ESSENTIAL EQUINE NUTRITION

LA Waldron

CONTEXT

CONTENTS

1

CURRENT STATUS OF EQUINE NUTRITION

Equine nutrition receives very little in research funding compared to other species, especially those used in agriculture. Within the limited work conducted in horses, the vast majority has focussed on the thoroughbred race horse.

This poses problems for the equine nutritionist on several fronts. Firstly, there is a lot of necessary information that is simply not present within standard nutrition recommendations and, of the data available, much has been extrapolated from other mammalian species, such as pigs and ruminants. Secondly, there is very little data regarding non-thoroughbred breeds. These include the native breeds, heavy horses (frequently used to produce riding horses) and the warm bloods, which are increasingly used in high level competition disciplines. Since genetics is an important factor dictating the utilisation of feed and basic nutrient requirements, these gaps in the research are highly relevant, especially in modern equestrian sport.

The 'average' or 'standard' horse used as the basic model when formulating diets is most typically a 500 kg thoroughbred. Thoroughbreds can be poor models for other riding breeds, as they tend to have a smaller capacity for ingesting feed, do not readily gain weight, respond poorly or adversely to high grain or sugar diets and have a much faster metabolic rate. This is due to hundreds of years of specific breeding for speed over all other considerations. Due to this highly focussed breeding strategy, thoroughbreds now have the reputation for being 'nervy', 'hot' and having poor feet or conformation. They tend to be thin and often poorly utilise the feed they receive. In addition to these issues, thoroughbreds have problems regarding their apparent increased susceptibility to gastric ailments, such as ulcers and colic.

The current program in our own research is focussed on producing data for leisure bred horses and ponies, including specific characterisation of forage materials, which is surprisingly under-researched considering the horse's fundamental need for fibre. The facility is very interested in generating the 'missing nutritional data' regarding basic requirements of vitamins and minerals for example. The majority of nutrition research is funded by private companies, as is the norm in modern academia,

2

WATER - THE FIRST LIMITING NUTRIENT

3

UNDERSTANDING ENERGY

animals due to their diminished ability to emulsify fats (the first stage of digestion). Sugars are the most readily available form of energy-bearing food in animals, as they are made up of glucose units which are readily digestible. Horses come into contact with sugars at varying levels primarily via lush grasses or though molassed feeds, and care needs to be taken with sugars in equine diets as many horses and ponies are sugar intolerant (see below).

The energy from different plant sources can be seen in the table below.

COMPARISON OF DIFFERENT FRESH FORAGES, ON DRY MATTER BASIS (NATIONAL RESEARCH COUNCIL, 1994)

Forage type	*Fibre %*	*Fat %*	*DE* (Mcal/kg)*
Alfalfa/lucerne	24	3	2.94
Red clover	23	5	2.53
Fescue	25	5.5	2.22
Orchard grass	32	4	2.29
Ryegrass	20	4	2.20
Timothy	32	4	2.37

*digestible energy

You will notice from the table that energy level is not only related to the amount of fat and fibre in the material, but also the digestibility of that material. Merely adding up the amounts of nutrients present is not enough to understand how energy-rich the feed material is – we also need to measure the digestible energy (DE). DE is the standard measure of energy used for horses and other mammals. It involves feeding a group of horses, under controlled conditions, the feed material for more than three days (which approximates to the length of time it takes for previous feed to clear the digestive tract). At our facility we keep them on the feed material for at least seven days, and collect the faeces produced on the final day. We then measure the amount of energy consumed per day and the amount of energy excreted per day, and from these numbers, work out the amount of energy that has disappeared (i.e. been digested) from

