

Powerful Influence: The Truth about Protein and Muscle Building

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Every athlete looks for that competitive edge to be stronger, faster, better. Some will work harder, some will lose weight, while others will supplement with protein. Protein has the reputation of being muscle promoting. Pick up any body building magazine and they will have you convinced that protein is the magic bullet. While it is true that protein is a major component of muscle, simply eating more protein will not guarantee a sculpted physique. Indeed, athletes and non-athletes need protein in their diet to remain healthy. However, the need for additional protein is overblown.

A quick review of human metabolism provides the background to understand the real role of protein in the human body. Protein is composed of twenty different amino acids. Each amino acid contains a nitrogen group and a distinguishing side group. Food can provide us with all twenty different amino acids. Imagine these amino acids as letters in the alphabet (except there are only twenty letters in this alphabet). Depending on the sequencing of the letters, millions of different words can be created. Just as they are in your body, these twenty amino acids are sequenced to make (spell) everything like enzymes, antibodies, blood components, hormones, tissues and even muscles. Your DNA provides the blueprint to make (spell) every component in your body. When a letter is not available, the production of that word comes to a complete halt. This may be problematic, as the word is needed to make a sentence (cell) which is needed to make a paragraph (tissue) and so on. Unfortunately, our body cannot interpret text messages or short hand. Each word must be spelled out perfectly for it to be recognized.

Of the twenty amino acids, nine (histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, valine) are *essential* meaning that your body cannot make them (or make them fast enough to meet your needs) and you must obtain them from the foods you eat. Using the alphabet analogy, consider the essential amino acids as the vowels. The other eleven amino acids are *non-essential* meaning that your body can make them (if there is sufficient nitrogen available in your body). Consider the non-essential ones as the consonant letters. Animal products provide all the essential amino acids your body needs. Therefore, foods like dairy, eggs, poultry, meats, fish, and seafood all contain essential amino acids in sufficient amounts. These foods are also known as *high quality* or *complete protein*. Certain plant food, such as soy, also contains all the essential amino acids. Unlike animal products, other plant food contains some combination of the essential amino acids but may be lacking in one or more. Because of these missing components, plant foods are called *low quality* or *incomplete protein*. Each plant's amino acid profile is different. However, by eating a variety of plant foods, you will still be able to obtain all the essential amino acids.

When you eat a protein, it will not remain that same protein after digestion. The process of digestion will breakdown the protein (word) into its individual amino acids (letters). The individual amino acids (letters) will be absorbed by the body and picked up by various cells that need them (to spell a word that they need to create). Therefore the idea that eating a certain food can cause some type of effect or reaction in the body is a fallacy. This is the whole reason why insulin cannot be given orally to a diabetic. The digestive system will break down insulin to the individual amino acids used to make(spell) insulin. Once inside the body, the cells will use the amino acids as they please. Therefore to bypass the digestive process, insulin is given as an injection (right into the bloodstream).

Currently, the typical American consumes more protein than the body needs. The excess protein consumed is not converted to muscle as evidenced by the current obesity epidemic. What happens to the excess protein consumed? Any amino acids (essential or not) not used by the body will be broken down first by removing the nitrogen group (this becomes ammonia) and the side group will be stored as fat. In addition, ammonia is very toxic to the body—even in the slightest amount. The body (specifically the kidney) has to convert the ammonia to a less toxic substance called urea and excrete it out via the urine. Therefore, eating excessive amount of protein will not cause weight loss or build more muscle mass. It simply puts a heavier load on the kidney to “detoxify” the ammonia. In addition, there needs to be an intake of sufficient fluid to make urine in order to excrete the urea. As a result, a high protein diet requires higher fluid intake.

