

Do you need to understand all about quality protein for horses? Horse owners should be concerned to provide their horse with protein which contains adequate and diverse essential amino acids because these can not be synthesised in the body.

Protein is quite literally life! It is fundamental to every process in the body but not many people understand what protein for horses is; why protein for horses is so important; what it looks like when your horse is low in protein; the best place to get protein for horses and how you can make sure there is enough protein to create a robust healthy horse.



Protein can be thought of as being like the alphabet, each letter is an amino acid which forms a chain to make a protein in the same way as letters strung together make words. Just as out of the alphabet many thousands of words can be constructed, out of amino acids ALL the proteins in the body are made.

The alphabet has two categories of letter, consonants and vowels. With just these 26 letters many thousands of words can be made just by arranging them in different orders. However without the very important vowels many words would not be able to be made. Letters make words that in turn make sentences for unlimited information and the ability to transmit that information. Amino acids are the same they make proteins that in turn

make structures which build and run the amazing living things on our planet.

There are two categories of amino acid, essential and non-essential. Essential amino acids (EAAs) MUST be present in the diet just like vowels must be present in the alphabet because these essential amino acids can only be obtained from food. The non-essential amino acids (NEAAs) can be created within the animal as long as there are adequate amounts of essential amino acids.

The 10 Essential Amino Acids for Horses

As it stands now, there are twenty two commonly occurring amino acids and nine of these are considered to be essential. Each amino acid has a unique structure and all of them contain nitrogen. Amino Acids form chains. Peptides chains are less than 10 amino acids and like the syllables in words. Polypeptides are chains of more than 10 amino acids and are like whole words.

The wall of the horse's digestive tract (stomach, fore and hind gut) cannot absorb polypeptide protein because the molecules of protein are too large. Instead every protein your horse eats is broken down into its smaller amino acid building blocks or the small peptide groups of amino acids and these absorbed through the intestinal wall into the body. Then these amino acids and peptides are transported to individual cells and reassembled into what ever protein that cell needs.

Protein provides the structure that makes connective tissue of bones, ligaments, tendons and muscle. Protein also makes a lot of other things in the body; defense mechanisms for strong immune systems, sensors, hair, skin, hooves. Examples of proteins are glutathione, which is critical for immune function and the pituitary hormones vasopression and oxytocin. ACTH (adrenocorticotropic hormone) which is a topic of hot conversation because high levels are currently being used to diagnose cushings disease in horses is also a protein.



The sequence of these amino acids in the protein polypeptides determines the biological role of a protein. Proteins can further be classified into globular and fibrous categories. Examples of globular proteins include antibodies; the catalysts known as enzymes; carrier proteins, such as haemoglobin, which transports oxygen through the blood stream. Fibrous proteins are long, coiled strands or flat sheets which give strength and elasticity. Examples of a fibrous proteins are keratin (found in hair, skin and hooves), collagen (the connective tissue of skin, tendons and bones) and myosin which is a muscle fibre protein.

If you are still reading and your brain hasn't spun off! It will now be obvious to you that the 'quality of protein' means whether the protein has a good availability of all the essential amino acids because the whole of the horse's complex structure, its immune system, hormonal regulation and its metabolic functions are highly dependent upon the presence of adequate quantity and quality of protein in the diet.



Just as if some vowels are not present in the alphabet if there are some essential amino acids missing or short then some proteins for the correct functioning of the body cannot be made. Immune function, muscle repair and building, tissue regeneration and repair, weight gain, keratin (hoof, skin and hair quality), growth etc. depend *extensively* on protein quality and availability.

Understand quality protein for your horse, this article explains what you need to know [Click To Tweet](#)

