**Week 5: Clinical nutrition**

**Learning outcomes**

Provide recommendations on rations for nutrition-related disorders.

Nutritional management of:

-- Horses and ponies susceptible to laminitis

-- Obesity

-- Horses or ponies with weight loss

-- Older horses

**Laminitis**

Initially known as barley disease, laminitis is associated with starch overload in the large intestinal environment.

High levels of starch in the large intestine can result in laminitis.

Laminitis is inflammation of the sensitive laminae of the hoof, and it can be a very painful and debilitating condition.

Pasture-associated laminitis is associated with high levels of fructan intake, and fructan is a component of the water soluble carbohydrates. Fructan can illicit similar disturbances in the hindgut that we see with starch. It can be more of a problem than starch.

A survey in 1990 of cases of laminitis in the UK indicated that 60 percent of horses with laminitis were kept on grass, 30 percent were managed in a combined stable and pasture environment and 9 percent were fully stabled.

A survey in the US indicated that 46 percent of the cases were linked with pasture.

Turning out certain horses on lush or stressed pasture or pasture rapidly growing at certain times of year seems to trigger laminitis.

This is related to ingestion of water soluble carbohydrates, and fructan is a component of the WSCs of plants.

Lush pasture is defined as pasture that is actively photosynthetic. There is an abundance of grass, and it's producing and storing a lot of WSCs.

Stressed pasture is pasture with environmental conditions not conducive for growth. In periods were there are droughts or lower temperatures, the grass is not growing; it's storing higher levels of WSCs rather than using them to grow.

During spring and summer months, there is much greater abundance of grass available, and horses can ingest higher levels of WSCs; this seems to trigger the onset or recurrence of laminitis in certain horses and ponies.

The highest incidence of laminitis is in May.

Grass has the highest amount of WSCs between 11 a.m. ad 6 p.m., with 6 p.m. being the highest.

Another aspect to consider is the WSC content of different species of grasses is very variable. Rye grasses typically accumulate much high levels of WSCs compared with fescue, cocksfoot and timothy varieties.

In improved pastures that many horses graze, we tend to see high levels of rye grass and accumulations of higher levels of WSCs.

The plant part is also important. Grasses store fructan predominantly in the stems. That means that, as a plant matures and becomes more stemmy, it contains higher levels of WSCs. However, high levels of WSCs in pastures may influence laminitis in other ways. The laminitis may not just be the direct result of the ingestion of high levels of fructan causing disruption to the LI environment. The high levels of WSCs may also promote insulin resistance. Some studies have shown similar insulin peaks in horses grazing pasture to those receiving high levels of starch in their diets. Horses that are insulin resistant may be more susceptible to developing laminitis because the threshold for developing laminitis may be lower in these animals. There may be other threshold-lowering factors: general obesity and genetic predisposition.

**Obesity and insulin resistance**

In humans, we see regional fat accumulation. We often see this in the abdominal region. This has been linked to diabetes and heart disease in humans. In horses and ponies, we also see this regional fat accumulation, but we typically see this in the neck area; the horses develop a cresty neck, a very thick neck with a lot of bulging fat. This has been linked with the development of laminitis or an increased risk of developing laminitis. But laminitis has also been linked to generalized obesity and also hyperinsulinemia (excess levels of insulin in the bloodstream) and hyperleptinemia (increased leptin in the bloodstream).

There is no universally accepted definition of obesity in horses and ponies.

We can say those horses that are scoring an 8 or 9 on the Henneke body condition score scale are obese.

Any animal with score of 7 would be considered overweight.

Body condition score doesn't account for regional fat accumulation, but it certainly may signify an increased risk of disease. It's important to look at a horse in terms of overall body condition score but also to look for regional fat accumulation, particularly in the neck area. However, note that not all obese animals go on to develop laminitis, and not all animals that are overweight are insulin resistant. Animals that are obese are more susceptible to becoming insulin resistant. Those with perfectly acceptable body condition scores may be insulin resistant. So there are many risk factors that affect the development of laminitis, but certainly any animal that is overweight or insulin resistant is in a higher risk category.

**Video 2**

Laminitis avoidance

If a horse has a history of developing laminitis or is overweight, we need to reduce the risk of it developing laminitis.

One way is to consider zero grazing and certainly not turning the horse out at times when we know the sugar content is higher, during the late spring and summer months.

We can bring the horse into a stable and provide an alternative forage source.

Another thing we can do is turn out horses and ponies when the fructan/WSC levels are lowest.

This means bringing the horses into the stable during day and turning them out overnight. An accompanying chart shows levels are highest at 11 a.m. and 6 p.m., with 6 p.m. being the highest.

