Proteins

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PROTEINS are Dietary Essential.

The body has a requirement for dietary protein. Protein is made up of long chains of small subunits called amino acids. Dietary protein is the body's supply of amino acids which are used to synthesize new proteins within the body. The newly synthesized body proteins include the:

- contractile proteins found in muscles
- structural proteins such as those found in joints and tendons
- enzyme proteins which help carry out biochemical reactions within the body

Food proteins are digested in the intestinal tract. This process breaks down food proteins into individual amino acids that are then used by the body as building blocks of new body components (e.g. proteins, hormones, neurotransmitters and immune system proteins). Excess dietary protein can be used to supply energy to the body in the same manner as dietary carbohydrate or fat.

PROTEINS are important for:

- nervous system function,
- vitamin and mineral performance,
- human growth and development,
- tissue formation and repair,
- brain function,
- antibody and immune system function,
- optimum calcium uptake,
- disease prevention,
- the transporting of nutrients and oxygen through the body,
- all enzyme function,
- some hormone function and,
- providing a source of energy.

Protein should make up about 12 to 15% of calorie intake. The current recommendation for daily protein consumption for adults is 0.8 gram of protein for each kilogram of body weight.

So, for example, a 140 pound or 64 kg individual would need about 51 grams of protein per day.

Insufficient Dietary PROTEIN

Insufficient dietary protein can be compensated for, in the short term, by drawing on body protein reserves. Such reserves can make up 5-7% of the total body protein and are found mainly in muscle and liver. The reserves are replenished when dietary protein consumption returns to normal. When these reserves are depleted, however, muscle protein is broken down to provide essential amino acids that are used for critical body functions such as liver metabolism. Long-term dietary protein deprivation results in edema in the legs and feet, wasting of body muscle mass, lethargy and loss of energy, and adverse changes in protein-rich tissues such as hair and skin.

Excess Dietary Protein

Excess dietary protein can also increase the incidence of gout in sensitive individuals. Gout is caused by uric acid crystals that are a by-product of the breakdown of the amino accumulating in the joints. This can cause painful swelling in the toes and other peripheral tissues.

By consuming too much complete protein, the kidneys are over-worked, the body's level of saturated fat is increased, and urinary function is over-burdened. Eat adequate amounts of good quality dietary protein, therefore, but avoid excess to ensure optimal health.

Type of Dietary PROTEIN

Dietary protein is a mixture of the many different proteins which are found in individual foods.

Not all food proteins have equal nutritional value. The nutritional value of food proteins is based on:

(1) The mixture of different amino acids that make up the protein
(2) The ease with which the protein is digested in the intestinal tract.

Not all food proteins have the ideal balance of amino acids and some food proteins that do are not well digested. An example is collagen. Collagen is a fibrous protein that causes meat to lose tenderness and to be tough. Collagen is very indigestible. When collagen is boiled, however, the fibrous characteristics are lost and the protein becomes gelatin, which is very digestible.

Types Of Amino Acids found in Dietary Protein

Dietary protein contains two groups of amino acids[1]. These is are the:

(1) Dietary essential amino acids
(2) Dietary non-essential amino acids

The number of essential amino acids required varies with age. The fraction of essential amino acids required in food proteins is greatest for infants (43%), less for adolescents (22%) and least for adults (11%) .

Amino Acids found in Food PROTEINS

Essential Amino Acids

Methionine	Valine
Phenylalanine	Isoleucine
Tryptophan	Threonine
Histidine	Arginine
Lysine	Leucine

Non-Essential Amino Acids

Alanine	Aspartic Acid
Asparagine	Cystine
Cysteine	Glycine
Glutamic Acid	Glutami
Proline	Serine
Tyrosine	Hydroxyproline

Evaluating The Nutritional Value Of PROTEINS From Fifferent Foods

When we examine the pattern of essential amino acids in protein from different foods, we notice that foods of animal origin such as meat, milk and eggs have a pattern of amino acids that more closely matches the list of essential amino acids required for human growth and maintenance. Proteins from foods of plant origin tend to lack some essential amino acids and can also be less digestible than foods of animal origin. Proteins from cereal grains are often low in lysine, a key essential amino acid for rapidly growing children2. Proteins from legumes such as soybeans are often deficient in methionine, a sulfur-containing essential amino acids. It is often necessary, therefore to blend legume and grain sources of vegetable protein to obtain a complete amino acid profile.

PROTEIN and Eggs

Numerous methods have been developed to determine the nutritional quality of dietary protein. The two factors used in the evaluation of dietary protein quality are (1) digestibility and (2) essential amino acid profile. The conventional standard for protein quality as used in determination of the dietary quality of food proteins is whole egg protein. Egg protein is rich in albumins. Albumins are a class of proteins which are highly water soluble and are fully digested. In addition to being highly digested, egg proteins contain an excellent balance of essential amino acids when compared to the pattern of essential amino acids as required by people of all ages. In determining dietary protein quality, whole egg protein is assigned a value of 100 while test proteins are ranked according to how closely they match the performance of individuals fed egg protein. These rankings are almost always assigned values less than 100. See Table 1 below for protein content and ratings of common foods.

Table 1: Protein Quality and Content of common foods.

Food	Typical Serving	Total Fat (grams)	Grams of Protein per Typical Serving	
			Total	Protein rating
Omega Pro	100 g	5	10	100
Simply Egg Whites	100 g	0	10	100
Break Free	100 g	2	10	100
Regular shell eggs	100 g	10	12	100
Milk	245 g	5	12	77
Chicken	104 g	10	41	80
Salmon	85 g	9	23	85
Ham	85 g	14	18	80
Beef	85 g	14	24	80
Pork	87 g	19	24	80
Beans	256 g	1	13	56
Wheat	115 g	1	12	44

A comparison is given below for amino acid requirement patterns for adults and the protein pattern in whole eggs. The table 2 below indicates that whole eggs provide more essential amino acids per gram of protein(490) than the average needed for adult nutrition (111). Eggs do not, of course, supply all of the dietary protein, so we are not providing an excess. Further, the table shows that the protein in eggs are an excellent source of dietary essential amino acids and would compensate for poorer quality proteins such as vegetable protein. Children require extra lysine for growth and as can be seen from the table, the pattern in eggs shows lysine to be far in excess of that required for adults so egg protein would be ideal for rapidly growing children and adolescents.

Table 2: Essential Amino Acids

	Pattern In Whole Eggs (mg amino acid per gram of protein)	Requirement Pattern For Adults (mg amino acid per gram of protein)
Histidine	22	11
Isoleucine	54	13
Leucine	86	19
Methionine + Cystine	57	17
Phenylalanine + Tyrosine	3	19
Lysine	70	16
Threonine	47	9
Tryptophan	17	5
Valine	66	13
Total essential amino acids	**490**	**111**

References:

(1) Laidlaw, S.A., Kopple, J.D. 1987. Newer concepts of the indispensable amino acids. Am. J. Clin. Nutr. 46: 593-605.

(2) Meredith, C.N., Wen, A., Bier, D.M., Matthews, D.E., Young, V.R. 1986. Lysine kinetics at graded lysine intakes in young men. Am. J. Clin. Nutr. 43: 787-794.

(3) Food and Nutrition Board, National Research Council: Recommended dietary allowances, 10th ed. Washington, DC: National Academy Press, 1989.

(4) A.E. Harper Symposium on Emerging Aspects of Amino Acid Metabolism. 1994. J. Nutr. 124: 1203S-1212S.

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