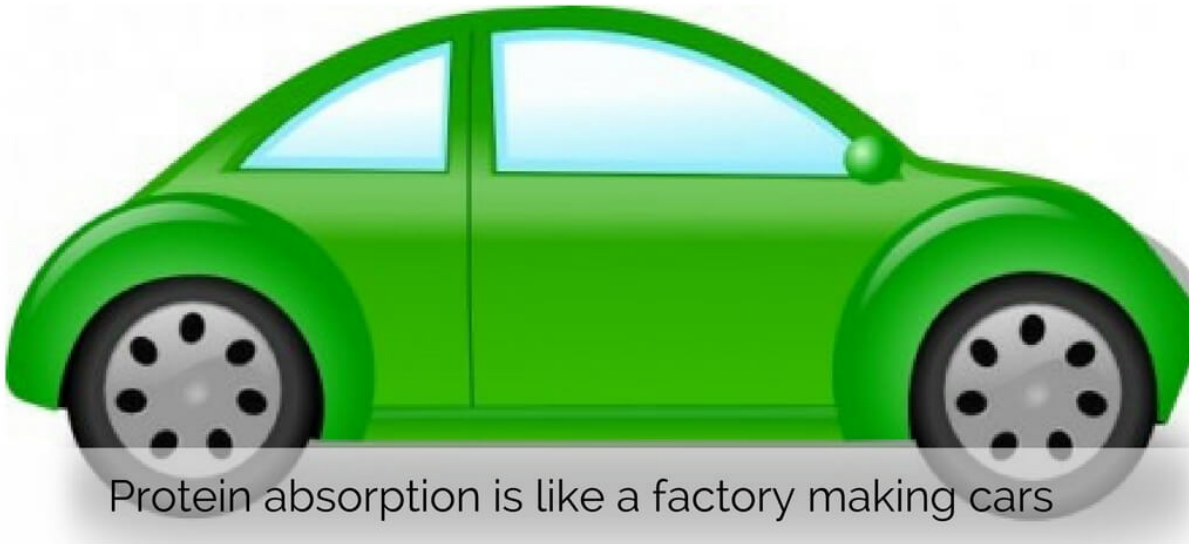
So when you think protein, think amino acids and the chains that are just like letters making thousands of words which are making thousands sentences which are making thousands of different things to read in many different forms. Now perhaps you realise that protein is quite literally life!

When your horse, on a daily basis, repeatedly has less of some of the essential amino acids than it needs for optimum healthy function then it cannot make some of the proteins it needs for health. An added complication is that the amount of each EAA contained in the diet affects the absorption of all the other EAAs. This means that if just one of the EAA's is low then all the other EAAs will be absorbed at that lower rate, a case of the lowest common denominator really upsetting the apple cart.

A good way of understanding this is to think of protein absorption like a factory making cars. Each car needs 4 wheels, a steering wheel, two axles and 1 body to be made and be shipped out to the garages who are selling the cars to the public. The car factory needs to make 10 cars a day to keep its finances healthy but everyday when the supplies are brought into the factory there are only ever 39 wheels. It doesn't matter what the workers do they can only make 9 cars because they are always going to have one car which cannot be completed because it only has 3 wheels. Each day they are always one car short of their target. This is one less car to sell to a garage and one less car to keep their finances healthy so the company can run efficiently. Pretty soon over time the company starts to struggle not being able to run itself and finance more stock.

Cumulatively the shortage of parts creates a shortage of cars which creates a shortage of finances and something has to give. It might be the laying off of workers. Maybe the tools to fit the cars together break and can't be mended. Whatever way you look at it the

company can't remain healthy and a slow demise sets in. Now you can see why you should think differently about protein for your horse and give it your up most priority!



An interesting fact is that one bacteria cell has about 2 million proteins. Some muscle proteins are called titan proteins because they are made of almost 27,000 amino acids each! Next to water, proteins are the most abundant molecule in the body. NOW! Are you starting to see the enormity of the situation and why shortage of protein in the horses diet is such a big issue if the greatest proportion of the diet, the grass hay and haylage eaten is low in protein and of a poor quality!

Amino acids for horses explained

If you would like to know about each of the essential amino acids then follow the links below.

[Methionine for horses](#)

[Lysine for horses](#)

[Histidine for horses](#)

[Leucine and Isoleucine for horses](#)

Phenylalanine for horses

Threonine for horses

Tryptophan for horses

Valine for horses

How can you tell if horses are short of protein?

From our experience many horses have access to poor quality pasture and poor quality hay or haylage. This is the norm in the testing we carry out through analysis of forage at Forageplus. Poor quality pasture, hay and haylage is poor in protein levels and quality.