If we are turning out, we need to make sure we are turning horses out on pastures that are well managed. We want to maintain young leafy swards. We don't want mature, stemmy grasses. Plants store higher amounts of WSCs in their stems.

The times of year when sugar grasses are higher are late spring and summer, and there is a second peak in autumn. We need to manage animals so they are not turned out in these times. Also, we don't want to turn them out in pastures that have been exposed to lower temperatures. A frosty night followed by a warm bright sunny day can mean higher levels of sugar in the grass, and that can elicit the onset of laminitis.

Another thing to remember is do not graze pastures during or following drought. Limited water access will suppress growth. If it's still bright and sunny, there will still be sugars accumulated and stored in the grass.

You may still want to turn out in pasture during day. What you can do is to use a grazing muzzle. Muzzles limit the amount of grass that a horse can intake. But it's important that horses can still intake water. And there are certain behavioral issues to consider. A grazing muzzle can change the dynamics in a herd. Don't introduce a horse to a new herd wearing a grazing muzzle.

You can also use strip grazing and reduce the amount of grass available to the horse. Use electric fencing to cut off part of the field.

Grasses can be mowed to prevent mature plants. Remove cuttings from the field because cuttings can ferment and promote the growth of spoilage organisms that can be detrimental to the horses' health.

You can turn horses out into alternative areas, such as an arena, and provide an alternative forage source.

Another good way of managing pasture is to use other species to graze the pasture, such as cattle and sheep. This can keep the grass at an appropriate height for horses and help with parasite control, as well.

**Alternative forage sources if you remove horses from pasture:**

Use a source that has a low WSC content. In the UK, the majority of horses are fed grass hay, but grass hay can contain significant levels of WSCs. Most will have a WSC content greater than 10 percent, but we know for horses susceptible to laminitis that we want forage that contains less than 10 percent WSCs.

These carbohydrates are soluble in water. We can soak the hay in water. In this case, soak the hay greater than three hours fully submerged. The sugars will leech out of the hay and into the water. When we discussed soaking hay to reduce dust, we wanted to limit the amount of nutrient loss. In this case, we want to reduce the sugar content. Soaking is variable. There is no guarantee how much sugar will leech out, but it's better than providing unsoaked hay. Because hay is cut at a mature stage of growth, it's very stemmy and contains high levels of these storage carbohydrates.

You can also feed other forage sources, such as alfalfa, which is lower in WSC but higher in energy. The animal may put on weight.

If you are soaking the forage, it's important to feed a forage balancer. Additional vitamin and mineral supplementation is required because these nutrients will also be leeched out in the soaking process. In fact, any diet based solely on forage should have vitamin and mineral supplementation in place.

Some information out there suggests that it might be useful to use magnesium to prevent the occurrence of laminitis; however, there have been no scientific studies conducted that have actually shown this to be effective. Nonetheless, there have been limited studies done, so it may be that it is effective, but we do not have evidence to support this.

Most horses or ponies that are susceptible to laminitis won't require any supplemental feeding. But animals susceptible to laminitis are not always overweight. They may be underweight. They may be insulin resistant. We want to avoid feeds that exacerbate insulin resistance or potentially cause a disruption to the large intestinal environment. Avoid cereal grains that are high in starch or pastures that high in WSCs. If we do need to provide additional energy in the diet, it's advisable to use oils instead of cereal grains unless there are contraindications to feeding oil in the diet.

Introduce oil into the diet gradually, no more than 100 milliliters per week, and supplement the diet with vitamin E if high levels of oil are being fed. The upper limit in terms of the amount of oil that can be fed in the diet is no more than 100 milliliters of oil per 100 kilograms of body weight. That would be 500 milliliters of oil for a 500 kilogram horse or 300 milliliters of oil for a 300 kilogram pony.

If cereals are fed, it's important that they are processed. So if horse is susceptible to laminitis and has had a previous incidence of laminitis and has recovered and is beginning to undertake some higher level of work and requires cereals in the diet, then make sure the horse is offered the cereal in the processed form, such as micronized or extruded, cooked in some way, processed in some way to make the starch more digestible in the small intestinal environment.

We also want to restrict meal sizes so that we're not providing any more than 1 gram of starch per kilogram of bodyweight. So if we think about cereal based feed stuffs, we don't want to feed any more than 0.25 kilograms per 100 kilogram of bodyweight. No more than 1.5 kilograms per meal for a 500 kilogram horse.

**Other considerations**

Avoid sudden dietary changes.

Avoid abruptly starving any horse or pony. Yes, we want them to lose a little weight, but there are other health problems associated with starving horses. We need to make sure they have access to low quality feeds and they are not standing without feed for long periods of time.