The following Figures summarize what occurs with different levels of protein intake. Figure 1 shows an ideal and balanced intake of the three energy providing nutrients (carbohydrate, protein, and fat). The main function of carbohydrates is to provide energy to all of your living cells. (This is very important. Without the energy, your cells would die). The main function of protein is to provide the building blocks (amino acids or *letters*) needed to synthesize/repair tissues (make *words*). Tissue synthesis and repair occurs on a daily basis. Everyday new skin cells, tissues, digestive enzymes, hormones, etc. are created. These processes require amino acids. However, in times of need, certain amino acids will be used to produce energy. Fat can be broken down for energy when needed or remain as fat for storage. The main priority for the body is to provide energy. Every other function becomes secondary. When there is sufficient carbohydrate intake, then protein can do what it is suppose to do—tissue synthesis/repair. However, if there are not enough carbohydrates in the diet, then tissue synthesis will be limited because certain amino acids are redirected to make energy (with the release of ammonia). Recall that tissue synthesis (or spelling of certain words) will not occur unless all the necessary amino acids (*letters*) are available. This means even if one letter is missing, that “word” will not be created. Eventually the body will take the leftover (unused) *letters* and convert them into fat (with the release of ammonia). Fat will then be used to help meet the energy need that could not be met by carbohydrate and protein (see Figure 2). When there is an excessive amount of protein consumed (with adequate carbohydrate intake), the amino acids will be used for tissue synthesis, however, the excess amino acids will be broken down (leading to an increase

in ammonia level and extra work from the kidneys to detoxify and excrete it) and stored as fat (see Figure 3).

Figure 1: Ideal/normal intake

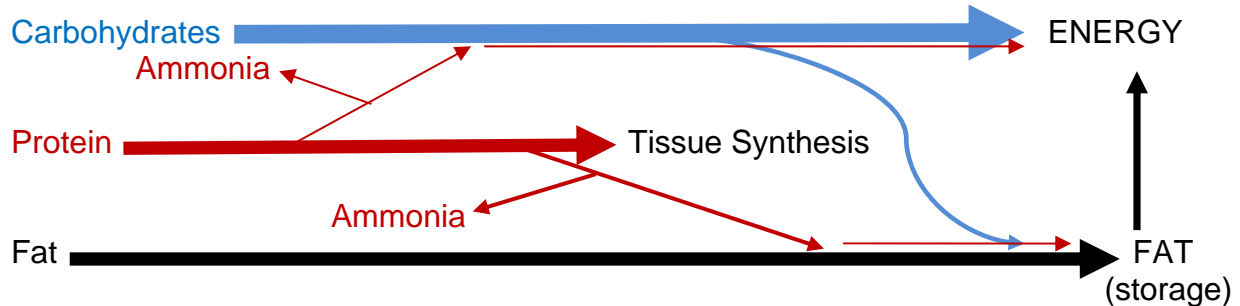


Figure 2: Low carbohydrate, moderate protein intake

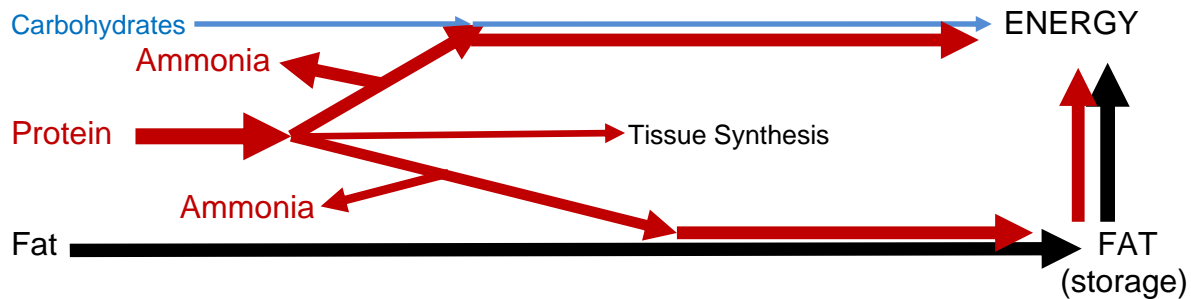
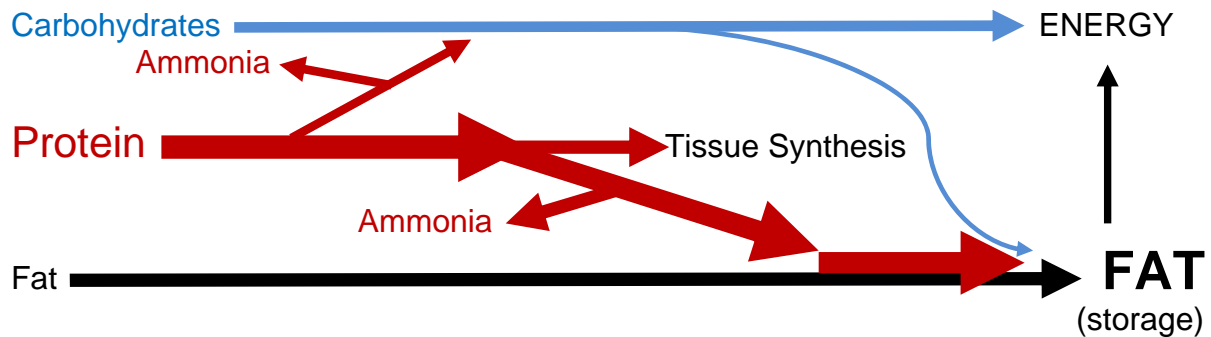