The horse's body constantly breaks down protein from the process of living and needs a constant supply of new protein as the building material to repair itself. Movement such as galloping, jumping and collection required in horse sports such as eventing, dressage, racing, endurance or even just hacking round the blocks causes additional wear and tear. But where are the building blocks for repairing bones, ligaments, tendons and muscles coming from? Proteins are life! They are everything and if your horse does not get enough and their EAAs and reserves are used up then you will see sickness, lameness or even both.

If your horse's diet has minerals balanced to the grass, hay or haylage fed and you are still seeing niggling health issues then it is likely that protein levels need to be increased in the daily diet. Horses which can't get access to the right levels and right quality of protein year after year are likely to become protein deficient. This chronic deficiency is likely to manifest itself as poor top line, skin issues, poor hoof quality, white line disease and abscesses, lung issues, lameness, tendon and ligament weakness, pituitary dysfunction, digestive tract inflammation, metabolic dysfunction with a predisposition to be overweight. Whilst vets and owners are treating the symptoms of horse ill health no one is looking for the cause!

Another little discussed symptom is a ravenous appetite. Protein is so crucial that the body will keep the 'I must eat' switch fully on if it is not getting enough. Many forages don't contain enough protein even when consumed at enormous levels. So if your horse is

always hungry consider upping food and substituting some of the forage for a high protein food or whey protein and see if you see a decrease in appetite. As an interesting aside is that this works for humans too. You can only eat so much protein such as steak before you feel full because your body has hormonal mechanisms for detecting when enough protein has been consumed and switching the appetite off so you physically just can't eat anymore.

Your horse is overweight and is ravenous all the time! Try feeding more protein to switch the appetite off![Click To Tweet](#)

What should you feed for good quality protein for horses?

It all starts with forage. Since grass, hay or haylage is the greatest proportion of your horse's diet this is the most sensible and cost effective place to start. An average 500 kg horse will consume around 10kg of hay per day if allowed ad-lib access, on green and growing pasture this will convert to around 50 kg of grass, assuming a dry matter content of 20%. So a year of hay consumption will equate to a staggering 3.6 tonnes a year, grass consumption will equate to 18.25 tonnes!

So ignoring the forage component of a horse's diet and concentrating solely on the bucket feed each day is not sensible or cheap! Since the forage proportion of the diet is going to be the primary source of protein it is critically important to know whether your hay or pasture is a reserve of poor or high quality protein. If you can this should be the best and greatest source of protein, ideally it should supply all the horses protein needs.

To be sure of horse protein levels check amounts in forage through Forageplus analysis services[Click To Tweet](#)

Try not to get over consumed with the bucket feed straight away but become obsessed with the quality of forage your horse eats because that has the greatest impact on health. Feeding protein through forage is also the cheapest way to feed protein. If you see any of the signs discussed above then either have your hay tested or change your hay.

Low protein for horses in forage might mean a bigger bucket feed

If however you are unable to change the forage you feed your horse and it is low in

protein and has poor quality, you can feed extra protein in the form of fibre feeds like alfalfa or beet pulp or a better quality forage chop. The inclusion of soya or copra or oats in the diet can also help. Whey protein is another way to boost protein and amino acids levels. Linseed gives good protein levels and replacing a percentage of the forage with feeds which have good protein levels at the same time as supplementing extra methionine and or essential amino acids in powder form can be very helpful.

Find out more about ways to boost protein through concentrate feeds you would put in a bucket [here](#).

It is also important to know the mineral levels in forage. If you balance mineral, vitamin and protein to the grass, hay or haylage eaten, feeding a bucket feed matched to balance to this forage, this often transforms horses in many different ways.

Find out more about balancing minerals to grass, hay and haylage [here](#).

What about the quality of protein for horses?

Quality protein consists of a diverse suite of amino acids. Poor quality protein may contain non-protein nitrogen (NPN) which may consist of free (unbound) amino acids, nitrates, nitrites etc.

If you are feeding your horse a forage with high levels of NPN it can create a host of health problems including poor immune system/immuno-suppression, liver and kidney stress (these organs are working too hard to detoxify the NPN). This is because your horse is exposed to huge amounts of forage. If your horse is eating excessive poor quality NPN you may smell excessive ammonia in the urine.

Find out more about nitrate levels in forage [here](#).