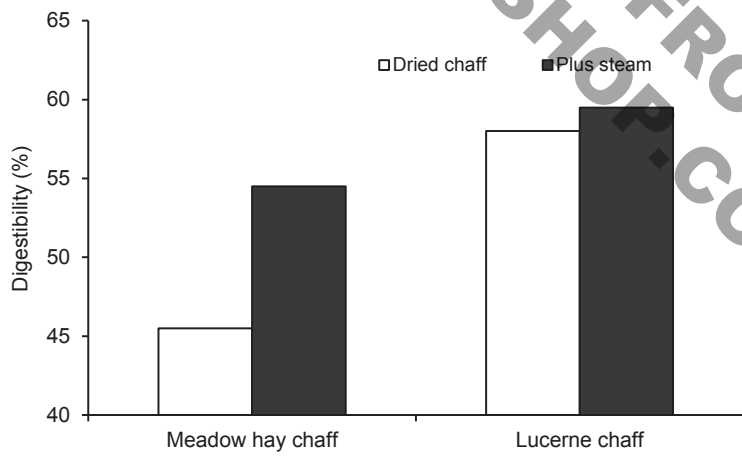
4

BASIC ELEMENTS IN EQUINE NUTRITION

soluble vitamins. Silage has a much higher energy value and nutrient profile compared to hay, as it is a more efficient preservation method, but it must be made correctly and be free of mould toxins. Specialist steam processing of chaff forage materials, can increase digestibility and improve nutritional quality by up to 18% for meadow hay and 4% for lucerne (figures below).

THE IMPACT OF PROCESSING ON FORAGE

Processing type	*Suitable for*	*Result*
Hay	All forage	Basic preservation, lower nutrient value and losses in leaf material
Silage/Haylage	Grass-based forage	Preserves more nutrients than hay when well made
Dried chaff	'Shatter'-prone leafy forages	Controlled drying maintains the more nutritious leaf components
Steamed chaff	All forages	Increases digestibility of nutrients, when processed carefully
Pellets	High protein forages	Maintains the protein content and reduces dust and losses of leaf material

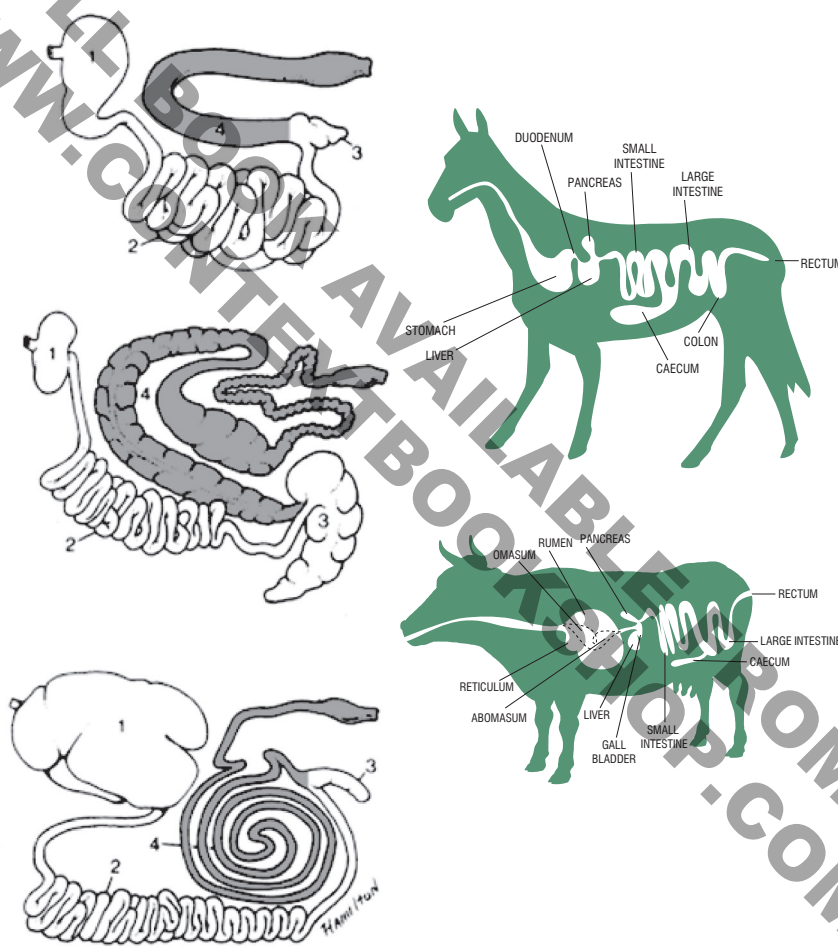


Effect of steam processing on chaff digestibility (personal communication, 2007)

5

THE EQUINE DIGESTIVE TRACT

Understanding the digestive system of a horse is essential for proper feeding and management. Horses are non-ruminant herbivores (like rabbits & guinea pigs), which means they do not have a rumen (like sheep & cattle) containing a bacterial population to help breakdown and utilise plant material. Instead, horses have a relatively large caecum (and colon) containing the necessary bacterial population for the digestion of plant material.



