B L A C K F O X

C O A C H I N G & N U T R I T I O N

B O R N F O R P R O G R E S S

PROTEINS / PROTEINS / POLYPEPTIDES

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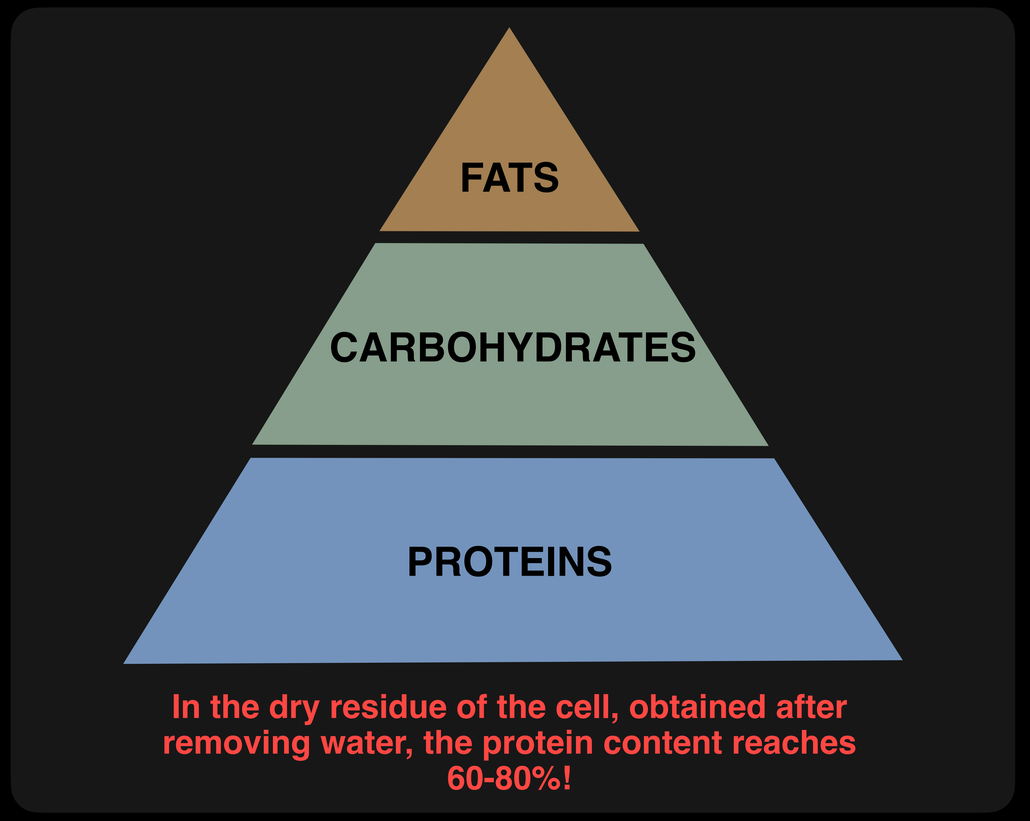
PROTEIN - THE BASIS OF THE PYRAMID

Protein has the greatest impact on body composition and macronutrient performance, and therefore should be prioritized in a structured diet.

The need for protein is an evolutionary dominant in human nutrition, due to the need to ensure an optimal physiological level of intake of essential amino acids.

From the point of view of chemistry, proteins are high molecular weight organic substances consisting of amino acids linked in a chain by a peptide bond.

In living organisms, the amino acid composition of proteins is determined by the genetic code; in the synthesis, in most cases, 20 standard amino acids are used (of which 8 are irreplaceable).



In the dry residue of the cell, obtained after removing water, the protein content reaches 60-80%!

Irreplaceable (8) - cannot independently synthesize in the body of an adult (methionine, lysine, tryptophan, phenylalanine, leucine, isoleucine, threonine, valine). For children, there is also histidine.

Replaceable (12) – synthesized in the body of an adult (histidine, glycine, alanine, serine, tyrosine, cysteine, arginine, asparagine, glutamine, aspartic acid, glutamic acid, proline).