Figure 3: High protein, moderate carbohydrate intake



The bottom line is that when there is an excess consumption of any one or more of the energy providing nutrient (carbohydrates, protein, or fat), the result will be more fat synthesis in the body. In other words, when you eat more than your body needs, the excess will be stored as fat.

For a healthy adult, the most common formula for recommended protein intake is 0.8 grams of protein/kilogram of healthy body weight per day. Researchers measured the nitrogen balance, that is the amount of nitrogen (protein) consumed compared to the amount of nitrogen excreted (e.g., urea in urine). Using this equation, an individual who weighs 150 pounds will need 54 grams of protein a day to attain equilibrium. A

piece of meat, the size of a deck of cards, contains 21-28 grams of protein. (Eating two deck of cards size of meat would provide ~56 grams of high quality protein and would exceed the individual's protein need for the day.) A cup of milk or yogurt provides 8 grams of protein. Along with random proteins from grains and other plant foods eaten throughout the day—it makes it is easy to reach 54 grams of protein.

So how does this tie to muscle? Tissue synthesis includes the building (and repair) of muscle. Certainly eating protein provides the building blocks needed to allow tissue synthesis to occur. Again, eating more protein does not mean the attainment of more muscle. However, when you add physical activity into the mix, you cause an increased demand for tissue synthesis. This is most evident with resistance and endurance activities. These activities increase the muscle protein turnover and in turn, increase the demand for more protein from food (compared to a non-active individual) to repair and build. This is the anabolic effect of physical exercise. Studies have shown that eating some amount of protein pre- or post- (30-60 minutes before or after) workout is effective in promoting muscle mass gains. The amount of protein needed to meet the body's anabolic needs is 1.4-1.8 grams of protein/kilogram of body weight per day. For the same 150 pound individual, this means upping the protein intake to 95-122 grams of protein a day. Anything more than this does not appear to support more muscle synthesis. Ironically, this range of protein is similar to what is currently being consumed by the average non-athletic adult. Supplementing with protein powder is clearly not needed. Taking in more protein will lead to the scenario displayed in Figure 3.

It is important to remember with physical activity the total energy burned is higher, therefore calories/energy needs must be met to prevent weight loss (unless that is the goal). It is also important to remember the need to maintain an adequate amount of carbohydrates to provide energy without having to use protein as an energy source (as shown in Figure 2). This will allow the protein to be used for tissue synthesis/repair.

Next time you pick up a bodybuilding magazine promoting a protein supplement or higher protein intakes, just recall human metabolism. Taking in excessive amount of protein will not make you buff. While it is true that athletes participating in resistance or endurance activities require more protein, the amount can be easily met with real food and a normal diet. Working out regularly and eating a balanced diet with sufficient protein and carbohydrates are what will help you to boost or maintain your muscle mass.

References:

Fulgoni, VL. *Current protein intake in American: analysis of the National Health and Nutrition Examination Survey, 2003-2004*. Protein Summit 2007: Exploring the Impact of High-Quality Protein on Optimal Health. Am J Clin Nutr. Vol 87, No. 5, 1554S-1557S. May 2008.

Griffin, TL. *Research from Munich Nutrition Conference: Protein and Gains in Muscle Mass*. Powerbar Sports. April 10, 2010.

[http://www.powerbar.com/articles/361/Research from Munich Nutrition Conference Protein and Gains in Muscle Mass.aspx](http://www.powerbar.com/articles/361/Research%20from%20Munich%20Nutrition%20Conference%20Protein%20and%20Gains%20in%20Muscle%20Mass.aspx).

Lemon, PW., Tarnoplsky, MA, MacDougall, JD, Atkinson, SA. *Protein requirements and muscle mass/strength changes during intensive training in novice bodybuilders*. J Applied Physiology. Vol. 72, No. 2, 767-775. 1992.

Whitney, E., Rolfes, S. *Understanding Nutrition, 11th ed.* Thomson-Wadsworth Publishing, 2007.