If it's appropriate to exercise a horse, that's important; it can help reduce weight gain, prevent weight increase and avoid development of obesity. We are aiming for a body score of 4 or 5 out of 9. If we do have an animal that is overweight, we need to think about putting a weight management program in place.

**Management of horses that are overweight and obese**

The simple formula is for the horse to eat less and exercise more. Often, this is easier said than done.

The general principles of reducing weight or minimizing weight gain is the total removal of high calorie feed stuffs, such as cereals and oils. Also, there should be no excessive feeding of treats. Carrots, apples and other treats contain sugars. Also, we need to assess the work levels of horses. We touched on this previously, but we're not always realistic about the workload of our horses and ponies. We need to make sure we are not feeding horses more energy than they require.

Set realistic goals and don't abruptly starve any animal. Any dietary changes should be made gradually, and we should avoid long periods of fasting. Horses are designed to eat little and often on an almost continual basis on low quality feed stuffs, and that's what we should be aiming for in any weight management program.

Once we have animals at their target weight, we need a weight maintenance program.

This process is a longtime commitment.

It may take a period of four to six months to reach a target body weight. The only way to control the nutritional intake of a horse or pony is to completely remove it from pasture.

There have been studies done that when we remove horses or ponies from pastures for half a day, they will actually do compensatory eating. They can actually eat as much in 12 hours as they can in 24 hours if brought inside part of the time. There has been some work done that ponies can eat up to 40 percent of dry matter intake in a period of three hours. So, bringing them into a stable and then turning them out for limited periods may not be as effective as we think.

If we bring horses into a stable environment, we want to begin by feeding them at 2 percent bodyweight for six to eight weeks. It's not always in the best interest to stable them for this time. Maybe we want to turn them out for periods of the day, overnight for example, and use a grazing muzzle, or maybe we want to use a turnout area.

Weight loss by feed restriction alone is quite difficult. We need to really drop the feed amount the animal is eating. It's much better to combine feed restriction with exercise. If this is not possible, it may be that we need to further decrease the diet to 1.5 percent of current bodyweight for another eight weeks. This is really dropping the intake levels. Divide the ration into three or four feeds per day and look for ways to make the horse take longer to eat it, such as hay nets with small holes or double hay netting to prolong the amount of time it takes them to eat the forage.

If you look at how much we're feeding when we feed at 2 percent of bodyweight, that is 10 kilograms (22 pounds) for a 500 kilogram (1,100 pound) horse; if feeding 1.5 percent of bodyweight, that would be 7.5 kilograms (16.5 pounds) for a 500 kilogram horse.

It is possible you may be need to reduce this further, even down to 1 percent. This is very severe. We would never go under 1 percent. That 1 percent would consist of forage, and it would need to be broken down into several meals throughout the day.

What if we need or want to turn our horses on grass?

We must make sure they don't have access to vast areas of lush pasture, maybe give them well-managed paddock areas.

We also must make sure these areas are free of toxic plants. Hungry horses may eat these plants.

House the horse or pony for significant portions of the day and feed alternative forage sources, but bear in mind the possibility of compensatory eating, and maybe look to use a grazing muzzle and strip grazing to give the animal access to limited amounts of pasture.

Grazing muzzles are not always easy to use. You need to change the duration of time that the horse or pony wears them depending on their change in body weight. As they start to lose weight, it may be that they can start to have the muzzle removed for longer periods of the day. Horses do need some time without their grazing muzzle, so make sure they have opportunities to spend time without it to partipate in mutual grooming, etc. Also remember that when the muzzle is removed, the horse can undertake compensatory grazing and still take in quite a lot of sugars and grass in a short space of time if the horse has access to lush pasture.

A weight management program is more effective if a restrictive diet can be combined with exercise. Some horses may be unfit or recovering from illness. Start with 10 minutes walking in hand daily. Gradually increase to one hour a day.

As the horse gets fitter, you can reduce the level of feed restriction. It's about balancing feed restriction with exercise.

A major part of any weight management program is monitoring weight loss. Not all animals lose weight at the same rate. Body condition scoring is not always appropriate. It's much better to weigh a horse on a weekly basis. Ideally, this would be done on a weight bridge (scale), but you can use a weight tape or a measuring tape. Adjust the diet accordingly.

**Horses and ponies with weight loss**

A horse may have low weight because it is unhealthy in some way. This needs complete investigation by a vet to rule out disease.

But it could be due to poor nutrition due to neglect or ignorance.

In general, horses that are mismanaged are still likely to eat food, whereas horses that are unhealthy are more likely to refuse food.

Some diseased horses may still eat and still lose weight. This may be due to poor absorption or poor metabolism of nutrients.

There may be a number of contributing factors present, perhaps a marginal diet.

