UNDERSTAND THE ROLE GUT HEALTH PLAYS IN OVERALL HORSE HEALTH AND HOW TO PREVENT SOME COMMON GUT-RELATED 'MYSTERY AILMENTS' MANY HORSES SUFFER FROM.

THE GUT BREAKTHROUGH

HOW TO FEED TO KEEP YOUR HORSE'S GUT (& YOUR HORSE) IN EXCELLENT HEALTH

by Dr Nerida Richards
Equine Nutritionist

POSEIDON EQUINE

WWW.POSEIDON-EQUINE.COM

TABLE OF CONTENTS

POSEIDON EQUINE

POSEIDON EQUINE PTY LTD
1-36 INVESTIGATOR DRIVE, UNANDERRA, NSW, 2526
+61 2 42 608 893
info@poseidon-equine.com
www.poseidon-equine.com

DESIGN BY
www.sheoakandco.com.au

INTRODUCTION

Despite their size and strength, horses are completely reliant on the trillions of micro-organisms that live in their digestive tract - particularly the hindgut.

Just like in humans, the microbiota in the horse plays a major role in digestion, metabolism, immunity and neurology. As such, it largely controls the overall wellbeing and health of the horse.

The 'microbiota' refers to the community of microorganisms - including many different types of bacteria, fungi and protozoa - that live in the gut. Ideally, their role is to help break down the food the horse eats, provide it with nutrients and to live symbiotically (ie. in harmony) with the horse. Through research, we are really starting to understand just how crucial healthy microbiota are.

As horse owners, it is important we understand that the balance between 'good' and 'bad' bacteria is influenced by *what* we feed, and that in turn this greatly impacts our horse's behaviour, health, immunity and performance.

The fact is, the gut is the 'engine' of the horse. Anything wrong with the gut will likely manifest as other issues such as behavioural or 'attitude' problems, a dull coat or brittle hooves, or just a general lack of *joie de vivre*.

Unfortunately, it's quite easy to inadvertently create a hindgut environment that will cause the horse pain, inflammation and have negative flow-on effects.

However, the flipside is that armed with some basic knowledge, we can consciously choose to feed our horses in a way that favours the proliferation 'good' bacteria, a healthy hindgut and a wonderfully happy, healthy horse.

Want to know how? Read on...

Anything wrong with the gut will likely manifest as other issues such as behavioural or 'attitude' problems, a dull coat or brittle hooves, or just a general lack of joie de vivre.

1. MEET THE BACTERIA

GOOD AND BAD BACTERIA

There are two major groups of bacteria that live in a horse's hindgut:

1. Fibre fermenters (aka 'good' bacteria)

These little guys are a diverse group of bacteria who love to ferment fibre. They devote themselves to the slow process of breaking fibre down via fermentation and turning it into volatile fatty acids (VFAs) which the horse can then absorb and use as a source of calories.

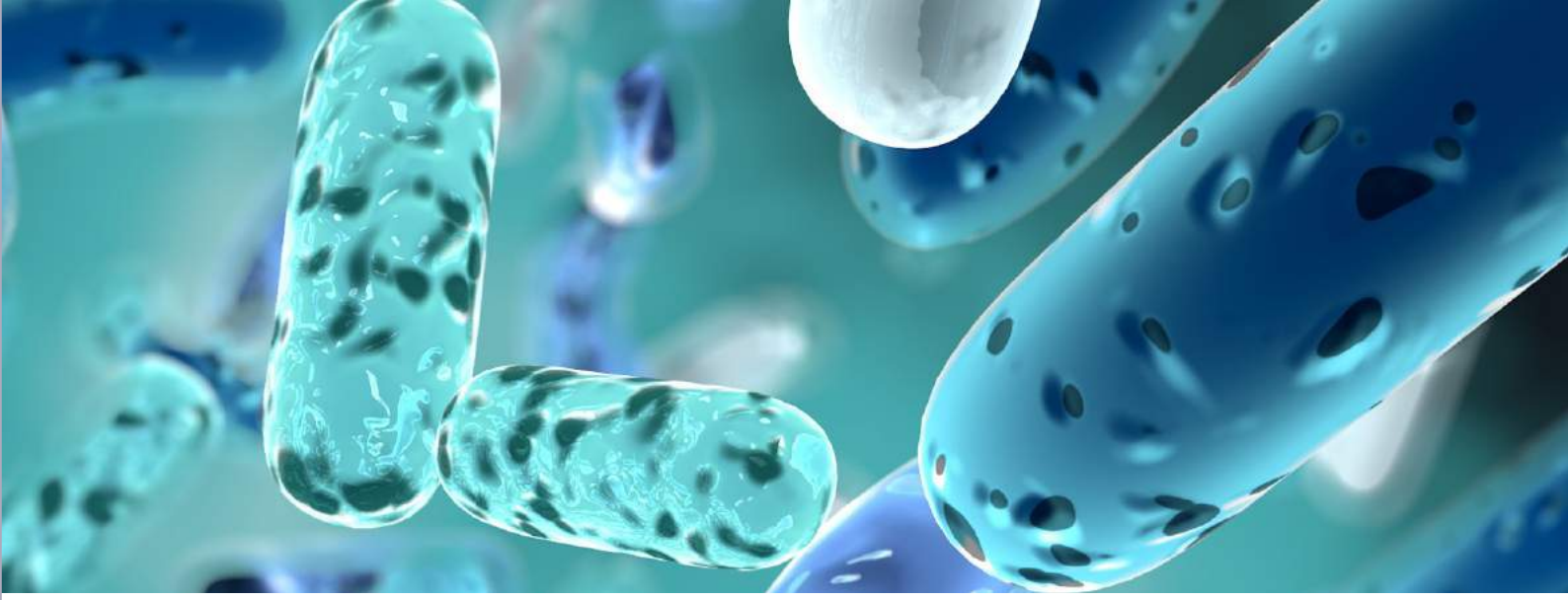
They are sleepy little critters and only produce VFAs at the same rate as the horse can absorb them. This means acids never build up in the hindgut and the hindgut pH remains neutral (close to 7). These fibre fermenters are what we refer to as 'good' bacteria.

