals. Inadequate protein intake leads to a dehydrated amino acid pool and consequent breakdown of healthy cells without repair, ultimately leading to elevated injury risk, slowed recovery time, and increased feelings of lethargy. Furthermore, recent research indicates a low protein intake is also associated with increased risk for stress fractures and osteoporosis, a disease that is becoming increasingly apparent among the female gender. On the flipside, excessive protein intake can cause the amino acid pool to overflow, ultimately leading to other health problems such as diminished kidney function, calcium excretion, and dehydration. Therefore, finding an appropriate protein intake for your athletic needs is not only essential to beat out your opponent, but it also will play a huge role in your overall health and wellbeing.

Determining Daily Protein Needs

Protein needs will vary from athlete to athlete depending on lean body weight and activity level. In addition, triathletes who follow a vegetarian lifestyle and women athletes who are pregnant or lactating require additional amounts of protein to prevent catabolism of lean body mass. Most triathletes require approximately 0.50-0.80 grams of daily protein per pound of lean body weight to support growth, repair, and development of cells during training (see table 1). For most, this equates out to be 2-4 servings of dairy (1 serving = 1 cup milk, 1 cup yogurt, 1.5 ounce cheese) and 5-9 ounces of meat/meat alternative per day or approximately 10-20% of total calorie intake.

Table 1. Determining Protein Needs

*Lean Body Weight (lbs) \ Protein (grams)	90	95	100	110	120	130	140	150	160	170	180	190	200
0.50 grams ¹	45	48	50	55	60	65	70	75	80	85	90	95	100
0.60 grams ²	54	57	60	66	72	78	84	90	96	102	108	114	120
0.70 grams ³	63	67	70	77	84	91	98	105	112	119	126	133	140
0.80 grams ⁴	72	76	80	88	96	104	112	120	128	128	144	152	160

1. Appropriate daily protein consumption for moderate-intensity endurance training lasting up to 1 hour.
2. Appropriate daily protein consumption for moderate intensity endurance training lasting 1-2 hours.
3. Appropriate daily protein consumption for moderate intensity endurance training lasting 2-3 hours.
4. Appropriate daily protein consumption for moderate intensity endurance training lasting 3+ hours.

*Lean body weight can be determined by having body fat tested via skin-fold analysis, hydrostatic weighing, or DEXA (dual X-ray absorption). Most health clubs and universities provide body fat testing.

The Vegetarian Athlete

Protein is perhaps the most recognized nutrient of concern in vegetarian athletes due to the incomplete nature and reduced digestibility of most plant sources of protein. With the exception of soybeans, milk, and egg whites, other vegetarian based foods lack all the essential amino acids necessary for maximal tissue growth and repair. Most vegetarian based foods need to be combined to attain all the essential amino acids; for example, tortillas and beans, rice and lentils, peanuts and wheat bread. The World Health Organization suggests that vegetarian endurance athletes consume 110% of their calculated protein requirement because of the reduced protein digestibility of plant foods, which is attributable to the high fiber content of the diet. Vegetarian diets providing adequate energy and a variety of protein-containing plant foods will supply all the essential amino acids needed for efficient protein metabolism, thereby enhancing recovery from exercise and helping to prevent muscular injury.