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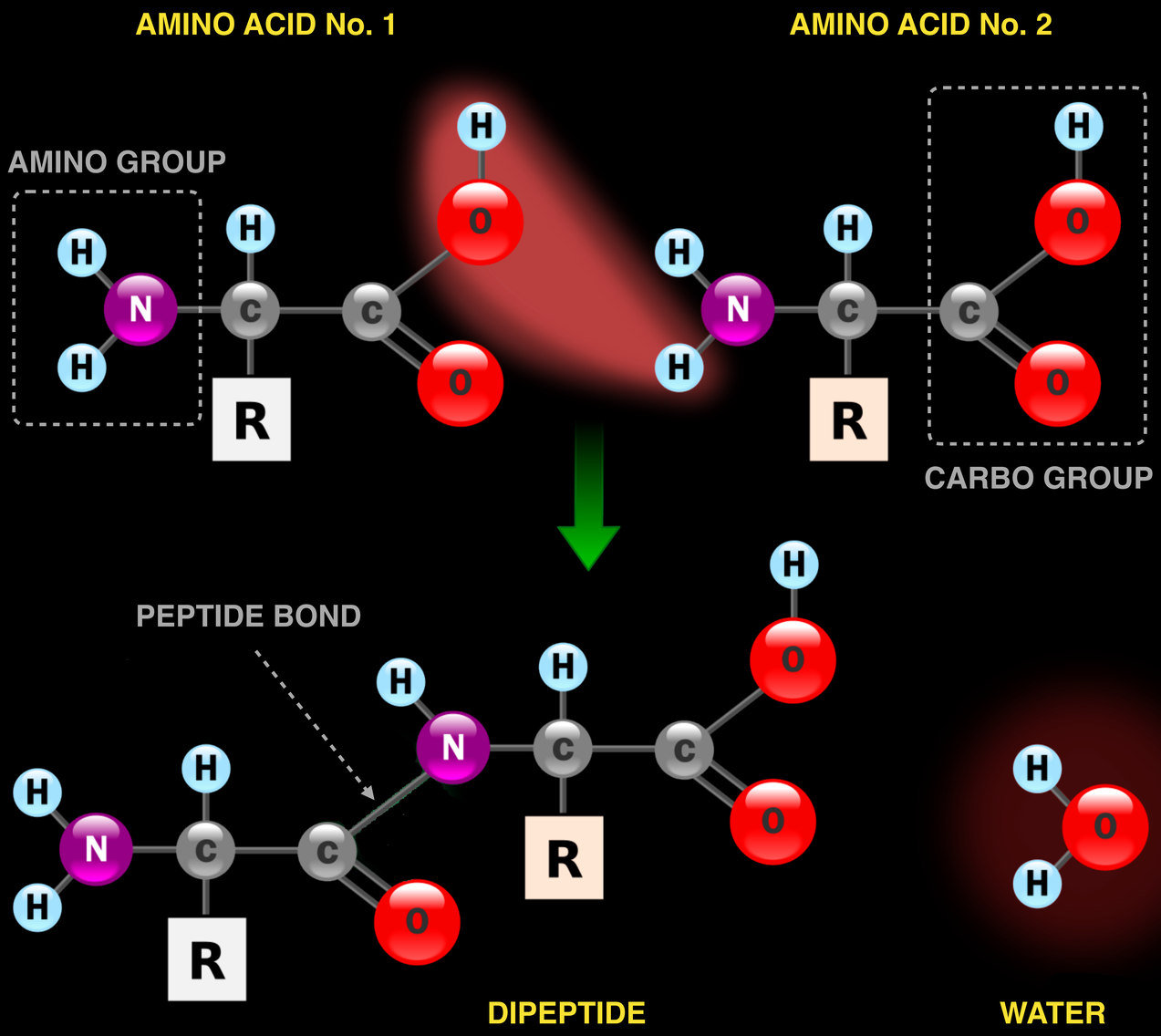
PROTEIN - AMINO ACID CHAIN



Any protein can be represented as:

- **aamino group (NH2)**
- **carboxyl group (COOH)**
- **radical (R) R-CH (NH2) -COOH**

Proteins are complex polypeptides in which individual amino acids are linked to each other by peptide bonds arising from the interaction of the α-carboxyl COOH and α-NH2 groups of amino acids.

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BASIC FUNCTIONS OF PROTEIN

Catalytic function
Most of the currently known enzymes, called biological catalysts, are proteins.