2. Starch & sugar fermenters (aka 'bad' bacteria)

These bacteria ferment starch, fructan and sugars and do so extremely rapidly. Compared to the sloth-like fibre fermenting 'good' bacteria, 'bad' bacteria do everything fast, including fermenting starch, fructan and sugars to VFAs and lactic acid.

They work so fast in fact, that the VFAs and lactic acid accumulate in the hindgut and cause the hindgut contents to become too acidic. Because the proliferation of these bacteria upsets the pH of the hindgut, we term them 'bad' bacteria.

> *Fibre fementing bacteria are what we refer to as 'good bacteria'. They provide the horse with useful calories in the form of VFAs.*



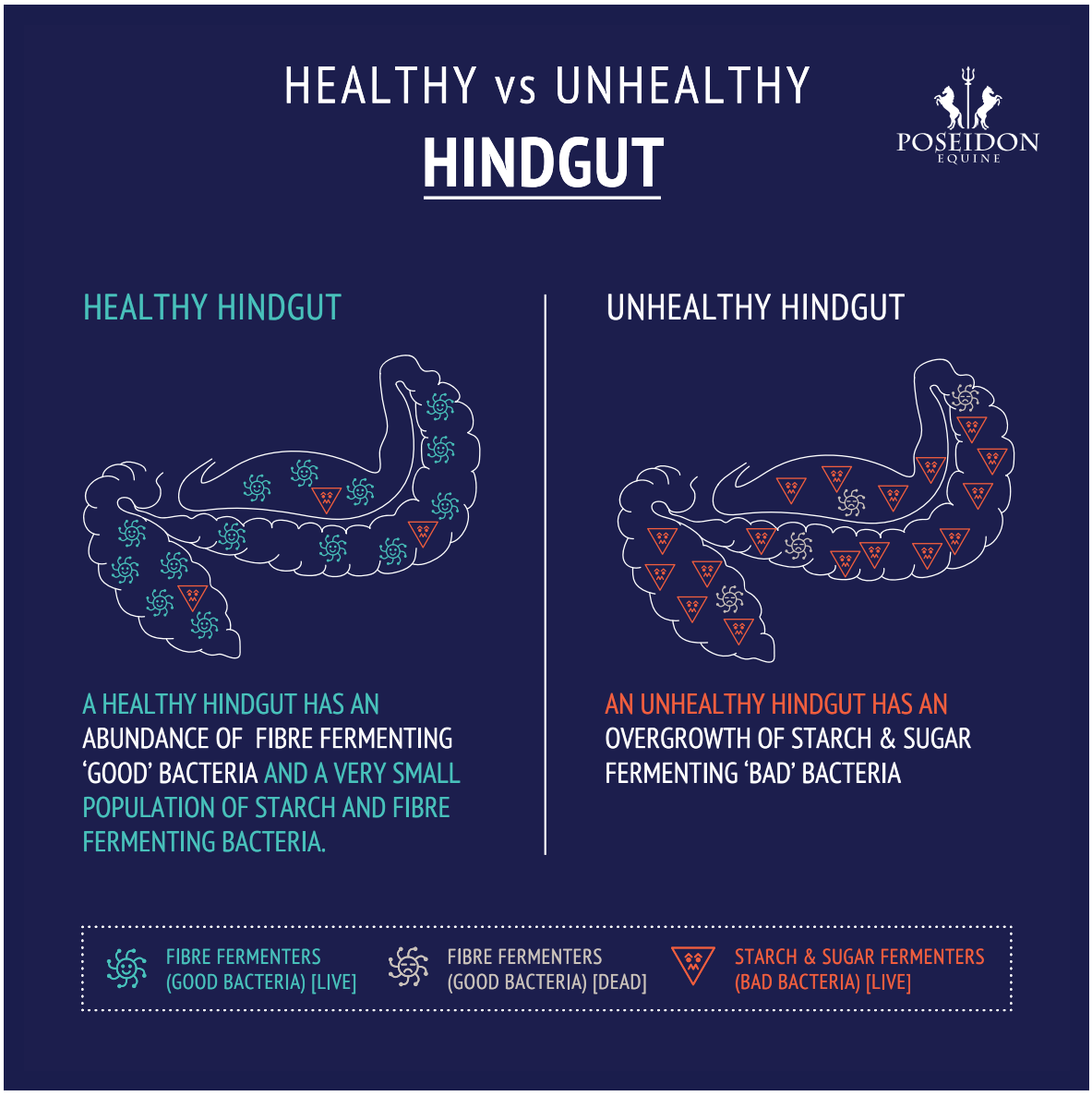


Figure 1. *A healthy vs an unhealthy hindgut*

2. BENEFITS OF GOOD BACTERIA

The 'good' bacteria provide the horse with many benefits, including:

Efficient fibre fermentation

A horse with a gut fully populated by these fibre loving bacteria is able to extract maximum nutrition out of everything it eats. This means you can feed less for better results.