We need to look at a horse's teeth.

Check if a worming program is in place.

Take a close look at the diet to see if there are deficiencies.

**In absence of disease**

Increase the level of digestible nutrients.

The diet will depend on the extent of the weight loss and the age of the animal.

It's considered a severe case if a horse has a body condition score of 3.5 or less on the Henneke scale.

We need to be careful about introducing changes to the diet. These must be gradual.

Horses that are extremely underweight can undergo refeeding syndrome. This is extremely dangerous and can have severe effects on the cardiac system. If it occurs, it occurs three to five days post the change in the diet and is associated with electrolyte imbalances that are occurring as a result of feeding high levels of NSCs in the diet.

In terms of refeeding, we don't want to give horses a lot of NSCs. We don't want to be feeding feed stuffs that are high in starch and WSCs, such as fructan.

We are looking for feedstuffs that are high in fat. Lucerne (alfalfa) is a good feed stuff, for example, because it's high in protein and low in NSCs. We could feed grass hay, but we'd be looking to feed soaked hay to remove as much of the WSCs as possible.

Use small frequent feedings, no more than .5 kilograms per meal, even feeding up to six times per day. Make sure there's plenty of forage available during this time. Gradually increase the amounts up to a period of 10 days. After 10 days, when we're feeding these high fat diets, then we can start to introduce other energy-dense feed stuffs, such as cereal grains and access to pasture.

We want to maintain weight gain and then gradually increase the amount of feed until the animal reaches a desired weight.

Oil is good for animals that are underweight, but it needs to be introduced gradually over a number of weeks. It's also important in horses extremely underweight to check their electrolyte intake. You can do this by making sure you're adding sufficient vitamins and minerals to the diet.

**Older horses**

Some studies have shown that older horses can have a decreased ability to digest nutrients in the diet, particularly protein, phosphorous and fiber. Other studies have shown no difference. Why are we seeing these differences in these studies? One thought is it may be attributable to damage in the large colon. Horses that have decreased ability to digest nutrients may have had chronic parasite infections. Or it may be due to poor dentition. If there are no problems with the older horse, we would typically feed older horses the same as any adult horse.

When we do see problems in older horses, it most commonly involves weight loss. There can be several causes.

Old horses can have dental problems. They can't chew their diet properly, reducing digestibility.

There can be renal and hepatic disease present, and this needs full investigation by a veterinian.

The horse may have Cushing's disease.

It's important to rule out these problems.

We see a lot of dental disease in older horses.

Some studies suggest that over 60 percent of horses over age 15 have dental disease. A similar study looking at horses over 20 also reported that 60 percent suffered from dental disease.

What can we do about dental problems?

Keep the horses at pasture. Grass is much easier for horses to chew than long stemmy grass hay.

If older horses do have to come inside, feed them good quality forage with a high leaf-to-stem ratio and use highly digestible fiber sources such as high temperature dried alfalfa and sugar beet pulp.

It may be that you need to chop the hay if the hay is the only forage source. In severe cases, supplementary feed may be required. You could look for a commercial senior feed specially formulated for that age group. You might look to mix that with a high fiber cube, for example, something like alfalfa pellets. A good idea is to soak the feed before giving it to the older horses. Soak it in warm water; it makes it easier to chew and more palatable. Make sure you provide feeds in small quantities throughout the day. A high volume of feed offered in one gulp might reduce daily dry matter intake. Again, if oil is not already added to the commercial feed, it might be worth adding. Make sure there's sufficient vitamin E for the amount of oil added to the diet. Oil is good way of increasing the energy content for horses with dental disease, because they're not having to eat any more feed to meet their energy requirements.

**Other considerations to think about:**

Sometimes, the quality and quantity of feed can increase intake and improve body condition score.

Some horses will have a higher intake if fed with companion horses.

It can work well to soak the feed and feed it warm.

You can entice a horse to eat feed more by adding molasses or apple.

Some work suggests adding flavoring such as crushed ginger cookies increases palatability.

If older horses are kept on grass with other horses, the older horses are likely to be lower on the pecking order. They might need to be fed separately so they get the full amount of feed you want them to have.

Older horses may have osteoarthritis. You may want to feed them from a raised container. A raised container for hay might also be good rather than using a hay net if the horse has osteoarthritis in its neck and has trouble pulling hay out of the net.

**Conclusion**

Diet can have an impact on the development of disease.

Good dietary management can be crucial in the prevention of disease.

It can improve health.

It can be integral in the animal recovering from a period of ill health.

Diet is integral to health.

Diet isn't everything, but without it, there's nothing.

By providing animals with an adequate diet, we're preventing them from developing problems, and surely prevention is better than a cure.