Transport function
The respiratory function of blood, in particular, the transfer of oxygen, is carried out by molecules of haemoglobin - a protein of erythrocytes. Serum albumin is involved in lipid transport.

Protective function
The main function of protection in the body is performed by the immune system, which ensures the synthesis of specific protective antibody proteins in response to the entry of bacteria, toxins, viruses or foreign proteins into the body.

Contractile function
Many protein substances are involved in the act of muscle contraction and relaxation. However, actin and myosin, specific proteins of muscle tissue, play the main role in these vital processes.

Structural function
Proteins that perform a structural (supporting) function occupy the first place in terms of quantity among other proteins of the human body. Among them, fibrillar proteins play the most important role, in particular, collagen in connective tissue, keratin in hair, nails, skin, elastin in the vascular wall, etc.

Hormonal function
The body's metabolism is regulated by a variety of mechanisms. In this regulation, an important place is occupied by hormones synthesized not only in the endocrine glands but also in many other cells of the body. Some hormones are proteins or polypeptides, for example, hormones of the pituitary gland, pancreas, etc. Some hormones are derivatives of amino acids

Nutritional (reserve) function
These proteins include the so-called reserve proteins, which are stored as a source of energy and substance in plant seeds (for example, 7S and 11S globulins) and animal eggs.

PROTEIN EXCHANGE / METABOLISM

I think after reading about the function of protein it becomes clear why this is the basis of the basics! Now let's talk briefly about its exchange. A simplified diagram of protein metabolism is shown in the next slide.

We see that proteins that come with food are digested and form an amino acid pool (reserve) so that the body, by combining amino acids, can collect the necessary protein - hormone, enzyme, muscle tissue, i.e. stock must be full! However, we do not have a "large reservoir", we cannot "store" amino acids in sufficient volume, as is the case with carbohydrates or fats. The pool of blood amino acids or the plasma pool of amino acids in the human body is a maximum of 100 g. Therefore, control of protein intake is so important!

Also, in the body, protein structures are constantly degraded, which requires material for their renewal. Besides, some amino acids can be converted into non-protein substances through the processes of decarboxylation, deamination and transamination, as well as into other amino acids (nonessential). In starvation conditions, “reserve proteins”, our tissues, are consumed first of all!

It is assumed that in the body of an adult, 300-400 g of protein is destroyed daily up to amino acids (proteolysis). At the same time, approximately the same amount of amino acids is included in the newly formed protein molecules (protein biosynthesis). A high turnover of protein in the body is necessary because many proteins are relatively short-lived: they begin to renew themselves several hours after synthesis, and the biochemical half-life is 2-8 days.

Since protein performs an incredible number of functions in the body (enzymatic, hormonal, building, immune, the function of regulating fluid in the body, and others), this imposes a certain obligation on its proper consumption daily for the body to function correctly.