Vitamin production

Fibre fermenting, 'good' bacteria produce vitamins including the B-group vitamins like vitamin B1 and biotin. These bacterial derived vitamins make a major contribution towards meeting a horse's daily requirement for these vitamins.

Healthy appetite

The vitamin B1 these 'good' bacteria produce is important for maintaining a healthy appetite.

Hoof quality

The biotin produced by the 'good' bacteria is essential for a horse to grow strong, healthy hooves.

Intact gut wall

The gut wall needs to remain strong to allow it to perform its job of being an effective barrier that blocks pathogens and toxins from entering the horse's body.

A neutral hindgut pH

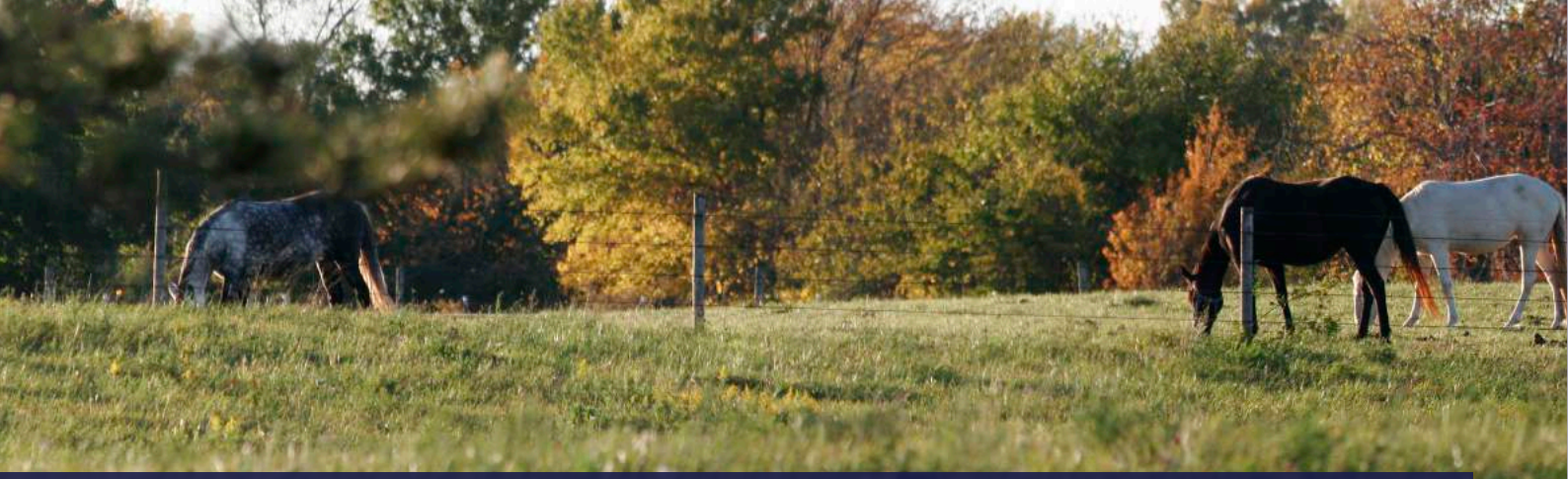
An abundance of 'good' bacteria help to keep the hindgut environment at a neutral pH - which doesn't cause damage to the gut wall.

Strong immune system

While not yet well understood, we know that gut bacteria play a major role in maintaining the immune function of their host animal (in this case, the horse), so keeping them healthy keeps the horse's immune system working the way it should too.

> *Vitamin B1 produced by 'good' bacteria is important for maintaining a healthy appetite.*

Figure 2. *Signs of a healthy gut*



3. DRAWBACKS OF BAD BACTERIA

If the population of starch and sugar fermenting, 'bad' bacteria increase too much, lots of undesirable things start to happen, including:

Reduced fibre fermentation

These bacteria love to live life in the fast lane so to them, fermenting fibre is slow, boring and not something they enjoy doing - if they don't have to ferment fibre they just won't. Which means a horse with a gut full of these bacteria will extract very few of the calories from fibre, earning the horse the title of 'hard keeper'.

Vitamin B1 is destroyed

Whereas the fibre fermenting 'good' bacteria produce vitamin B1, the starch and sugar fermenting 'bad' bacteria actually destroy this vitamin. They produce an enzyme called thiaminase which chops up vitamin B1 before a horse can absorb and make use of it. Not helpful!

Hoof problems

Biotin production is reduced when 'bad' bacteria take over, eventually leading to problems with hoof growth and strength.

Erosion of the gut wall

When excessive acid is produced and accumulates in the hindgut, the low pH starts to physically erode the gut wall. With holes in it, the gut wall starts to leak and eventually allows pathogens and toxins to enter the horse's body.

Laminitis

Something that leaks from the gut during hindgut acidosis (researchers still don't know what) is well known to cause severe laminitis.

Colic

Because of the rapid rate at which 'bad' bacteria ferment starch and sugars they also create a lot of gas which can lead to pain, resulting in colic.

Behavioural changes

Horses with disrupted hindgut function tend to show changes in behaviour including hyperactivity and stereotypical behaviours like crib-biting and chewing timber.

A horse with a gut full of 'bad' bacteria will extract very few of the calories from fibre, earning the horse the title of 'hard keeper'.

Figure 3. *Signs of an unhealthy gut*

4. SUPPORTING GOOD BACTERIA

Given the benefits that the 'good' bacteria provide and the drawbacks associated with too many 'bad' bacteria, it makes sense that we would feed to try and favour the 'good' bacteria and inhibit the 'bad' bacteria.

