Optimum Nutrition for Competition, Breeding & Leisure.

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Fibre – First & Foremost

Fibre – along with water, is the most fundamental and crucial nutrient in the horse's diet, regardless of the type of work or lifestyle. All horses, from elite athletes to family hacks have the same digestive system which is primarily designed to digest fibrous foliage to sustain digestive equilibrium and life.

To go forward with equine nutrition, we have to look back at how the equine species evolved and how far removed the horse is now from his natural habitat and lifestyle. It is quite ironic that an animal which is naturally a free-roaming, herbivore is now frequently enclosed and fed unsuitable cereal based ´meals´.

The plethora of modern day feeds and supplements can be confusing to even the most educated horse owners, but by understanding the basic digestive system of the horse, we can all clearly understand what type of feed materials we should – and shouldn't feed our horse/s.

First of all, let's stand back and take a look at the horse. The first thing that is noticeable is that he has a long head attached to a long neck which given the opportunity is usually pointing to the ground. This tells us that he is a grazing animal. The equine head houses 40-42 teeth within the jaw that functions like a large hinge pivoting from the back of the head just behind the ears.

Swinging the jaw whilst chewing forage at ground level means that the teeth are worn evenly. When feed is raised either in a bowl or hay net, the natural jaw action is disrupted and uneven tooth wear results. Fibrous foliage has a large surface area, therefore the horse has to swing the jaw and chew intensely to break the forage down into smaller particles in preparation for swallowing. In contrast, cereals have a much smaller surface area so the horse has to chew in small circles which also results in hooks and sharp edges, leading to pain and discomfort.

Apart from the benefits to teeth, chewing plays a large part in the initial stages of digestion as saliva is only produced in response to chewing. Saliva contains high levels of bicarbonate and saline which acts as a buffer to gastric acid and as a lubricant to prevent choke. Equine saliva doesn't contain carbohydrate digesting enzymes such as amylase.

Feed type affects chewing rates and hence saliva production. For example; Long fibre such as hay requires between 3000 – 5000 chews per kg, whereas on average, concentrates require only 800-1200 chews per kg.

The Equine Digestive System

Species	Stomach (%)	Small Intestine (%)	Large Intestine (%)
Horse	10	30	60
Cow	70	20	10
Dog	60	30	10
Human	35	35	30

As you can see from this chart, the horse has a very small stomach compared to other species. This reflects the ´trickle feeding´ natural grazing behaviour of the horse. Although the stomach is less than 10% of the digestive tract, its optimum function is when only two thirds full, therefore it really only represents 6% of the tract. This means that concentrate feed should be restricted to 1.5/2kg max per meal.

Stomach

When food is chewed in the mouth, saliva is produced and mixed with the feed bolus in preparation for swallowing. The moist food then enters the stomach and is mixed with gastric acids which are continually produced in the lower portion (distal). The fact that gastric acid is continuously produced and saliva is only produced when the horse is chewing poses a major problem for horses that are stabled and fed intermittent meals.

Small Intestine:

The small intestine is approximately 25 metres long (80ft) and is comprised of 3 parts – the duodenum, jejunum and ileum.
Food moves quickly through the small intestine and as speed of passage is affected by volume, smaller meals will move slower allowing more time for nutrient uptake and optimum absorption. Digestive enzymes are secreted by the pancreas and gut membrane which digest soluble carbohydrates, fats and protein. However, amylase activity is low therefore there is limited capacity (and time) for starch digestion. When undigested starch passes through the small intestine into the large intestine degradation occurs rapidly resulting in an acidic surge which destroys populations of fibre digesting microbes, resulting in colic and laminitis.

Bile plays a major part in fat digestion, but unlike humans, horses do not have a gall bladder and bile is secreted continuously from the liver. The vitamins A, D & E are also absorbed in the small intestine, along with most minerals and trace elements.