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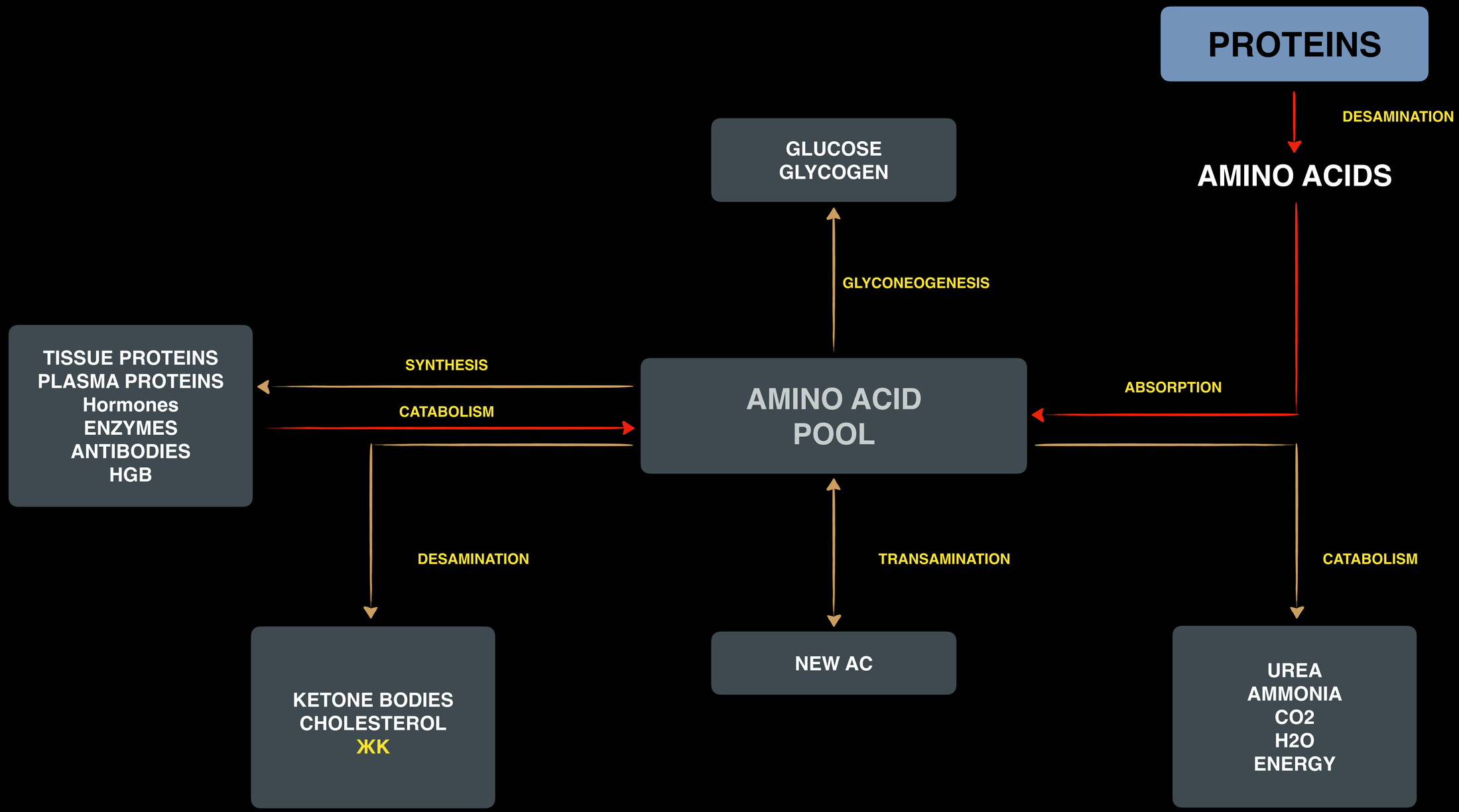
WAYS OF PROTEIN METABOLISM



STAGES OF DIGESTION

Denaturation is carried out in the stomach under the action of secreted hydrochloric acid, the pH of which is approximately 2.0 (the pH value in the stomach can vary from 1 to 4, decreasing with food intake, which is optimal for the work of digestive enzymes). At the same time, the acid has a protective function, killing many bacteria. Hydrochloric acid activates the main proteolytic enzyme in the stomach - pepsin.

Digestion (cleavage and shortening of the length of the polypeptide chains) continues in the duodenum and the upper part of the small intestine.

In the small intestine, pancreatic enzymes begin to act, which are also produced in an inactive form and are activated as soon as they reach the intestine. These are enzymes: trypsin and chymotrypsin. They split the peptide bond into even smaller peptides. Additional enzymes of the small intestine cleave off individual amino acids from both ends of the peptide, thereby producing individual amino acids, which are then absorbed into the bloodstream.

The amino acids formed during the digestion of proteins are absorbed in the intestines and transported through the portal system of the liver or the blood into the thoracic lymphatic duct through the lymphatic vessels.

Further, according to the needs of the body, there are 3 distribution options for amino acids:
They can participate in the synthesis of protein structures - hormones, enzymes, etc.
Can be broken down into non-protein substances (example: gluconeogenesis).
Can be used as fuel for ATP resynthesis.

About 5% of the consumed protein leaves the body undigested.

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CAN EXCESS PROTEIN CAUSE KIDNEY STONES?

Excess protein can raise the level of uric acid, which contributes to the formation of kidney stones. However, there is no evidence that increased protein intake in healthy people will damage the kidneys.

