



Protein and the Body

Janice R. Hermann, Ph.D., RD/LD
Nutrition Specialist

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Protein Is a Nutrient

Protein is a nutrient that the body needs to grow and maintain itself. Next to water, protein is the most plentiful substance in our bodies. Just about everyone knows that muscles are made of protein. Actually, every single cell in the body has some protein. In addition, other important parts of the body like hair, skin, eyes, and body organs are all made from protein.

Many substances that control body functions, such as enzymes and hormones, also are made from protein. Other important functions of protein include forming blood cells and making antibodies to protect us from illness and infections.

Amino Acids

Proteins are made from simpler substances called amino acids. There are 20 amino acids in the protein that we eat every day. The body takes these amino acids and links them together in very long strings. This is how the body makes all of the different proteins it needs to function properly. Nine of the amino acids are called **essential** because bodies cannot make them. These essential amino acids must come from the foods we eat.

Figure 1 shows a diagram of the hormone insulin that regulates blood glucose (sugar). Insulin is a very small protein. Many proteins are made of thousands of amino acids strung together. The letters in the circles are the abbreviations for the amino acid that is in that location. Proteins can be very complex because of all the combinations of amino acids that make up the chains.

Foods that Contain Protein

Both plant and animal foods contain protein. Foods that provide all the essential amino acids are called **high quality** proteins. Animal foods, like meat, fish, poultry, eggs, and dairy products, are all high quality protein sources. These are the foods people usually think of when they want to eat protein. The essential amino acids in animal products are in the right balance.

Foods that do not provide a good balance of all the essential amino acids are called **lower quality** proteins. Plant foods contain lower quality proteins. Most fruits and vegetables are poor sources of protein. Other plant foods, like baked beans, split peas and lentils, peanuts and other nuts, seeds, and grains like wheat, are better sources. They contribute a lot to our protein intake. However, each type of plant protein is

low in one or more of the essential amino acids. This makes them a lower quality protein. Animal proteins contain a better balance of the essential amino acids than plant proteins.

People who do not eat animal products should eat different types of plant foods together or within the same day to get the proper balance and amount of essential amino acids their bodies need. Combining beans and rice, or beans and corn, or peanut butter and bread will provide all of the essential amino acids in the right amounts. These food combinations mix foods from different plant groups to complement the amino acids provided by each.

Combining foods from any two of the following plant groups will make a higher quality protein:

- **Legumes**, such as dry beans, peas, peanuts, lentils, and soybeans
- **Grains**, such as wheat, rye, rice, corn, oats, and barley
- **Seeds and nuts**, such as sunflower and pumpkin seeds, pecans, and walnuts

Any of the following products eaten with any one of the plant groups listed above also will make a higher quality protein:

- **Eggs**
- **Dairy products**, such as milk, cheese, and yogurt
- **Meat**, such as beef, poultry, fish, lamb, and pork

A small amount of animal product mixed with a larger amount of plant product can also meet a person's protein needs.

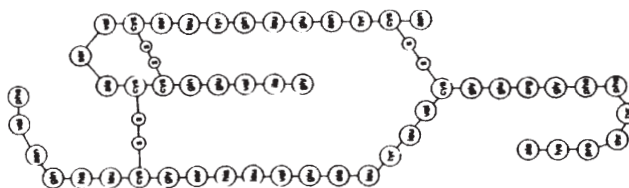


Figure 1. Amino acids in the protein insulin.

Other Uses for Protein

Three major nutrients provide calories: protein, carbohydrate, and fat. Each gram of protein and carbohydrate provides 4 calories. The best use for protein is to repair and maintain body tissues. If people eat more protein than they need for tissue maintenance and repair, their bodies use it for energy. If it is not needed for energy, their bodies use extra protein to make fat. It then becomes part of fat cells. If people do not eat enough calories, protein in food and in their bodies will be used for energy. If this happens, protein is not used for its main purpose, which is to maintain the body. Getting enough protein and eating a balanced diet with adequate calories are important. This way, protein will be used for tissues and other protein functions. Fat and carbohydrate will be used to meet energy needs.