Doing this is relatively simple. You just have to do three main things:

1. Feed low fructan forages

Fructan is a storage carbohydrate made by plants as a source of food for themselves. In temperate (C3) grasses*, fructan is one of the main carbohydrates produced. The problem with fructan is that the horse cannot digest it in the small intestine, which means it all ends up in the hindgut where it will feed and therefore favour the starch and sugar fermenting 'bad' bacteria.

So for gut health and a better balance of hindgut bacteria you should always try to feed low fructan forages (see p.11).

2. Feed grains that contains starch which can be digested in the small intestine

Raw grains (with the exception of oats) contain a lot of starch, but less than one third of the starch they contain is digested by the enzymes in the small intestine. This means that a large amount of starch is left to travel to the hindgut where it will be fermented by the 'bad' bacteria, again favouring them. It also creates an environment which puts the 'good' bacteria at a disadvantage (see p. 12).

Cooking grains using a combination of heat and water changes the structure of the starch and allows the enzymes in the small intestine to do a much better job of digesting the starch before it reaches the hindgut. When you feed cooked grains, only tiny amounts of starch make it to the hindgut, meaning you can feed some grain while still helping the fibre fermenting 'good' bacteria to thrive.

3. Feed in small meals

The horse's stomach plays the important role of regulating how fast it releases food into the small intestine. Under ideal conditions, the stomach is able to hold onto food and release it slowly, so it travels slowly through the small intestine, giving the small intestinal enzymes time to do their important work of cutting up starch or sugars so they can be absorbed before they reach the hindgut.

However, the stomach of a horse is only small (9-15 L). If you feed a meal that is too big to fit in the stomach, the stomach is forced to release food at the same rate the horse is eating it.

With a more rapid release from the stomach the feed will then also travel faster through the small intestine and doesn't allow enzymes the time they need to chop up starch and sugars so they can be digested. And there is only one place they can end up, and that is the hindgut! Once there they will feed the 'bad' bacteria and contribute to making an environment that makes your lovely fibre fermenting 'good' bacteria go into hiding or die.

* Temperate (C3) grasses include ryegrass and cereal forages like oaten, wheaten and barley hay or chaff.

