

Protein

The Digestion, Absorption, Transportation and Metabolism of Protein

This site provides a great overview of what protein is and how our bodies use it:

http://www.thevisualmd.com/health_centers/wellness/nutrition_protein/what_are_proteins_video

In the mouth, proteins are moistened with saliva and crushed with the chewing motion of the teeth before being swallowed. Only mechanical digestion of protein occurs here.

Proteins are very complex molecules arranged in chains of amino acids. During digestion the bonds holding these amino acids together are broken by protein-digesting enzymes called proteases. Unlike carbohydrate and fat, where most digestion occurs in the small intestine, major protein digestion begins in the stomach. The stomach secretes an enzyme called pepsinogen. Hydrochloric acid secreted in the stomach, helps convert pepsinogen to the enzyme, pepsin, which in turn attacks the peptide bonds that hold the amino acids together in the protein chain. The proteins are broken into shorter chains, called polypeptides.

Digestion continues in the upper part of the small intestine (the duodenum). The pancreas secretes the enzyme trypsin. Trypsin breaks the polypeptides into simple amino acids through a process called hydrolysis. After breakdown, the amino acids are small enough to pass through the finger-like projections in the small intestine, the villi. The amino acids are absorbed into the blood stream and carried to the cells by both the red blood cells and by the liquid part of the blood, the plasma. The amino acids are distributed to all body tissues, where the various body cells take what they need to repair and reform the protein structures they require. All dietary proteins have been absorbed before they reach the large intestine.

Each protein has a specific function in the body and is constantly being synthesized and broken down as needed. Protein is used within the body in many ways: a component of body tissues, blood plasma, hemoglobin, enzymes, hormones, antibodies, and many others.

Protein Requirements of the Body (needed for Diet Project)

Experts are still not entirely sure how much protein we need, and estimates are often revised. Both national and international health organizations, which advise on nutrient requirements, suggest standards that are calculated to meet or exceed the requirements of practically everyone, taking into account individual variation, such as age, gender, energy requirement and so on. Health Canada guidelines suggest that eating 10% of our daily energy as protein will provide an adequate amount. Most North Americans consume much more than this minimum amount. As with protein and carbohydrates, there is a recommended range. **For people between 4 and 18 years of age, 10 – 30% of your total energy intake should come from protein.**

Calculating the Maximum Recommended Protein Intake (UL)

For example, if you require 2100 kcal/day, at most 30% of those Calories should come from protein.

Step 1: Find 30% of 2100 kcal.

$$30\% = 0.30$$

$0.30 \times 2100 \text{ kcal} = 630 \text{ kcal}$. You should consume no more than 630 kcal from protein.

Step 2: Convert kcal of protein to grams of protein

Since there are 4 kcal in every gram of protein, to convert from kcal to g, divide by 4.

$$630 \text{ kcal} \div 4 \text{ kcal/g} = 157.5 \text{ g}$$

That means you should consume no more than 157.5g of protein each day.

Calculating the Minimum Recommended Protein Intake (RDA)

Another way to calculate the protein requirement is based on weight. If your weight is in the normal range on the Body Mass Index (BMI) chart, the RDA for a healthy teenager (14 – 18 years old) is 0.85 grams per kilogram of protein per day. Refer to the Health Canada DRI Tables for amounts for other ages.

To calculate this, multiply your weight in kilograms by 0.85 g. (Remember, to convert from pounds to kilograms, multiply divide by 2.2.) For example, if you are 15-year-old boy who weighs 72 kg, your RDA for protein is:

$72 \text{ kg} \times 0.85 \text{ g/kg} = 61.2 \text{ g}$ of protein. This means that approximately 61.2 grams of protein should be eaten daily.

Effects of Too Much and Too Little Protein

Most Canadians do not have a concern about the amount or quality of protein in our diet. We generally have more than we require. Overabundance of protein has no benefit—it often has negative health effects. If you consume more protein than your body requires, the surplus amino acids may be converted to glucose for energy use, or converted to fatty acids and stored as adipose tissue. This may increase your risk of heart disease, some types of cancer, obesity and kidney disease.

On the other hand, deficiencies of protein may lead to malnutrition and devastating diseases. People deprived of protein, energy, or both, develop protein-energy malnutrition (PEM). This affects many malnourished children in developing countries, or those affected by war, disease, drought, or other types of devastation. In our society, PEM is often evident in people living in poverty, elderly people who live alone, drug addicts, alcoholics, AIDS patients, cancer patients, or people suffering from eating disorders.