The digestive systems of the dog, horse and cow. (Hayes, 1987)

Some of the differences between the horse and cow are advantageous to the horse, others are disadvantageous. The cow, for example, can

6

FEEDSTUFFS FOR HORSES

now appear to be black – as ergot fungus has infected them. This fungus produces a neurotoxin, and is hazardous to animals and humans alike who consume it. Good feed manufacturers should have quality control systems to check for such problems. However, it's wise to check for the presence of any mould if you are buying locally or from a non-recognised source. For the same reasons, feed should always be stored in a cool dry place and used up promptly once the bag is opened.

Comparing the main grains used in horse feeds, there are major differences in their energy and protein value. Some grain (e.g. rice) has a very low lysine level – which (as the most important amino acid) needs to be supplemented to ensure the horse has all the basic protein subunits it requires.

NUTRITIONAL CHARACTERISTICS OF COMMONLY USED GRAINS FOR HORSE FEED

Grain type	*Digestible energy (Mcal/kg)*	*Crude protein (%)*	*Lysine (%)*
Maize	3.88	9	0.26
Barley	3.67	12	0.45
Oats	3.27	13	0.55
Wheat by-product	3.40	18	0.67
Rice	3.80	8	Low

The best protein and lysine levels are available from oats and wheat-by-products, which is probably why oats has traditionally been a grain of choice for horses.

As horse owners increasingly rely on fully formulated diets bought readymade, there are fewer issues with trying to balance horse feeds in your own feed room. However, it is still useful to understand why certain grains are used in the mix. For owners who prefer to use 'straights' (i.e. single types of feedstuffs they blend themselves), then understanding what each grain type contributes nutritionally is vital to ensuring a balanced diet is fed.

7

FEEDING INDIVIDUAL HORSES

8

FEEDING FOR BREEDING

If your mare is already pregnant the final three months is the period where the foal's growth accelerates rapidly. As a result, the mares feeding requirements will increase correspondingly. Suitable regular feeding, as the broodmares requirements increase in the last period of pregnancy are needed to maintain and build her reserves of nutrients to prepare her for producing milk for the foal after its birth. The table below shows how a mares requirements change during pregnancy, birth and lactation. Not only do general requirements increase – but some nutrients are needed to fulfil specific functions during breeding. For example, calcium daily intake (for milk) increases from 20 g per day in early pregnancy to 36 g in late pregnancy and 60 g at peak lactation.

CHANGES IN BASIC NUTRITIONAL REQUIREMENTS IN 500 kg BROODMARE (NRC 2007)

Daily intake	*Digestible Energy (Mcal)*	*Protein (g)*	*Lysine (g)*
<5 months gestation	16.7	630	27.1
Pre-foaling	21.4	893	38.4
Peak lactation	31.7	1535	84.8

When we see how much extra a mare needs in late gestation and lactation, it is obvious why stud feeds are so highly formulated. Breeders should use broodmare feeds in the appropriate amounts according to stage of pregnancy and/or lactation. These feeds are formulated to give a high concentration of nutrients in a relatively small volume of feed. This allows us to get all the nutrients the mares require into them without overloading their gut, which is being comprehensively squeezed into a smaller and smaller area by the foal as it reaches full term.

What about if you have a mare that's a very good doer and is likely to get fat on stud mix? In these cases, you can opt for a feed concentrate, which is designed to be fed alongside forages and/or grains. Concentrates contain the protein, vitamins and minerals but are low in energy contribution, making it easier to maintain correct body condition score whilst ensuring the mare has the elevated levels of other nutrients which

9

NUTRITIONAL PROBLEMS AND DISEASES IN HORSES

humans) the stomach provides an important primary step in digestion. In horses the stomach is differentiated as a top and bottom area. The bottom area contains the glands which secrete strong acid, which is important in initialising the breakdown of protein. It also provides a 'disinfecting' service – as many potentially harmful bacteria and compounds are negated by the strongly acidic conditions. The bottom part of the stomach is dark red, glandular and also provides mucous secretion, which forms a protective coating in this area of the stomach preventing acid burns. The upper part of the stomach is paler in colour and lacks the ability for secreting acid and protective mucous. It provides extra capacity for consuming high volume, lower density feeds – such as forages.

