

YORK *mind-body* HEALTH
Information Sheet

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Protein and Amino Acids

What Is Protein?

About half the dry weight of your body is protein. There are thousands of different kinds of protein molecules, performing a variety of functions. Most protein is structural – it makes up skin, hair, bone and teeth. Enzymes – molecules which drive chemical reactions in the body – are mostly proteins. Other examples are:

- Haemoglobin – found in red blood cells, it is vital for transporting oxygen to cells.
- Insulin – a hormone or signalling molecule.

Protein and Amino Acids

A protein molecule is made up of a sequence of basic building blocks called amino acids, joined end to end. (The chemical bonds between amino acids are called peptide bonds.) Protein molecules differ in terms of the number of amino acids making them up, and also the specific sequence. Most proteins are able to serve their particular purpose by virtue of the 3D shape of the molecule, which is likewise a function of the specific number and sequence of amino acids.

There are 22 amino acids found in nature. All proteins are made from these 22.

Proteins and Genes

Your body manufactures proteins to order. The blueprints for proteins are found in the genes. That's essentially what a gene is - a blueprint for one or more protein molecules. If the manufacturing process goes wrong, the result is often a protein with the wrong sequence of amino acids. Because these faulty molecules form unexpected 3D shapes, they can't perform their intended functions. In the genetic disease sickle-cell anaemia, haemoglobin molecules turn out wrong in just this way, with the consequence that the blood cannot transport oxygen in the normal way.

Protein and the Diet

We obtain our amino acid building blocks, from which our cells build our proteins, from dietary protein. Plants and animals like us are built from protein. We don't use dietary protein molecules directly - rather they are broken down in the process of digestion into the constituent amino acids, which are then absorbed.

Actually the body can make several amino acids from others, but eight of the twenty-two are essential, meaning they can't be made and must be obtained from the diet. Several more amino acids are semi-essential meaning they can't be made in adequate quantities.

Fully meeting the body's protein needs requires

- i You eat adequate amounts of the amino acids, in the right proportions.
- ii Your body can successfully break down the protein you eat and absorb the amino acids (i.e. an adequately functioning gastro-intestinal tract).

Protein and Digestion

The breaking down of proteins into amino acids happens largely by the action of stomach acid, in the presence of particular enzymes called proteases. If you don't produce enough of these, protein digestion and absorption will be compromised. Stomach acid insufficiency, a condition known as hypochlorhydria, is relatively common. Stomach acid production naturally declines as we age. Furthermore, many people take acid suppressing medications. Conversely true cases of stomach acid excess are rare - often what is perceived as an excess of acid is actually an inability of the stomach lining to withstand its own acid - a problem with the stomach lining not the acid. Alternatively if the acid gets to places where it shouldn't (notably the oesophagus) it is treated as excess acid.

Protein Sources

Dietary protein comes from both plant and animal sources:

- **Animal:** meats, fish, eggs, dairy products especially cheese.
- **Plant:** beans and pulses, nuts, whole grains, seeds (fruit and vegetables contain negligible amounts of protein).

Protein Quality

As stated, we need the full range of amino acids in the right proportions – especially the eight essential amino acids. This idea is quantified as the Biological Value (BV) of a protein source - a high value source has all the essential amino acids in the right proportions. It turns out that animal sources in general have higher BV. Many plant sources such as brown rice, are missing one or more of the essential amino acids. However, soya beans and quinoa do contain all eight (they are known as complete proteins). Note that eating large amounts of animal foods is probably not healthy for other reasons, so plant sources, which have other health-giving properties besides, should not be neglected.

Here are some BV scores of some typical high protein foods (1):

Food	BV
Whey protein	104
Whole egg	100
Cheddar cheese	95
Cow's milk	91
Fish	83
Beef	80
Chicken	79
Soya	74
Rice	59
Almonds	52
Haricot beans	49
Hazelnut	45

Protein – Carbohydrate Balance

Another important function of dietary protein is that it slows the absorption of sugar into the blood, which can cause problems if it's too fast. Balanced, stable blood sugar levels are important for mood and energy stability. Therefore a useful principle is to have a protein component for every meal. This has the benefit of being more satiating for longer.

Breakfast is for many people is protein-light – although milk is a source of good quality protein it doesn't have large amounts (as it's a liquid). An egg at breakfast time is a good way to get your protein.

Snacks are also commonly lacking in protein. Ideal snacks are nuts and seeds, which have a variety of healthy nutrients besides protein. Oat cakes with cottage cheese, tinned fish or hummus also make easy snacks or even light meals.

Protein as Energy

Protein is not just used structurally by the body, it can also be burned to release energy. Whilst this is a natural process happening to some extent all the time, in conditions of starvation, protein can become the major source of energy. Muscle wastage is the result of the body metabolising its own protein for energy. This is one reason why semi-starvation diets are a bad idea - some of the weight loss is not fat loss but muscle loss.

Evidence suggests that different people's metabolisms are tuned to burn carbohydrates and proteins with more or less efficiency. The practical consequence is that some people will do much better on a diet relatively high in protein, while others a relatively low protein diet serves them best. This idea is behind the concept of metabolic typing, covered in a separate article.

How Much Protein Do We Need?

Estimates vary. The World Health Organisation suggests around 10% of your total calorie intake should come from protein, or around 35g a day. The UK Department of Health suggests 36g for women and 44g for men. Some weight loss diets suggest much higher amounts.

Too much protein is not a good idea. It can cause osteoporosis and can put excessive strain on the kidneys. Modern farming methods mean that many animal sources of protein contain high levels of hormones such as oestrogen. Contrary to popular opinion, you don't need high levels of protein to build muscle mass, even if you are a body builder.

The right level is really an individual matter - it depends on your individual biochemistry.

Amino Acids and Neurotransmitters

Neurotransmitters are molecules that transmit signals between nerve cells, and as such are a vital aspect of brain functioning. Examples of neurotransmitters are serotonin and dopamine. It is thought that neurotransmitter imbalance plays a role in mood disorders such as depression, and cognitive disorders such as ADHD.

Neurotransmitters are either amino acids themselves or are derived biochemically from them. Serotonin for instance is derived from an

amino acid called tryptophan. In one study, subjects who ate a diet devoid of tryptophan developed symptoms of depression (2). Thus we can conclude that adequate protein in our diet is important for mental and emotional functioning.

Footnotes

1. Source: 'The Insulin Factor' by Antony Haynes

2. This study was published in the Lancet in 1997. (Smith, K. et al. 1997 'Relapse of depression after rapid depletion of tryptophan' *Lancet* Vol.349 pp.915-9)