

# How to Feed Performance Horses for Optimal Digestive Health

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## 1. Introduction

Horses are non-ruminant herbivores, highly adapted to the slow intake of a plant-based, high-fiber diet. However, modern-day management practices of performance horses have shifted toward overall reduced access to forage and increased reliance on the practice of meal-feeding. This shift is not only counter to best feeding and management practices to promote optimal digestive health, but it has placed equine athletes at a higher risk of gastrointestinal disturbances such as gastric ulcers, recurrent colic, and conditions involving inflammation of the bowel. Clinical signs of these disturbances may include irritability, weight loss, poor appetite, chronic diarrhea, among others. While proper diagnosis and appropriate medical treatment in these patients is critical, it is also important to evaluate the horse's diet and feeding management practices.

Performance horses are typically managed under conditions that are not conducive to optimal digestive health. Increased confinement in stalls and meal feeding affect the physiology of the digestive tract by altering both intestinal motility and the microbiome environment, increasing colic risk.<sup>1</sup> Feeding large, high-starch grain meals that exceed >1 g/kg body weight (BW)/meal, a practice common in horses with high dietary energy requirements,

has been linked to greater risk of nonglandular gastric ulcers.<sup>2</sup> The high-stress lifestyle and over-use of nonsteroidal anti-inflammatory drugs that is more commonly observed in the performance horse population has been associated with alterations in intestinal permeability ("leaky gut") and an increased risk of right dorsal colitis.<sup>3,4</sup> Fortunately, basic equine nutrition principles for promoting good digestive health can be applied in such a way to either 1) maintain and/or improve athletic performance or 2) support medical treatment of performance horses suffering from gastrointestinal disease. This paper will outline specific nutrition and feeding management guidelines that promote optimal digestive health, with a focus on the performance horse.

## 2. Feeding and Management Practices

### Forages

It is a long standing recommendation for horses to receive a minimum of 1% BW in forage per day in order to maintain proper digestive function, but this minimum recommendation is commonly overlooked in performance horse management situations. And while 1% BW is the minimum recommendation, 1.5–2% BW is a better target in most cases, and it is recommended that forage make up at least 50% of the

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## NOTES

total daily ration when possible.<sup>5</sup> Forage requirements can be met by both preserved forages (long-stemmed hay, hay pellets, chopped hay, and commercially available forage-replacement alternatives) and fresh pasture. Forage intake while on pasture can vary greatly, and total dry matter intake while grazing is dependent upon several factors, including total hours of access and overall pasture quality. Studies have shown that horses allowed 4 hours or less of daily pasture access will consume  $0.22 \pm 0.02$  kg DM/100 kg BW/hour, and horses allowed more than 4 hours of daily pasture access will consume  $0.11 \pm 0.02$  kg DM/100 kg BW/hour.<sup>6</sup> For example, if a 500-kg horse were allowed to graze on pasture for 6 hours per day, dry-matter intake would be expected at 3.3 kg, which is equivalent to approximately 3.7 kg hay (as-fed basis).

Chewing long-stemmed forage increases saliva output, and saliva contains bicarbonate, which helps to buffer acid secretions in the stomach.<sup>7</sup> Maximizing access to forage will increase time spent chewing, as well as potentially decreasing boredom and stress while confined. Horses in a natural setting are estimated to graze for approximately 14 hours each day.<sup>8</sup> When stalled, the horse's opportunity to forage is limited, and the utilization of small-hole hay nets (3.2-cm and 4.4-cm openings) as opposed to feeding from the stall floor is an effective way to increase the overall time to consumption of hay and better mimics grazing conditions.<sup>9</sup>