In the wild, horses continuously graze throughout the day. This means that their stomach always contains some level of forage. Interestingly, feed doesn't appear to spend that long in the stomach, perhaps less than 30 minutes, although this is tricky to measure accurately without resorting to surgical methods. Horses stomachs, compared to the rest of their digestive tract, are relatively small, especially in Thoroughbreds that have been bred for hundreds of years to be very light weight, and have smaller gastric organs as a result. This is all important in their potential to be more affected by ulceration compared to other mammals. The regular intake of forage forms an interleaved mat of fibrous material that lies against the wall of the stomach. This mat is thought to absorb the acid, removing it from the walls, especially from the unprotected upper part of the stomach, which cannot secrete protective mucous. However, many horses nowadays are not allowed a continuous supply of forage, especially when competing. This may be done to reduce the body weight to allow higher speeds, and may also be related to our own social conditioning (from experience!) that we shouldn't exercise on a full stomach. However, from a horse's point of view, this is at odds with its gastric function. It appears that leaving a horse with an empty stomach for any length of time contributes to ulcer development.

So – what is an ulcer? The answer for horses is that ulcers are burns caused by stomach acid having too much contact with unprotected stomach wall tissue. Any acid burn will cause damage, and ulcers are

10

PADDOCKS AND PASTURE

of the bacteria that perform the correct type of fermentation, and are a good insurance policy in making high quality silage. Remember that silage is normally made earlier in the year than hay, when the plants contain higher levels of nutrients, and this is reflected in their nutritional value (see table below). Preserving plants when immature (early in the growing season) means they contain more energy and protein, but less fibre in comparison with hay made from the same sort of pasture in late summer. The moist characteristic of ensiled forage typically makes it more palatable and can make it easier to chew in horses with poor teeth. All silage destined for equine consumption must be cut long and not chopped up, as is commonly done for clamp silage for cattle. Ideally, it should be a long length akin to hay cutting. Short chopped silage can cause impaction, in the same way as grass cuttings, and will cause major blockages, and should never be fed to horses.

COMPARISON BETWEEN HAY AND SILAGE MADE FROM THE SAME PASTURE

Forage type	*Energy (Mcal/kg)*	*Crude Protein (%)*	*Fibre* (%)*
Grass hay (mature)	2.04	11	69
Grass silage (immature)	2.30	17	51
Legume hay (mature)	2.21	18	51
Legume silage (immature)	2.52	23	37

*NDF; NRC 2007

It is very important that only correctly-made silage is fed to horses. If air is allowed into the ensiled grass, it can cause growth of various micro-organisms like fungi and mould, and a certain type of bacteria called Clostridia, which causes botulism. Clostridia produce a toxin which causes paralysis of the gut, and is fatal in horses. The differences between silage, balege and haylege are rather vague, but tend to reflect how much wilting the grass has been exposed to, with silage containing most water and haylege being the driest. Irrespective of which type you use, when you open the wrapped bales, the forage should smell sweet, almost like ripe bananas (to my nose anyway!). If it smells or looks bad, then be wary of using it. Watch out for black slimy patches, mould growth or very dry areas, which have escaped fermentation.

11

FORMULATING DIETS FOR HORSES

Although the concept of 'formulating a diet' is mainly associated with commercial feed manufacturers, there is no reason why any horse owner can't also use the basic principles of diet formulation to evaluate their own horses daily nutritional intake, and make changes accordingly.

So, how do we go about formulating a diet? Firstly, in order to assess how much of the different types and combinations of feedstuffs that are available should be fed, we need to know what levels of nutrients are typically contained in those materials. I say 'typically' because it must always be remembered that natural materials, such as forages and grains, always have some variability associated with them, caused by conditions they were grown and harvested in, genetic varieties, weather conditions during growth and so on. In some species, we are fortunate that the main types of feed materials or ingredients are very well characterised. Although we can analyse for nutrient levels by chemical or other laboratory analyses, this doesn't directly relate to the amount of nutrients a horse can digest and absorb from that material. In order to get those values, digestibility trials are needed, where the levels of nutrients are measured in the feed and then the faeces from horses are collected under carefully controlled conditions, and analysed for the amount of nutrients that have been removed by the process of digestion and hind gut fermentation. This will give us the true value of nutrient digestibility for any feed materials and any given nutrient.

Once we have these nutritional values for feedstuffs, we can start to evaluate how best to include them as part of a daily balanced diet for a horse or pony. First of all we have to look at what that horse and pony needs, and then match the diet to their specific requirements.

Once you know the needs of the horse, you can start to examine the amounts of feed they require per day and the amounts of nutrients within their daily ration that are required. Happily for horse owners, the days of long hand calculations for diets is now over, and there are many easy to use and accessible diet formulation packages on the internet, Even the global standards body, the NRC, offer this service now via their website.

INDEX