Protein During Pregnancy and Lactation

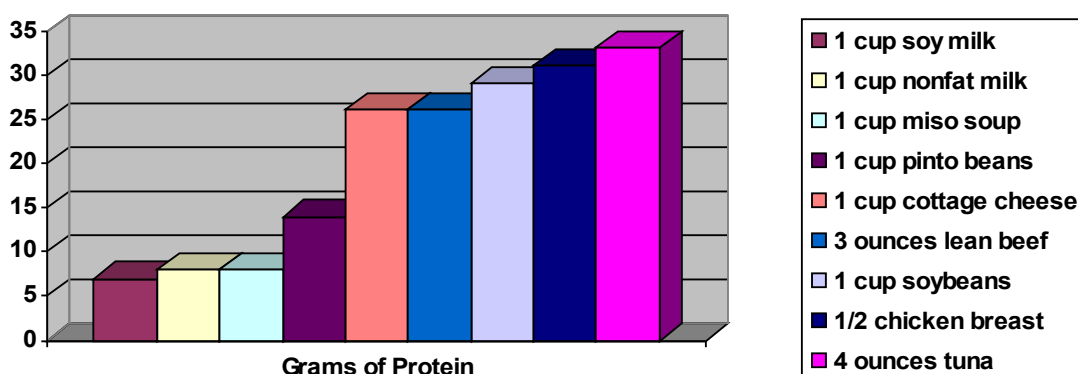
Because protein is required for all growth processes, women athletes require additional protein when pregnant and lactating. In fact, there is profound evidence that women who eat too little protein during pregnancy run a higher risk of having a low-birth weight baby who will be more susceptible to heart disease and diabetes later in life. Women who maintain a low level of activity during pregnancy or lactation are recommended to add six to ten extra grams of protein per day, which is equivalent to about 2 Tbsp of nut butter, 1 cup of nonfat milk, 1 piece of string cheese, or ½

cup beans.

Finding Protein in Food

Just like carbohydrate and fat, not all protein sources are created equal. Powerhouse protein sources, aka “complete” proteins, are those that provide you with all 20 amino acids necessary to rebuild and repair damaged tissue. Complete protein sources are found in such animal foods as chicken, turkey, fish, egg, milk as well as soy foods. In contrast, many vegetarian protein sources, including legumes and nuts, are missing several of the necessary amino acids needed to build. Fortunately, research has shown that by including a variety of plant-based foods, such as beans and grains, throughout the day, these missing amino acids will be accounted for. As a general rule, aim at filling 25% of each meal plate with a quality protein source (see table 2 for examples), with another 25% being fulfilled by a healthy starch (potato, whole wheat pasta, brown rice, 100% whole grain bread) and the remaining 50% being filled with colorful fruits and vegetables.

Table 2. Good Sources of Protein



Protein Use During Training

Triathletes are accustomed to viewing carbohydrate, rather than protein, as the “exercise macronutrient”. While carbohydrate, primarily in the form of muscle glycogen, supplies the majority of fuel during high intensity training, amino acids, which are supplied via breakdown of muscle protein, start to contribute an increasing amount of energy during prolonged endurance activity. In fact, during extended exercise, up to 15% of the working muscles' total energy needs may come from protein. In the absence of additional protein consumption, this energy comes from the breakdown of muscle protein. This can lead to significant net muscle protein loss during workouts and create a greater need for rebuilding and repairing muscle protein following exercise. With this breakdown of muscle protein and consequent depletion of the amino acid pool, an athlete becomes increasingly susceptible to muscle injury and slowed recovery.

Furthermore, a key reason why protein may be effective in enhancing endurance is its ability to stimulate insulin, a hormone responsible for transferring carbohydrate from the blood into the muscles, where it can be converted to energy. When carbohydrate is consumed, insulin levels increase, resulting in greater transfer of carbohydrate into the muscles and an increase in endurance. However, when carbohydrate is consumed with protein, the transfer of carbohydrate into the muscles may become even more efficient, helping to spare muscle glycogen and enhance endurance as well as prevent muscle breakdown which otherwise would initiate muscle soreness and delayed recovery.

The Research

In order to determine the effectiveness of protein on endurance performance and muscle recovery, sports scientists have conducted a multitude of research studies over the past 5-10 years. In particular, the scientists looked at how consumption of protein while in the act of endurance activity affected performance as well as how consumption of protein affected muscle recovery post-activity. Table 3 displays how the research presented below can be implemented into your training routine.

Use of Protein During Endurance Activity

The most dramatic proof of protein's benefits in a sports drink was shown in a study conducted at the University of Texas. Researchers compared the effects of a conventional 7.75% carbohydrate sports drink and a carbohydrate-protein sports drink containing the same amount of calories in cyclists during exercise of variable intensity. This was followed by a high-intensity cycling bout to exhaustion. The sports drink containing carbohydrate and protein in a 4:1 ratio increased endurance 24 percent more than the carbohydrate sports drink and 57 percent more than water¹.