Perhaps the most significant feature of forage in terms of digestive health is that it supplies the fermentable fiber required by the hindgut microbes to function properly. When feeding a hindgut fermenter such as the horse, maintaining a healthy population of hindgut microorganisms plays a critical role in not only digestion, but overall horse health. Together with their genetic material and interactions with each other in their environment, these hindgut microbes are a part of a diverse and complex ecosystem referred to as the "equine microbiome." The importance of a healthy microbiome environment cannot be overstated, and recent advances in laboratory techniques and gene sequencing technology have made it easier to isolate, identify, and quantify the specific organisms present in the horse's hindgut. The newest frontier in equine nutrition research involves delving into the equine microbiome, and scientists are currently working to characterize what both a healthy and unhealthy equine microbiome looks like, in addition to how that microbial ecosystem can be manipulated to improve horse health and performance.<sup>10,11</sup>

#### Concentrates

The demands of exercise and performance increase digestible energy and nutrient requirements of the horse. When forage alone cannot meet these increased demands, a concentrate feed will be required to meet the nutritional needs of the performance horse. Concentrates include cereal grains

like corn, oats, and barley, as well as commercially available pelleted and textured grain mixes. When appraising the impact of concentrates on digestive health, meal size, and composition are important factors to consider, especially in relation to preventing starch overload in the hindgut. The horse's small intestine is well suited to digest starch, a useful energy source for many performance horses, up to a certain point. Many studies have attempted to elucidate the upper limit of small intestinal starch digestion to prevent starch from reaching the hindgut. Small intestinal starch digestion varies somewhat with cereal grain source (i.e., oat starch is more digestible than barley starch) and processing (i.e., mechanical and hydrothermal), but a general guideline is to limit starch intake, regardless of the source, to  $<2$  g/kg BW/meal in order to prevent starch overload and rapid fermentation in the hindgut.<sup>12,13</sup> Practically, this translates into feeding no more than a 2.5 kg meal of a cereal grain-based concentrate (40% starch) for a 500-kg horse (or, limiting meal size to 0.5% of the horse's BW). Limiting the starch content of a meal even further may be warranted in certain circumstances (i.e., in horses with insulin dysregulation or gastric ulcers), but this is a good benchmark goal for most healthy performance horses. For horses that are prone to bolting or rushing their concentrate meals, feeding hay before the concentrate meal can also help to slow the rate of intake.<sup>14</sup>

Concentrate composition will also dictate the total amount of starch contained in a meal. Concentrate meals consisting of straight cereal grains will contain the highest concentration of starch, while multi-ingredient rations and commercially available products will vary considerably depending on the proportion of ingredients in the ration or feed formulation. Book values for cereal grains are readily available, and if the starch level of a commercially available horse feed product is not listed on the feed tag, the manufacturer should be able to provide that information upon request. Many commercially available products for performance horses contain added fat and fiber, which are used as additional sources of digestible energy. This is generally positive in terms of digestive health, as it reduces reliance on starch to serve as the primary energy source, as well as supplies additional digestible fiber. For horses with elevated energy requirements, feeding fat- and fiber-added rations increases the energy density of the diet and in most cases is a recommended practice. However, there is an upper threshold for small intestinal fat digestion that, if exceeded, can reduce the digestibility of certain nutrients. The inclusion of fat at up to at least 10% of total dry matter intake (forage + concentrate) appears to have minimal negative impact on digestive health.<sup>15</sup> Because forages are naturally low in fat (1% to 3% DM basis), exceeding this level of fat in the total ration is not common, even with the use of high-fat concentrate feeds ( $>10\%$  to  $14\%$  fat).

### Feed Additives and Supplements

There is an overwhelming array of “digestive aid” supplements and feed additives for horses available on the market, and their use is especially popular in performance horse rations. While some may play a role in promoting digestive health, there is no substitute for proper feed selection and implementation of appropriate feeding practices. Without those in place, no supplement or additive can have any significant impact on overall digestive health. While a full review of additives and supplements is not within the scope of this discussion, there are a few points to consider related to their selection and use. Some of the more common additives that have been studied in relation to their impact on digestive health include probiotics (live strains of microorganisms), prebiotics (substrates for microbial fermentation), and yeast cultures and yeast derivatives. When evaluating the efficacy of these additives, it cannot be assumed that results obtained in studies conducted in human or other lab animal species will apply to the horse. Look for published data that confirm safety and efficacy in the species of interest (the horse) that show a clear justification for recommended dosage. Rather than relying on an additive or supplement to promote digestive health, consider them as adjunct support for an overall feeding program that follows the principles outlined above related to forage and concentrate feeding and management practices.

