**Protein Quality and Need**

Proteins are found in different foods. All animal and plant cells contain some protein but the amount of protein present in food varies widely. It is not just the amount of protein that needs to be considered the quality of the protein is also important and that depends on the amino acids that are present.

*Complete proteins*: Contain all essential amino acids in sufficient quantity. Support growth and provide life. Animal based proteins are in this group only one exception, gelatin. It doesn’t contain tryptophan.

*Incomplete proteins:* Don’t contain essential amino acids. Not support growth, not provide life. Zein in corn is an example for this proteins, it doesn’t contain lysine or tryptophan.

*Partly complete proteins*: They can provide life but not support growth. For example, wheat protein gliadin doesn’t contain lysine, legume protein is poor in methionine.

However, as the limiting amino acid tends to be different in different vegetable proteins, combination of vegetable sources of proteins in the same meal (e.g. legumes or pulses with cereals), can result in a mix of higher biological value. These combinations are generally found in traditional culinary recipes from the different continents (e.g. beans with rice/pasta/manioc, chick-peas with bread, lentils with potatoes, etc).

**Biological Value**

A scale of measurement used to determine what percentage of a given nutrient source is utilized by the body. When a protein contains the essential amino acids in the right proportion required by humans it has high biological value. In general, proteins from animal sources have a higher biological value than proteins from plant sources. Animal sources of protein are meat, poultry, fish, eggs, milk, cheese and yogurt, and they provide high biological value proteins. Plants, legumes, grains, nuts, seeds and vegetables provide low biological value proteins.

The biological value of a protein is a number from 100 down to 0 that describes how well it is absorbed by the body. The proteins in eggs have the highest biological value so they are excepted as 100.

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| **Protein Source** | **Biological Value** |
| Egg | 100 |
| Milk | 90 |
| Fish | 83 |
| Beef | 80 |
| Chicken | 79 |
| Rice | 74 |
| Soy | 59 |
| Wheat | 54 |
| Beans | 54 |
| Peanut | 43 |

Unlike carbohydrates or fats that can be stored in the body for future use, unused amino acids (protein) are excreted. Consuming a lot of food with a protein that has low biological value will not be very effective because most of the protein will not be utilized.

Major nutrition and health-related organizations have issued recommendations regarding protein requirements for individuals in different life stages and physiological conditions. Recommended intakes of protein -that are able to cover the needs of the majority of the population- have been calculated firstly by defining an average requirement (AR) of dietary protein able to maintain the body's nitrogen balance. In adults, the recommended amount of protein ranges from 0.80 to 0.83 g per kilogram of body weight for both men and women with modest levels of physical activity. Recommended amounts for children and pregnant or lactating women are higher, to allow for the deposition of body tissues and the secretion of milk. Sedentary older adults have been identified as the population group most at risk for protein deficiencies.

**Nitrogen Balance**

Nitrogen balance is commonly referred to as the net difference between the intake (and/or the effective absorption) of nitrogen contained in the diet and its excretion. Since nitrogen is contained predominantly in proteins, this term pertains mainly to the balance of proteins and of amino acids. Nitrogen excretion and/or loss can occur through different routes. The principal component is in the urine as urea, ammonia and creatinine. Fecal and miscellaneous losses represent an additional route, which may be fairly constant and lower as an absolute amount.

A healthy adult is typically in nitrogen balance, which means, protein intake is equal to nitrogen excretion. A *negative nitrogen balance* occurs when more protein is used by the body than is taken in. This occurs on starvation diets and those with low protein and carbohydrate intake or during illness, anxiety, or stress. A *positive nitrogen balance* implies a net gain of protein in the body, nitrogen intake exceeds nitrogen output. A normal state for children, pregnant women, athletes or individuals recovering from illness or surgery, whose bodies require extra protein in order to build tissue.

**Protein Malnutrition**

Describes a range of disorders occurring mainly in developing countries. It mainly affects young children and is the result of both too little energy and too little protein in the diet. The two most common forms are Marasmus and Kwashiorkor.

*Kwashiorkor* is caused by a lack of protein in the diet. Kwashiorkor is most common in countries where there is a limited supply or lack of food. It is mostly found in children and infants in sub-Saharan Africa, Southeast Asia, and Central America. A limited supply or lack of food is common in these countries during times of famine caused by natural disasters such as droughts or floods or political unrest. A lack of nutritional knowledge and regional dependence on low-protein diets, such the maize-based diets of many South American countries, can also cause people to develop this condition. The main sign of kwashiorkor is too much fluid in the body's tissues, which causes swelling under the skin (edema). It usually begins in the legs, but can involve the whole body, an enlarged tummy ("pot belly"). The other symptoms of kwashiorkor include: change in skin and hair color (to a rust color) and texture, fatigue, diarrhea, loss of muscle mass, failure to grow or gain weight, damaged immune system, which can lead to more frequent and severe infections, irritability, flaky rash. Kwashiorkor can be corrected by eating more protein and more calories overall, especially if treatment is started early. Even with treatment, children who have had kwashiorkor may never reach their full growth and height potential. If treatment comes too late, a child may have permanent physical and mental disabilities. If left untreated, the condition can lead to coma, shock, or death.

*Marasmus*, is a severe form of protein-energy malnutrition caused by a shortage of protein and calories in the body. Nutrient deficiency is the main cause of marasmus. Both adults and children can be affected by marasmus, but young children in developing countries are affected most often. It occurs in children that don’t ingest enough protein, calories, carbohydrates, and other important nutrients. This is usually due to poverty and a scarcity of food. The main symptom of marasmus is being underweight. Children with this condition have lost a lot of muscle mass and subcutaneous fat. Subcutaneous fat is the layer of fat just under the skin. Dry skin and brittle hair are also symptoms of marasmus. In children with marasmus, the following can also occur: chronic diarrhea, respiratory infections, intellectual disability, and stunted growth. Marasmus is life-threatening medical emergency, so it's very important to treat it at the onset of symptoms. In order to treat marasmus, a treatment plan must be set up by medical professionals if possible. Feeding is usually done in small amounts and through tubes to the veins and stomach. These tubes allow for food and fluid to be delivered quickly and directly to the body. A diet treatment rich in nutrients, carbohydrates, and calories is very important. It can still take months for a full recovery, even with the right treatment.