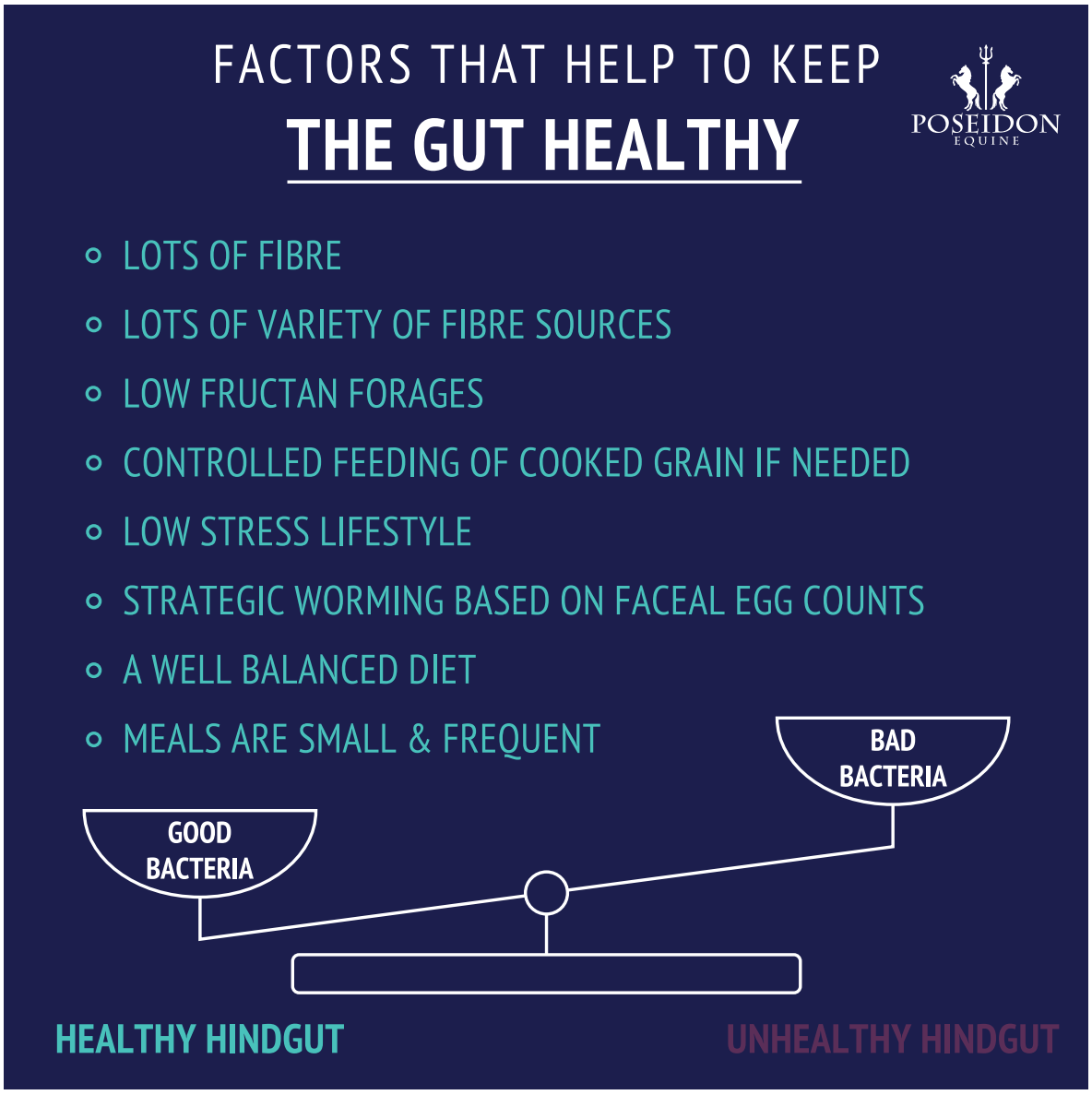


Figure 4. *Factors that help to keep the gut healthy*

5. FEED INGREDIENTS THAT SUPPORT GOOD BACTERIA

Which feeds can help promote the proliferation of 'good' bacteria and keep the hindgut healthy?

Low sugar, low starch, low fructan forages

These forages include native grasses, subtropical grasses and lucerne pasture, hay or chaff as well as most haylage type products (see p. 11). They provide an abundance of beautiful fibre to feed the 'good' bacteria and contain only very limited amounts of hindgut fermentable starch and fructan, so they won't feed the 'bad' bacteria.

These types of forages should always form the base of the horse's diet and will put you a long way down the road of creating a diet that will support healthy hindgut bacterial populations.

Sugarbeet Pulp

Sugarbeet pulp is the fibrous part of the sugarbeet root left over after sugar has been extracted for human consumption. The 'unmolassed' beet pulp is low in sugars (less than 10%) and contains virtually no starch so it won't feed the 'bad' bacteria.

Plus, sugarbeet pulp is virtually all fibre so it is a lovely source of food for the fibre fermenting 'good' bacteria you want to support.

Copra meal

Copra meal is a co-product of the coconut oil industry and is the white part of coconut that is left after most of the oil has been extracted. It is low in starch and sugars (less than 12%) and high in fibre so it will starve the 'bad' bacteria and feed the good ones.

Copra meal is also a useful source of protein and oils. However, be conscious of the quality of the copra meal you buy and ask your supplier for current aflatoxin (a mycotoxin) lab certificates to be sure the copra meal is safe.

Legume hulls

Lupin and soybean hulls are the fibrous soft hulls taken from these seeds during processing. Virtually starch free and very low in fructan and sugars, these high fibre ingredients do an amazing job of supporting the good bacteria and keeping the bad bacteria to a minimum. And because their fibre contains almost no lignin, they are almost completely digestible and provide the same amount of calories as oats.

Lupins

If any ingredient could be classified as a superfood for horses, lupins would probably be it. High in fibre, oils and quality protein and almost starch free, lupins pack a huge punch when it comes to providing nutrients and they do it whilst also supporting a very healthy hindgut bacterial population. Lupins are useful for horse's who need to gain weight, particularly where a low starch, low sugar diet is required.

Oats

Oats and horses just seem to get along. Oats contain 30 - 40% starch, but the starch is readily digested by the horse's enzymes in the small intestine, which means most of it is gone by the time it reaches the hindgut. And even if some oat starch does get to the hindgut, research has shown that oat starch won't unbalance the bacterial populations the way the starch from other grains does.

Oats are also the highest fibre grain available. Oats make an economical and palatable source of calories and can certainly be fed in diets that are designed to support the fibre fermenting hindgut bacteria.

Full fat soybean

Soybean contains the best quality protein of any plant derived protein and does an amazing job of supporting

processes like muscle building and milk production in horses. Soybean is low in starch and fructan so it won't feed the sugar and starch fermenting hindgut bacteria. However, if you are going to feed full fat soybean, make sure that it has been properly cooked - raw soybean contains anti-nutritional factors that will actually block protein digestion in a horse's small intestine.

Oils

Oils are a dense source of energy, providing nearly 3 times as many calories as an equal weight of oats! This means that for horses with high calorie requirements, using oils allows you to reduce your reliance on more traditional sources of energy like high starch grains, while still being able to meet daily dietary energy requirements. Less starch in the diet means the diet is less likely to negatively impact the hindgut bacteria.

Oils have lots of other benefits too: they are a source of essential (omega 3 & 6) fatty acids; they are a cool source of energy, making them useful for horses that can become hyperactive; they also reduce the heat load placed on a horse during the digestion process, which makes them really handy for horses living in hot climates.

Cooked or extruded grains

While cereal grains are high in starch, they can be fed in a way that stops the starch having a negative impact on hindgut health. Cooked starch is very easily digested in the small intestine, which means that if you feed *cooked* grains the starch is virtually all gone by the time it reaches the hindgut - so it won't feed the bad bacteria. The most effective way to cook grains to improve starch digestion is via extrusion. You can also boil your own grains to make the starch more digestible.

Figure 5. *Low sugar, low starch, low fructan forages*

6. FEED INGREDIENTS THAT ALLOW BAD BACTERIA TO TAKE OVER

Which feeds help promote the overgrowth of 'bad' bacteria and hence, are the feeds we should avoid?

High fructan forages

High fructan forages include ryegrass and cereal forages such as oaten, wheaten and barley hay or chaff. These forages are all temperate (C3) grasses and the main storage carbohydrate they produce is fructan.

Under certain environmental conditions, these grasses can accumulate more than 30% of their dry weight in water soluble carbohydrates, including fructan. That's A LOT of food for the fructan-loving starch and sugar fermenting 'bad' bacteria in the hindgut.

