The Doctor is in .... the Water

By Brian Goldman, MD

Protein

Have you ever gotten into a conversation about nutrition with the myriad dietary experts at the gym or the pool? Invariably the issue of relative benefits of carbohydrates and protein are broached and the evils of saturated fats and trans fatty acids are avoided (since they are usually associated with diets high in fat and animal protein). One thing that is not spoken too loudly (in order to avoid conflict and to promote harmonious lane relations) is that meat is not necessarily the only good thing for muscles. The focus for decades in competitive athletics is that we need protein, and that protein must come from meat. In addition we need lots of it, more than is essential for our basic bodily functions. Without additional animal- protein we will not excel in our sport, get as strong as that guy who always seems to win the 50 free or that girl who kicks our butt in the 100 IM. Well, I am here today to tell you that a lot of what we are fed in the lay sports nutritional press is not accurate. We do need protein but it does not have to come from animals. In addition, we need some protein, but not as much as we may think.
Let me lead you down the lane in this edition of The Doctor is in…the water. Don't draft too closely, though, as I am prone to stopping for frequent wall breaks.

What are Proteins?

Proteins are compounds composed of subunits called ***amino acids***. Amino acids are linked together by peptide bonds to form long chains that twist and turn into three dimensional-shaped structures depending on the order of the amino acids. There are over fifty thousand different protein-containing compounds in the body formed from different combinations of just 20 amino acids.

Twenty amino acids exist. These are formed from carbon, hydrogen and oxygen just like fats and carbohydrates. In addition they have other elements like nitrogen, sulfur, phosphorus, cobalt and iron. They can be classified as ***essential*** if they cannot be made in the human body and therefore must be obtained through diet and ***nonessential*** if they can be made in the body. There are eight essential amino acids.

All amino acids can be found in both plants and animals; they are physiologically equivalent. That means that an amino acid obtained from a plant source is biologically equivalent, just as nutritious, as the same amino acid found from an animal source.

Proteins found in eggs, milk meat fish and poultry have the highest amounts of all of the amino acids. In addition, they are packaged with saturated fatty acids and cholesterol. Vegetables such as lentils, dried beans, peas, nuts, cereals have one or more essential amino acids. By eating a variety of grains, fruits and vegetables you can supply all of the amino acids necessary to sustain yourself and support your swimming habit.

Protein in our body

Protein can be found in the body as skeletal muscle. 60-75% of all protein in the body is located in the skeletal muscle. Protein can be used to form other compounds like hormones. Protein is used as fuel for gluconeogenesis. Recall gluconeogenesis is the process where the body makes glucose molecules for energy use. Protein can also be converted to triglycerides for storage in fat cells called adipocytes.

Recommended protein intake

Little benefit comes from eating excessive protein. Muscle mass does not increase simply by eating high protein food.
The diets of endurance and resistance trained athletes often exceed 2-3x the recommended intake, usually as meat. This is because the athlete's diet normally emphasizes high-protein food.

As a result, excessive dietary protein is broken down and metabolized directly for energy or is recycled to become components of other molecules such as fat.
Elimination of excessive dietary protein intake can trigger harmful side effects including strained liver and kidney function.

Current recommendations for dietary intake of protein

For the average adult protein should equal approximately 0.83 g of protein per kg of body mass.
(Let's take, for example, a 70-kg/154 lb person. His daily protein needs would be 70 kg x 0.83 g of protein/kg body mass = 58.1 grams. That is approximately 2 ounces of protein if you convert 1 gram of protein to ounces where 1 gram = approximately 0.035 ounces.) The amount needed is higher for infants and pregnant or nursing women.
If protein is from plants alone the amount can be increased by 10% due to dietary fiber's effect in reducing the digestibility of many plant based protein sources.
Protein needs will go up with stress, disease and injury.

Athletes may need a larger amount: 1.2 to 1.8 g of protein/kg of body mass. For the 154 lb swimmer, the recommended daily amount of protein would go up to 3 to 4.4 ounces.