Exercise physiologists at Springfield College in Massachusetts reported similar results with a protein-containing sports drink. They compared the effect of a carbohydrate-only sports drink to a carbohydrate-protein sports drink with respect to their ability to help athletes meet the demands of two-a-day workouts or multiple events or competitions in the same day.

Following a treadmill run of moderate to high intensity, the subjects consumed either a carbohydrate drink or a carbohydrate-protein drink during a 60-minute recovery period. This was followed by a high-intensity treadmill run to exhaustion. The subjects in the carbohydrate-protein group were able to run 20% longer than the subjects receiving the carbohydrate drink².

The key factor associated with extended endurance appears to be insulin. Insulin levels, measured by the Springfield College researchers, were twice as high in the carbohydrate-protein group as in the carbohydrate group. The authors concluded that the carbohydrate/protein drink induced a greater rate of muscle glycogen replenishment than a carbohydrate-only drink, which translated into improved exercise endurance during a second bout of exercise performed on the same day.

Use of Protein Post-Training

In a study performed by researchers at the Vanderbilt University Medical Center, subjects were fed a placebo, a carbohydrate drink, or a carbohydrate-protein drink after 60 minutes of cycling. Protein synthesis was measured three hours later. There was no difference between the placebo and the carbohydrate drink in terms of protein synthesis. But the carbohydrate-protein supplement increased protein synthesis in leg muscle six-fold³, thereby enhancing repair of muscle protein and speeding recovery time. Another recently published study found that a carbohydrate-protein sports drink taken after exercise enhanced muscle protein synthesis 38% more than a protein shake⁴, which was attributable to enhanced stimulation of insulin.

Table 3. Applying the Research on Protein

**Recommendations for
Carbohydrate and Protein
Use During Endurance
Training**

For every hour beyond 90 minutes of training, aim at consuming ½ gram carbohydrate and up to 1/8 gram of protein per pound of lean body weight.

Sports Drinks/Foods Containing Protein and/or Amino Acids:
Accelerade, Spiz, Powerbar, Clif Bar, Metabol Endurance Formula,
Power Gel, Champion Nutrition Revenge Pro

**Recommendations for
Carbohydrate and Protein
Use Post Endurance Training**

Within 30 minutes after completion, aim at consuming approximately ½ gram of carbohydrate and 1/8 grams of protein per pound of lean body weight.

Sample Recovery Foods: Endurox R4 Recovery Drink, Low-Fat chocolate milk, smoothie with protein boost, bagel with peanut butter, meal replacement shake.

Case Study

Fred is a 150 pound male triathlete with 10% body fat. He has a history of premature depletion of muscle glycogen, aka “the wall” during endurance activity and slow recovery times. Therefore, his main goals this upcoming season are to 1) prevent the “wall” and 2) enhance recovery from training.

Training Protocol: Based on a lean body weight of 135 pounds, Fred requires ~68 grams of carbohydrate and ~17 grams of protein each hour beyond 90 minutes of training. In order to meet his unique needs, Fred could drink 24 ounces of Accelerade (52 grams carbohydrate, 13 grams protein) in combination with 1/3 Powerbar (~15-16 grams carbohydrate, ~3-4 grams protein) washed down with 8 ounces of water.

Recovery Protocol: Within 30 minutes after training, Fred should aim at consuming 68 grams of carbohydrate and 17 grams of protein. For example, Fred could consume a 3 ounce bagel spread with 1 Tbsp of peanut butter and 1 cup low-fat chocolate milk.

Summary

Protein has rightfully received increased attention by sports scientists as well as endurance athletes. Ensuring that adequate amounts of protein are consumed each day to meet individual training demands and lifestyle changes (vegetarianism, pregnancy and lactation) will prevent unwanted catabolism of lean body mass, thereby enhancing recovery from hard training. In addition, it is clear that protein in the right combination with carbohydrate can offer triathletes significant benefits in terms of endurance as well as preservation and rebuilding of muscle protein. Current research indicates that endurance athletes training greater than 90 minutes will benefit from consuming a 4:1 ratio of carbohydrates to protein, which equates out to be an hourly replacement rate of approximately ½ gram of carbohydrate and up to 1/8 gram of protein per pound of lean body weight each hour beyond the 90 minute mark of endurance training as well as within 30 minutes post training.

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