Uncooked cereal grains

Grains like corn, wheat, barley and rice contain a lot of starch (60 to 70% of their weight). BUT, the starch is packed in a way that makes it very difficult for a horse's enzymes in the small intestine to digest it.

So when these grains are fed, only about 30% of the starch they contain is digested in the small intestine, which means the remaining 70% of the starch winds up in the hindgut where it feeds the starch and sugar fermenting 'bad' bacteria.

With their favourite food in ready supply, uncooked cereal grains support a rapid explosion of 'bad' bacteria in the horse's hindgut. An acidic hindgut and those gut-related problems we mentioned earlier, may then occur as a result.

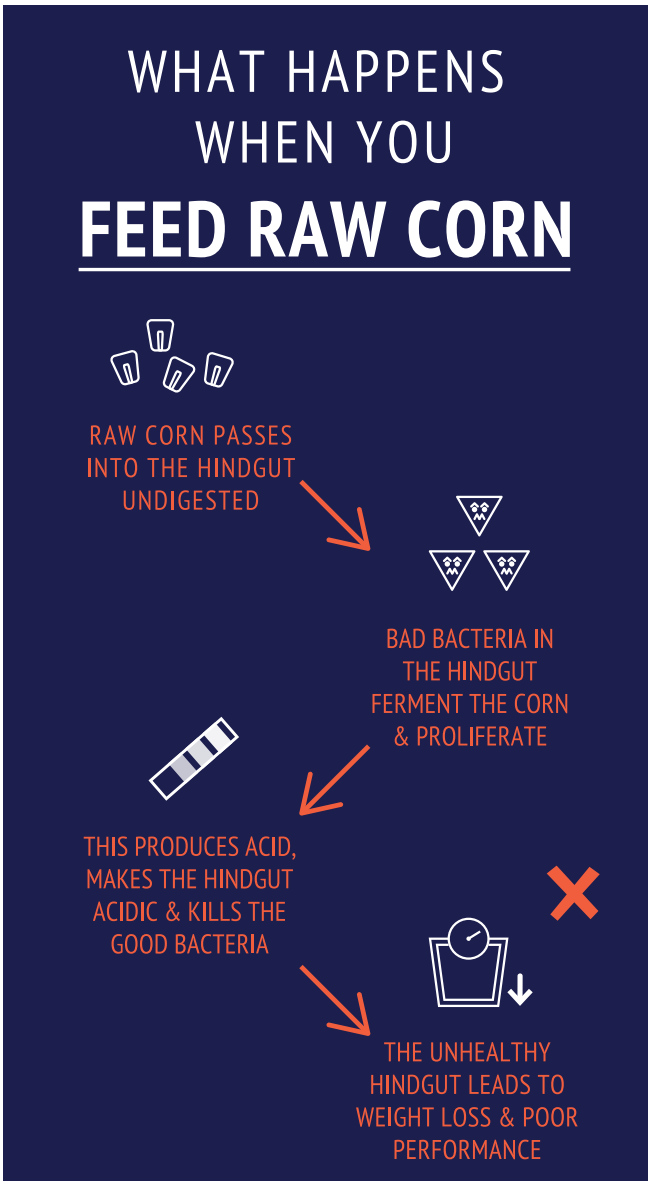


Figure 5. *What happens when you feed a horse raw corn*

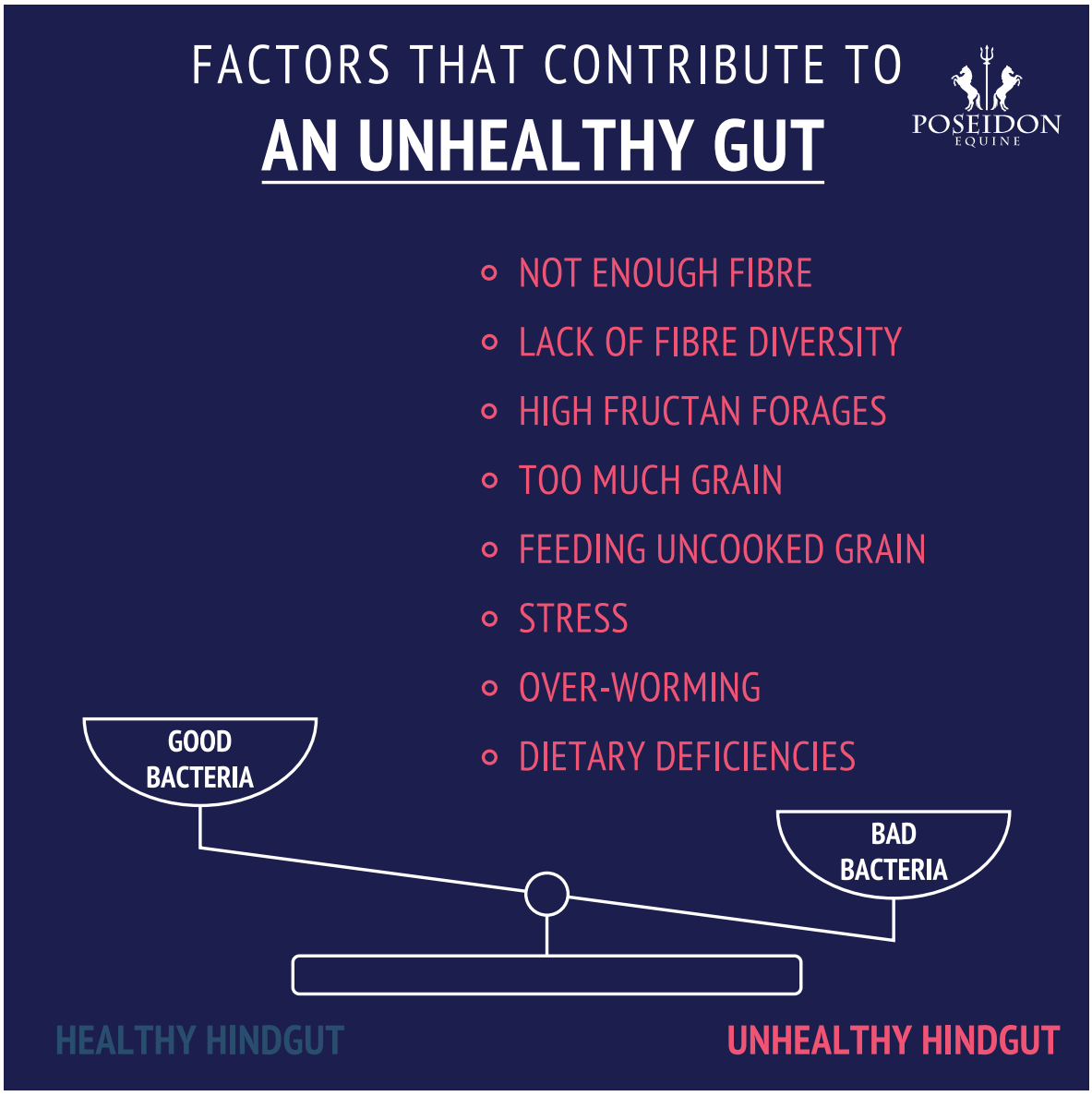


Figure 6. *Factors that contribute to an unhealthy hindgut*

7. SOME GUT-FRIENDLY DIETS

By now we know that the health of the horse's gut microbiota is integral to its overall health, happiness and performance AND that our feed choices can influence whether the hindgut contains a lot of 'good' or 'bad' bacteria. But... what does a gut-friendly horse diet really look like? Here are some examples:

EXAMPLE 1
'POPPY'

Height: 17hh
Weight: 640 kg
Age: 10 years old
Workload: Novice to Elementary dressage. Ridden 5 days/week. Competes twice/month.
Access to Pasture: Daytime only. Stabled at night.
Goals: Supply enough energy to perform.
Challenges: Prone to gastric ulcers.

1. FORAGE
Poppy has access to pasture & teff hay but does not maintain weight on this alone.

2. HIGH CALORIE FIBRE
To top up energy and diversify Poppy's high energy fibre intake, let's add beet pulp to her diet.

3. HIGH CALORIE FEEDS
To further top up Poppy's intake of energy, we can add lupins.