Nitrogen balance

Nitrogen is found in protein. The concept of balance is important in management of our body's resources for everything from oxygen, water and electrolytes to nitrogen and more. When nitrogen intake from food equals nitrogen excretion in urine feces and sweat you are in nitrogen balance. A ***positive*** nitrogen balance, when the intake of protein is in excess of protein excretion or elimination, is found in growing kids, pregnancy, and recovery from illness. It is also present during resistance exercise training when muscle cells promote protein synthesis.

When a ***negative*** nitrogen balance occurs protein breakdown is in excess of protein intake. Protein is used for energy primarily from amino acids from skeletal muscle. This can occur when an individual who is doing regular intense exercise training is on a low carbohydrate diet and has insufficient carbohydrate stores in the form of glycogen. In this case, protein becomes the primary energy fuel source.

Negative nitrogen balance also occurs with fever, burns, dieting, growth, steroid administration, recovery from illnesses and starvation. Negative nitrogen balance can occur in athletes involved in intense training. During training there is an increased protein breakdown especially during endurance type training. During exercise recovery there is increased protein production (synthesis), which requires a supply of nitrogen-rich amino acids.

Protein dynamics in exercise and training

Protein use for energy reaches its highest level during exercise in the glycogen-depleted state. Remember carbohydrates are a protein sparer. Carbohydrate availability affects the demand on protein reserves in exercise. The more glycogen (or carbohydrates) available for the athlete to use as fuel for exercise the less protein will be needed as a primary energy source.

Take home: Athletes in training should consume a high carbohydrate diet with adequate energy to conserve muscle protein.

Current science recommends 1.2 to 1.8 g of protein/kg body mass daily. No further advantage occurs for athletes with >1.8 g/kg body mass intake of protein. **Current intake of protein for adults is at least 1.8 mg/kg so additional supplementation is not needed.** In addition, animal sources of protein offer no advantage over plant sources of protein.

Final Bullets to remember about protein:

There are 20 amino acids that link together in long chains to form proteins.

The body cannot synthesize 8 of them. These 8 are called essential amino acids. They must be obtained in the diet.

Physically active people and competitive athletes can usually obtain the required nutrients from a broad array of plant sources.

Proteins provide many of the building blocks for the cells of our body and contribute carbon, hydrogen and oxygen molecules for energy metabolism.

The recommended daily allowance for protein is 0.83 g of protein/kg of body mass for adults.

Depleting carbohydrate reserves increases protein breakdown during exercise. To avoid this, athletes who train vigorously must maintain optimal levels of muscle and liver glycogen to minimize deterioration in athletic performance and loss of muscle mass.

For athletes who engage in intense exercise training, protein intake requirements may be 1.2 to 1.8 g of protein/kg of body mass. This higher amount is due to protein breakdown during exercise and protein synthesis during recovery.

Finally, protein from plants and animal sources can both provide you with adequate amino acids required for proper body functioning. One is not better than the other though animal sources tend to have a higher number of all of the amino acids together while several plant sources may need to be consumed to ensure that you have obtained all of the essential amino acids.

Well, that does it for protein. I hope this column has been enlightening and has stimulated your curiosity into looking into current dairy and beef lobbying interests. For some really heavy reading check out the comments that went into creating the current dietary recommendations for the latest food pyramid (MyPyramid.gov)

Until next time when we talk about vitamins and minerals…I will be in the water.

Update

In the column concerning protein I mistakenly gave the conversion of grams to ounces as 1 gram = 0.035 ounces. That is true from a pure weight consideration. When it comes to food content, however, that number is not accurate. A better estimate is given by example: 1ounce of meat, like fish, chicken, beef or pork, contains about 7 grams of protein. 1 cup of milk like skim or 1% contains 8 grams of protein, 1 whole egg contains 7 grams of protein, 1/2 cup of beans contains 5-7 grams of protein, 1 cup of soy milk contains 7 grams of protein. And so on...you really have to look at the labels.

In the article I gave an example of a 70 kg average citizen. She would need to eat 0.83 grams of protein per kg of body mass. That would convert to (0.83 x 70=) 58.1 grams of protein per day. You can see that that would equal any combination of meat, dairy, legumes, soy foods, nuts, etc. If the 70 kg citizen was an active athlete, her needs would increase to 1.2 to 1.8 grams of protein per kg of body mass or 84 to 126 grams of protein per day.

I hope that clears things up.