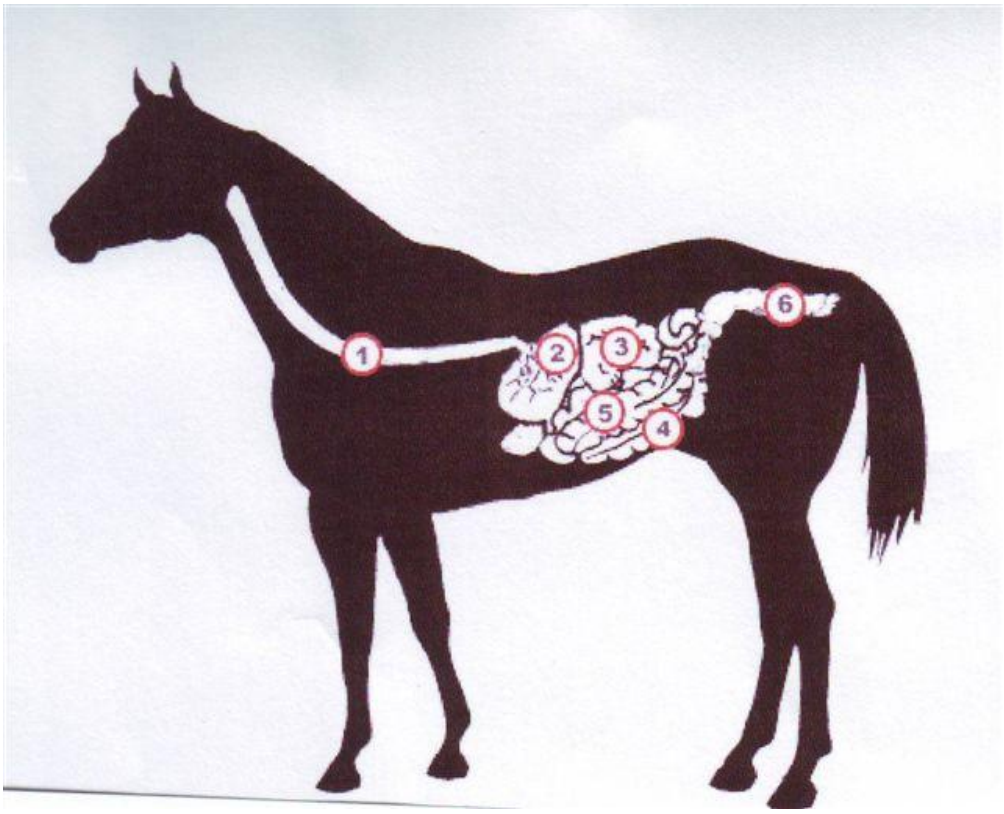
Caecum and Large Intestine:

The caecum and colon represent the largest portion of the equine gastrointestinal tract (60%) which is the largest hindgut of any domestic animal. The large intestine holds around 100 litres of fluid and houses billions of microbes which produce fibre digesting enzymes. These microbes are critical to digestive equilibrium and survive in a neutral pH environment which is stabilised by bicarbonate secreted from the pancreas. When feed leaves the small intestine, it enters the caecum where undigested nutrients are fermented before entering the colon. Horses cannot breakdown fibre themselves so are totally reliant on the resident microbial populations in the hindgut to do it for them which is why it is so important for fibre to be the mainstay of the horse's diet. A healthy, fibrous diet results in large, healthy populations of fibre digesting microbes.

Plant material digested in the hindgut differs in cell contents (energy and nutrients), but all fibre contains cellulose, hemi cellulose and lignin. Lignin is indigestible so is excreted, but the rest of the fibre cell contents are converted to volatile fatty acids (propionic, butyric and acetic) which are a major source of natural energy for the horse. Digestive microbes also produce B complex vitamins and vitamin K which are then absorbed by the horse. The large intestine is also the primary site of phosphorus absorption, and acts as a reservoir for water and electrolytes.