4. QUALITY PROTEIN
Poppy needs more quality protein in her diet. Let's add lucerne hay (& the lupins will also help).

5. VITAMINS & MINERALS
Poppy is not fed a fortified hard feed or supplement. We'll feed her Digestive VM at the full rate.

POPPY'S NEW DIET
8 hours access to green, mainly kikuyu pasture
+ 4kg teff hay*
+ 1.5kg lucerne hay*
+ 600g lucerne chaff
+ 250g beet pulp
+ 500g lupins
+ 130g Digestive EQ
+ 85g Digestive VM
+ 40g salt
+ free choice salt

* (feed hay in a slow feeder overnight)

EXAMPLE 2
'BOB'

Height: 16.1hh
Weight: 550 kg
Age: 8 years old
Workload: OTTB. Ridden 5 days/week. Competes once to twice/month in grade 1 pony club & showjumping.
Access to Pasture: 24hr access to diverse pasture.
Goals: Gain weight.
Challenges: 'Hot' behaviour.

1. FORAGE
Bob has acess to pasture but does not maintain weight on this alone, so let's add lucerne hay.

2. HIGH CALORIE FIBRE
Bob's pasture contains a nice diversity of species so we won't add any extra high calorie fibres.

3. HIGH CALORIE FEEDS
To top up Bob's intake of energy, we'll add some extruded, grain-based hard feed.

4. QUALITY PROTEIN
The lucerne hay and extruded hard feed we're adding to Bob's diet will provide enough protein.

5. VITAMINS & MINERALS
Bob won't be fed the hard feed at the recommended rate, so we'll top up with Digestive VM.

BOB'S NEW DIET
24/7 access to paddock of diverse but quite short green pick
+ 6kg grass hay
+ 2kg lucerne hay
+ 600g 50/50 Chaff
+ 1.1kg lupins
+ 200g full fat soybean
+ 200ml linseed Oil
+ 130g Digestive EQ
+ 70g Digestive VM
+ 30g salt
+ free choice salt

EXAMPLE 3

'BONGO'

Height: 14.1hh
Weight: 420 kg
Age: 20 years old
Workload: Not in work (retired).
Access to Pasture: 24hr access to poor quality pasture.
Goals: Fix mineral deficiencies (esp. Phosophorus).
Challenges: Hard to keep weight on.