Protein Requirements

Every person needs to eat protein. How much protein he or she needs depends on his or her body size and special needs, like growth. Children need more protein per pound of body weight than adults because they are growing and building new protein tissue. Pregnant and nursing women need more protein for growth of the baby and to produce milk. The Dietary Reference Intake (DRI) tell us the amount of protein an average person needs each day. Calculate the protein needs based on the formula of 0.8 grams of protein for each kilogram of body weight. To find weight in kilograms, divide weight in pounds by 2.2.

Example:

Person's weight = 165 pounds

165 pounds/2.2 pounds
per kilogram

75 kilograms X 0.8 grams
per kilogram

This person has a protein requirement of 60 grams per day.

Another simple, shorthand approach is to multiply body weight in pounds by 0.4. This is a rough estimate involving fewer calculations.

Example:

165 pounds X 0.4 = 66 grams per day.

It is important to keep in mind that extra protein does not give special benefits. People do not store extra dietary protein as body muscle. Extra protein beyond the daily requirement will not make extra muscle or grow hair faster or protect against diseases. Protein beyond what is needed is either broken down and used for energy, or it is turned into fat and stored in fat cells. Too little protein will result in a gradual breakdown of body protein tissues and loss of muscle tissue. The body will not be able to function properly under these conditions.

The best way to meet protein needs is to eat the recommended amount of food from each of the USDA Daily Food Plan food groups. Recommended amounts from each USDA Daily Food Plan food group each day for a reference 2,000 calorie diet are:

- 6 oz. of grains
- 2 1/2 cups of vegetables
- 2 cups of fruit
- 3 cups of dairy
- 5 1/2 oz. of protein foods
- 6 teaspoons of oil

Table 1 shows the protein and fat content of various common foods.

To get the protein needed without too much fat or cholesterol, choose lean cuts of meat and lean fish, and remove the skin from poultry. Cooked legumes and grains are low in fat if you do not add fat when cooking and are inexpensive sources of protein. Nuts and peanut butter are very high in fat even though they do not contain any cholesterol. Eggs are high in cholesterol, but not too high in fat. Choose low fat dairy products often, and do not add fat when cooking or serving these foods.

By watching protein sources and eating a diet following the USDA Daily Food Plan, people can be sure that they are getting enough protein to meet their requirements without getting extra fat that they don't need.

References

- United States Department of Agriculture. ChooseMyPlate.gov. Accessed at: www.choosemyplate.gov
- United States Department of Agriculture. Dietary Guidelines for Americans 2010. Accessed at: <http://www.cnpp.usda.gov/DietaryGuidelines.htm>
- Whitney, E.N. & Rolfes, S.R. Understanding Nutrition, 13th ed. 2013. Thomson/Wadsworth Publishing Co., Belmont, CA.

Table 1. Protein in Common Foods, Grams per Serving

Food and serving size	Protein	Fat
Chicken, light meat, no skin 3 ounces, cooked	26.3	3.0
Pork roast, 3 ounces, cooked	23.9	8.9
Chicken, dark meat, 3 ounces, cooked	23.3	9.3
Beef, round steak, 3 ounces, cooked	22.6	4.9
Cheddar cheese, 3 ounces	21.1	28.2
Cottage cheese, low fat, $\frac{1}{2}$ cup	15.6	2.2
Milk, skim, 1 cup	8.4	0.4
Egg, 1 whole	6.3	5.3
Peanut butter, 2 tablespoons	7.9	16.0
Baked beans, $\frac{1}{2}$ cup	6.6	1.3
Sunflower seeds, $\frac{1}{4}$ cup	6.2	15.9
Pecans, $\frac{1}{4}$ cup	2.3	20.2
Oatmeal, $\frac{3}{4}$ cup	4.6	1.8
Rice, $\frac{1}{2}$ cup	2.8	0.3
Whole wheat bread, 1 slice	2.6	1.5
White bread, 1 slice	2.5	0.9
Apple, 1 whole	0.3	0.5
Green beans, $\frac{1}{2}$ cup	0.9	0.1
Broccoli, $\frac{1}{2}$ cup	2.3	0.1

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Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
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- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
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- It dispenses no funds to the public.
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- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
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