The Equine Digestive System

1. Oesophagus. 2. Stomach. 3. Small Intestine. 4. Caecum
5. Large intestine. 6. Rectum



Forage Facts & Nutrient Values

Grass:

The nutrient quality of grass can differ immensely depending on many factors such as: soil quality, environmental factors (rainfall/sun), pasture management etc. But in general grass contains approx. 80% water, 16-20% + protein, 12MJ/kg energy (dry weight), vitamins and some minerals (iron, manganese, zinc, copper & selenium, calcium & phosphorus). Sugar values fluctuate immensely. On average a horse will ingest approximately 10kg of grass in 1 hour which equates to 2kg of dry matter.

Meadow Hay:

Meadow hay is generally made from pasture and contains various species of grasses, herbs and plants. It also ranges in nutrient and energy values depending on quality but on average it contains 12-15% water, 8-12% protein, and 9-11MJ/kg energy. Meadow hay usually contains higher levels of minerals than seed hay due to the proportion of deeper rooting herbaceous species. Vitamin levels are lower than in grass, notably vitamins A & E.

Seed Hay:

Seed hay is more uniform and usually contains one or 2 species of grass, typically Timothy or Rye. Seed hays have lower energy (6-8MJ/kg), protein (4-8%) and nutrient levels as they tend to be more stalky than meadow hays.

Haylage:

Haylage is known as a semi- wilted forage which means that it is hay that is cut and baled before it has dried, typically with moisture levels around 40%. Once the haylage is cut it is sealed in an airtight plastic bag which means that there are very few dust and mould spores present, making haylage suitable forage for horses suffering from respiratory disease. If the sack is punctured or damaged it should be discarded as mould growth will occur rapidly. Due to the high water content, fibre levels are lower than dry forage so more has to be fed to meet the horse's fibre needs. Its moist state also means that it is consumed faster than dry hay leaving the horse for longer periods without the satisfaction of chewing. Typically, its energy and nutrient content is similar to hay.

Straw:

Straw is made from the stalks that are left from grain harvesting (oats, barley & wheat) and is more commonly used as bedding rather than a feedstuff these days. However, in many parts of the world straw still constitutes the major form of forage for horses. Straw is high in fibre, but low in nutrients (4-6% protein, 5MJ/kg energy) so is not suitable for most horses. However, it is adequate for use as a forage feed for animals that do not require high levels of energy and nutrients and is useful for satisfying chewing and fibre needs for laminitic horses and ponies. It should not be fed to young horses until the microbial flora is established in the large intestine as it may cause impaction. Due to its high fibre/dry matter content (90%), plenty of fresh water must be made available to avoid impaction colic.

Feed Related Disorders (FREDs)

Physiological

Teeth/Chewing

We have mentioned teeth and jaw action but it is also known that mouth pain leads to abnormal head and neck carriage which in turn leads to back pain and subsequent obscure lameness and/or poor performance.

Colic

Colic is a general term that refers to pain and/or discomfort within the gastrointestinal system. There are several types of colic ranging from mild spasmodic cases to intestinal torsions, but it is well proven that when horses are fed a natural diet of at least 1.5% bodyweight in forage with limited or no cereals, colic rarely occurs. Common sense procedures such as ensuring the horse has access to pasture/turn out where he can graze and exhibit natural behaviour with others of his own species will also help reduce stress and incidence of colic.

Nutritionally Induced Laminitis

Laminitis is one of the most common and debilitating diseases of the equine species that we see today. Although there are several causes, nutritionally induced laminitis is one of the most common. In the UK many diet related laminitis cases are associated with overload of soluble carbohydrates, usually in the form of grass. However, starch is also implemented in many cases and one of the reasons why cereals should be kept to a minimum or excluded in equine diets.

Although glycogen (starch/sugar) does provide energy for the horse, there is also a risk of digestive disturbance and disease. Feeding digestible fibre and oil as an energy source is a much safer alternative – benefits without the risk.

Horses that are prone to laminitis in particular must be fed a high fibre, low soluble carbohydrate diet (sugar/starch) diet. Recovering laminitics will also need a good complement of vitamin, minerals and antioxidants to aid recovery. Never starve a laminitic.