It is only when a person already has kidney problems that caution is needed. If you have had kidney stones before, you are more likely to get them again. Most kidney stones form when calcium combines with oxalate or phosphorus.

Drink plenty of water (drinking extra water dilutes substances in the urine that lead to stones), ensure an adequate intake of calcium (lack of calcium in food increases urinary oxalate levels and increases the risk of recurring stones), limit animal protein and avoid foods that catalyze stone formation (for example , beets, chocolate, spinach, rhubarb, tea, and most nuts that are rich in oxalate).

IF THERE IS A LOT OF PROTEIN DOES IT TURN TO FAT?

If your body has used up all of the protein it needs to grow, repair, catalyze chemical reactions, transport molecules, and all the other physiological functions that proteins are used for, the excess will be broken down into amino acids and then converted to glucose in a process called gluconeogenesis.

After the amino acids have been converted to glucose, your body will:

Use this glucose for immediate energy;

Store this glucose as glycogen to be used for energy at a later date;

Store glucose as fat in adipose tissue, since all glycogen stores are full (the liver can store about 100 grams of glucose in the form of glycogen, and muscles about 500 grams).

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PROTEIN SOURCES

Protein sources can be ranked according to their digestibility and amino acid profile. Digestibility refers to how much protein eaten can be used by the body. Sources of animal protein are generally among the best sources.

Sources of complete protein containing a full set of essential amino acids in an amount sufficient for protein biosynthesis in the human body are animal products (milk, dairy products, eggs, meat and meat products, fish, seafood). Proteins of animal origin are assimilated by the body by 93-96%. For adults, the recommended proportion of animal proteins in the daily diet of their total amount is 50%. For children, the recommended proportion of animal proteins in the daily diet is 60%.

In proteins of plant origin (cereals, vegetables, fruits) there is a deficiency of essential amino acids. Legumes contain inhibitors of proteinases, which reduce the absorption of protein from them. As for protein isolates and concentrates from legumes, their amino acid composition and assimilation are close to those of animal protein. Protein from plant products is absorbed by the body by 50-80% (for example, rice -50%, wheat - 42%, peanuts - 52%). Protein from higher mushrooms is assimilated at a level of 20-40%.

GENERAL RECOMMENDATIONS AND RESULTS

- **Protein is the most important macronutrient for altering the composition and performance of the body, followed by carbohydrates and then fats.**

- **Proteins provide the raw materials for muscle growth and repair and are essential for virtually all physiological systems. CAREFULLY FOLLOWING THE NORMAL!**

- **We distribute our protein intake evenly throughout the day! We use different sources!**

- **It is especially important to supply sufficient protein in a timely manner during a hypocaloric diet, when most of the protein eaten can be used for energy.**

- **A lack of protein leads to a violation of its synthesis, a weakening of the immune system, a decrease in the production of hormones, dysfunction of the liver, pancreas, blood system (anemia) and, in extreme cases, the development of hungry edema.**

- **If you find it difficult to get the norm, then use protein supplements (about them on the next slide).**

- **Do not use BCAAs - a complex of three essential amino acids: Leucine, Isoleucine, Valine. These are just three essential amino acids, and with a balanced diet is a waste of money**

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SPORT SUPPLEMENTS - PROTEIN

Whey protein (protein) is a concentrated blend of globular proteins derived from whey. In this case, whey should be understood as a liquid composition that is formed during curdling and is a by-product in the manufacture of cheese. It is currently the best protein for both muscle growth and fat loss.

BASIC FORMS

Whey protein usually comes in three main forms: concentrate (WPC), isolate (WPI), and hydrolyzate (WPH).

Concentrates, as a rule, contain a little fat and cholesterol, but the degree of their purification is not very high. The share of biologically active substances, as well as carbohydrates in the form of lactose is 29% - 89%.

Isolates are more thoroughly cleaned. The content of bioactive substances is over 90%. Concentrates and isolates have a milky milky flavor.

Hydrolysates are whey proteins that are easily absorbed by the human body, but they tend to be significantly more expensive. Highly hydrolyzed whey may be less allergenic than other forms.

Regular food first, supplements - addition!

Protein consumption is not higher than 1.8 g / kg of body weight
(except for athletes or people on a variety of diets)

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