1. FORAGE
Bongo has acess to pasture but does not maintain weight on it alone. Let's give him some lucerne hay.

2. HIGH CALORIE FIBRE
To top up Bongo's high calorie fibre intake, we're going to add beet pulp.

3. HIGH CALORIE FEEDS
To further top up Bongo's calorie intake, we're adding a Senior Feed to his diet.

4. QUALITY PROTEIN
To add some more quality protein to Bongo's diet, let's also give him some lucerne chaff.

5. VITAMINS & MINERALS
We'll top up with Digestive VM & add Monosodium Phosphate to correct the phosphate deficiency.

BONGO'S NEW DIET
24/7 access to ankle height dry pasture
+ 4kg lucerne hay
+ 300g lucerne chaff
+ 250g beet pulp
+ 200g full fat soybean
+ 130g Digestive EQ
+ 60g Digestive VM
+ 40g Dicalcium Phosphate
+ free choice salt

EXAMPLE 4

'LOLLY'

Height: 15.3hh
Weight: 500 kg
Age: 15 years old
Workload: Ridden 1-2 days/week.
Access to Pasture: 24hr access to green, diverse pasture.
Goals: Meet mineral &vitamins without added calories.
Challenges: Runs off the smell of an oily rag.

1. FORAGE
Lolly has acess to pasture and (easily) maintains weight on this alone.

2. HIGH CALORIE FIBRE
Lolly's pasture contains a nice diversity of species so we don't add any high calorie fibres.

3. HIGH CALORIE FEEDS
Lolly does not need more calories, so we'll skip this.

4. QUALITY PROTEIN
Lolly's grazes nice green pasture and has low protein needs but we'll add a little chaff to feed with her Digestive VM.

5. VITAMINS & MINERALS
Lolly is not fed a fortified hard feed or supplement. We'll give her Digestive VM at the full rate.

LOLLY'S NEW DIET
24/7 access to paddock of green pasture ankle height
+ 300g lucerne chaff
+ 130g Digestive EQ
+ 60g Digestive VM
+ free choice salt

FREE DIET FORMULATION TOOL

Every horse and situation is unique, so you might be wondering how you can create a gut-friendly diet for your horse. It's easy! You can design the perfect diet for your particular horse & situation (for free) using Poseidon Equine's Feed Assist Nutrition Calculator. You can find it at: *poseidon-equine.com/pages/feed-assist*

A HELPING HAND

Whilst the name of the game is to feed our horses a balanced diet, which also helps to promote good gut health, sometimes they just need a bit of extra help.

There are times when our horses encounter extra stress - such as a heavy competition schedule, a lot of travel, illness, or change of paddock - and sometimes we just don't quite manage our horse's diets as well as we could.

When this happens, we open the door for less-than-perfect gut health and this can manifest as weight loss, behavioural problems, performance issues, laminitis, gastric ulcers and loss of appetite.

There are also times when it seems that no matter what we do, we just can't get our horse's gut back into good shape.

That's where Poseidon Equine products may help. To learn more about them, read on and if you have more questions or need help, we'd love to hear from you!

Call us on: +61 242 608 893, or

Email us at: *info@poseidon-equine.com*

GUT HEALTH SUPPLEMENT

Digestive EQ

Digestive EQ is a **gut health supplement** designed to support the digestive and immune systems of your horse.

Its unique formulation is designed to **assist with fore gut and hind gut digestion, and inflammation and immune challenges.**

It also contains a **mycotoxin binder** to negate mycotoxins and help **get your horse's gut healthy again.**

It comes in a **great-tasting**, easy-to-feed **powder** form.

- DIGESTIVE ENHANCER & PH STABILISER
- DUAL ACTION MYCOTOXIN BINDER
- POWERFUL PREBIOTIC
- THREONINE & GLUTAMINE
- ADDED ENZYMES & ANTIOXIDANTS
- NON SWABBABLE

VITAMIN & MINERAL SUPPLEMENT

Digestive VM

Designed to complement and be fed alongside Digestive EQ, **Digestive VM** is the ultimate **vitamin, mineral and amino acid supplement.**

With ingredients like organic selenium and chromium, natural vitamin E, plus essential amino acids, **Digestive VM is platinum standard.**

For **added digestive support,** it also contains glutamine and a yeast derived prebiotic.

It comes in a **great-tasting**, easy-to-feed **pellet** form.

- ESSENTIAL TRACE MINERALS
- FULLY FORTIFIED WITH VITAMINS INCLUDING BIOTIN
- ORGANIC SELENIUM & NATURAL VITAMIN E ANTIOXIDANTS
- BIOAVAILABLE SOURCE OF CALCIUM & MAGNESIUM
- + EQ FEED WITH DIGESTIVE EQ FOR OPTIMUM GUT HEALTH
- NON SWABBABLE

PASTE FOR ACUTE STRESS

Stress Paste

Stress Paste is a concentrated nutritional formula designed to **support your horse in times of acute stress.** Such times may include when competing, racing, transporting or in extreme heat & humidity.

Acute stress affects horses in many ways. They can stop eating. They can stop drinking. Muscles can fatigue quickly with dehydration and can result in reduced nutrients available to support energy production.

Stress Paste is designed to address each of these responses to stress and **keep the horse eating and hydrated with well-functioning, well protected muscles.** It is also designed to **support the gut** so it can remain healthy during higher stress periods.

- B-VITAMINS FOR MUSCLE ENERGY & APPETITE
- POWERFUL PREBIOTIC FOR GUT MICROBIOME SUPPORT
- VITAMINS C & E FOR ANTIOXIDANT PROTECTION
- MAGNESIUM HYDROXIDE FOR GUT BUFFERING
- NATURAL BETAINE FOR HYDRATION & HEAT RESILIENCE
- THREONINE, GLUTAMINE, PROLINE & SERINE FOR GUT WALL HEALTH
- MAGNESIUM & B1 FOR NORMAL NERVE FUNCTION
- PECTIN TO HELP PROTECT THE STOMACH

TRUE HEALTH BEGINS IN THE GUT

POSEIDON
EQUINE