It is well known that spring grass should be avoided or kept to a minimum. But also be aware of growth spurts in the autumn. Frost affected grass is also thought to contain higher levels of fructans which have been implicated in causing laminitis.

EGUS (Equine gastric Ulceration Syndrome)

Equine gastric ulceration syndrome is one of the most common diet related disorders to occur in competition horses, especially horses in race training. Several studies have been carried out in recent times and all have reported a high incidence of EGUS, often seen in over 90% of horses studied. The main cause of EGUS is a high cereal ´meals ´and forage deprivation meaning that the horse is spending long periods without food in the stomach. As previously discussed, the continuous secretion of gastric acid accompanied by the lack of alkaline saliva leaves the stomach exposed to the acidic effects. Most of the acid is produced in the lower part of the stomach, and although the upper part does not produce acid, it is not protected. Therefore, when the horse is physically moving during competition or exercise, the acid from the lower stomach comes into contact with the upper area resulting in ulcers.

Food Intolerance

Equine food intolerance and allergies are becoming more common and widespread. Many are difficult to diagnose and often process of elimination is the only way of determining the exact cause. Like us, horses are individuals and some individuals are more sensitive than others. However, cereal proteins are the most likely to cause a reaction rather than dietary protein which was previously implicated. Once again, a high fibre diet with oil providing the energy source will eliminate the problem.

ERS (Equine Rhabdomyolysis Syndrome)

Although it is thought that ERS (commonly known as azoturia or ´tying up´) may occur due to calcium irregularity within muscle cells, starch and sugar have also been implicated so should be removed from the diet and replaced by a fibre and oil based feed. Practical pre and post exercise management such as warming up and down before and after competition and allowing the horse regular access to turn out will also help in prevention. Adequate electrolytes should always be provided during competition and hot/humid weather conditions.

Psychological

Stereotypic Behaviour & Poor Performance

Although stereotypic behaviour is usually referred to as a psychological condition, it invariably causes secondary physical problems effects and poor performance.

Almost all stereotypical behaviours are man made and many relate to unsuitable dietary management. Scientific research has proven that when feeding time is restricted abnormal behaviour patterns increase. The most common behaviour patterns are known as crib-biting (cribbing), wind sucking, wood chewing, weaving and box walking, and all are stress induced. These behaviours are performed by horses in a subconscious effort to cope with stress – similar to smoking in humans. Forage deprivation is one of the main causes.

Stabled horses fed ´meals ´rather than ad-lib forage are known to have the highest incidence of stereotypic behaviour as these horses may spend only 15-20% of their time eating opposed to 65-70% + if able to naturally graze.

To prevent stereotypic behaviours occurring make sure that your horse is turned out for a period each day (longer the better) and is able to interact with others of his own species. Ensure that forage intake is at least 1.5%/bodyweight/day and cereal meals are either replaced by more a more suitable feed or kept to a minimum. As always, make forage the foundation of the diet.

Conclusion

In conclusion, it seems that if we simply understand the evolved digestive physiology of the horse and feed him as such, many of the man made digestive and psychological disorders will become history. Our understanding of equine nutrition has moved on in recent times thanks to scientific research and although there is still much to learn, we must move forward and away from antiquated ideas on feeding horses. One thing we do know is that the digestive system of the horse is very different to that of cattle, sheep and pigs, therefore the outdated system of feeding agricultural products such as cereals even when they are dressed up in different disguises such as ´muesli´ should be avoided when alternative, more suitable feed ingredients are available.

So many modern-day equine diseases seemed to be associated or aggravated by inappropriate diet and despite the diversity of diseases; most feeding recommendations for prevention and recovery are the same and come back to feeding the natural diet of the horse – fibrous foliage. It is just plain common sense.

Finally, let's not be blinded by glossy packaging or adverts, but make our own choices from the knowledge that we have of our horse's digestive design and evolved physiology. But most of all, when formulating a diet for our horse, whatever his job, always make
Fibre - first and foremost.

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