What is the cause of poor quality protein for horses

Unbalanced soil fertility is usually the reason for high levels of NPN. All land needs to be looked after, applying either the wrong applications/fertilisers or not applying anything can result in deficiencies and excesses which then upset the mineral balance of the soil.

This harms the delicate underground balance and eco-system and ultimately it damages our horses.

Many people in the horse world believe that if they apply no fertilisers to their land then it makes the land suitable for horses and 'organic'. They are fearful of applying anything to the land and so do nothing but this is as bad as applying the wrong thing. The soil becomes sick with over grazing and compaction which then means the grass grown is sick. Sick soil and sick grass result in sick horses, and NPN and poor quality protein is one result of this in forage. Equally, many hay producers are interested in cash crops.

Applying NPK fertilisers without reference to the mineral balance of the soil might result in heavy crops which make money but the quality of that crop is highly compromised due to NPN and other imbalances.

Forage analysis and determining the quality of protein for horses

Forage analysis which test for protein are really just tests for nitrogen. Crude protein is actually the amount of nitrogen found in plant tissue multiplied by a factor of 6.25. That's because on the average, all protein contains 16% nitrogen. This arbitrary calculation then has no bearing on quality because it is not measuring individual amino acids (this would, by the way be really expensive). However, if you also have a mineral analysis of your hay showing sulphur levels you can use this number to work out the nitrogen to sulphur ratio.

This really should be a maximum of 10 parts nitrogen to one part sulphur. If the ratio is higher then you have a proportion of the protein which is not correctly formed, will be unavailable to the horse and possibly be a nitrate threat.

Antagonists			Analysis	Very Low	Lo
Lead	Pb	mg/kg	0.3	0.5	
Iron	Fe	mg/kg	408	50	
Aluminium	Al	mg/kg	94	70	
Molybdenum	Mo	mg/kg		0.01	
Sulphur	S	%	0.11	0.10	

	%	g/kg	%	g/kg
Digestible Energy (DE), Mcal/kg		1.72		2.1
Crude Protein	8.1	80.7	10.3	100
Estimated Lysine	0.28	2.8	0.36	3.6
Acid Detergent Fiber (ADF)	29.3	293.4		374
Neutral Detergent Fiber (NDF)	46.0	460.2	58.7	587
WSC (Water Sol. Carbs.)	12.1	120.9	15.4	154
ESC (Simple Sugars)	5.9	59.1	7.5	75
Starch	0.3	3.4	0.4	4
Non Fiber Carbo. (NFC)	17.1	170.8	21.8	218

	(MJ/kg)	(MCal/kg)	S	N/S Ratio
05	0.41	9.21	2.2	0.11%
				15.0
		0.00		#DIV/0!
		0.00		#DIV/0!
		0.00		#DIV/0!
7	3.8	90.9		

The photo above shows the values on both a nutritional and a full mineral analysis and we have ringed the figures used in red. Always choose the dry matter figures. The forage looks like it has good levels of protein, 10.3% (DM), but sadly much of this protein is NPN. You can see that the nitrogen sulphur ratio in the above forage is 15:1 which is unacceptable and means that what on first sight looks like excellent protein levels in the forage tested, actually is revealed to be poor in terms of quality. This is a very common problem in UK forages and is caused by poor mineral balance in the soil and over

application of nitrogen to fertilise.

To determine the ratio you need to find the nitrogen level in the protein figure. Do this by dividing crude protein by 6.25 then multiply by 10 and use this figure with the sulphur figure to determine the ratio.

While you are learning about N:S ratio take time to investigate William Albrecht Ph.D of the University of Missouri, if you can find his book 'Soil Fertility and Animal Health' you will start to realise that unbalanced soil fertility is the main culprit for imbalanced mineral ratios, high nitrates and NPN leading to sick forage, grass, haylage and hay which in turn creates sick horses. Producing a forage crop which is nutritionally complete for your horse, looking after your land, might not cure your horse but it will certainly lead to you preventing problems in unborn future generations. For us it has meant an end to abscesses, better skin health, better tolerance to exercise and all round better health. We are still improving the soil in our pasture over a 5 year programme, but this has to be the key to long term health of our horses. Dr Albrecht points out, human's and animals are ultimately a soil crop. We thrive or fail according to the wealth of the soil.

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