### Feed Transitions

Changes in the amount or type of feed offered to a horse should be implemented gradually, to allow the digestive system to adapt and to prevent digestive disturbances. Large increases or decreases in total volume of feed offered should occur gradually as well. This applies to fresh pasture, preserved forages (i.e., hay), and concentrate feeds. It is recommended that horses not acclimated to grazing be introduced to lush pasture over a period of several days.<sup>5</sup> When transitioning from one type of hay to a different type of hay, and even from one batch of hay to a new batch of the same hay variety, it is good practice to combine the old and new hay for a minimum of several days and for up to 2 weeks as the transition is made. When making the switch from one concentrate feed to another, a good general rule of thumb is to make the change at a rate of no more than approximately 0.5 kg per day. This conservative approach to feed transitions will further promote digestive health, especially in performance horses with a history of digestive upset.

### 3. Feeding Recommendations for Certain Gastrointestinal Conditions

#### Gastric Ulcers

It is well documented that performance horses are at a high risk for the development of gastric ulcers,

specifically equine squamous gastric disease (ESGD). Little evidence exists for the role of diet in equine glandular gastric disease.<sup>16</sup> In addition to following the principles of feeding management outlined above, there are some special considerations for horses being treated for or with a history of ESGD. Without alterations in the feeding and management of these horses, it is likely that squamous ulcers will return once treatment is complete. When managing horses with ESGD, additional feeding recommendations are to provide as much turnout on pasture as possible, allow free choice access or offer hay frequently (4–6 meals/day), limit starch content of concentrate meals to <1 g/kg BW, and avoid orally administered hypertonic electrolyte solutions.<sup>16</sup> Feeding smaller, more frequent meals and incorporating alfalfa hay into the forage component of the ration are also recommended to lessen the severity and prevent the recurrence of gastric ulcers.<sup>17</sup> The inclusion of alfalfa hay in the diet, preferably provided at regular 5- to 6-hour intervals, is recommended as it has been shown to buffer gastric contents and decrease gastric ulcer severity.<sup>18</sup> Gastric protectant and buffering supplements that have published data behind them may also have a role in maintaining proper gastric pH and promoting a healthy gastric environment, and these include a pectin-lecithin complex and a natural-source mineral complex rich in seaweed-derived calcium.<sup>19,20</sup>

#### Chronic Colic

A wide variety of conditions may result in frequent bouts of colic, and the horse should be screened for such conditions and treated appropriately. Long-term feeding management recommendations for these horses are based on following the feeding and management practices outlined above, as well as minimizing common colic risk factors (Table 1). Stabled horses with reduced access to grazing are 3 times more likely to suffer from colic, and pasture access should be maximized when possible.<sup>21</sup> Only highly digestible feeds should be utilized, and small, frequent meals should be offered throughout the day. In addition to grass pasture, good forage options include high-quality grass hay, alfalfa hay or grass-alfalfa mix hay, soaked alfalfa cubes, and beet pulp. Having hay tested at a forage testing lab<sup>a</sup> will ensure that the forage is of acceptable quality, as consumption of overly mature hay can easily lead to colic in sensitive horses. A general guideline is the higher the relative feed value, the less mature and the better the hay quality. In horses with a history of chronic colic, aim for feeding hay with a relative feed value of >86. Alfalfa hay should be avoided in horses with a history of or increased risk of enteroliths, as the higher protein and mineral content increases colonic pH which has been implicated to be a predisposing factor for enterolith formation.<sup>22,23</sup> Finally, supplementing 1–2 Tbsp per day of plain white salt or a commercial electrolyte supplement may encourage water intake, especially

**Table 1. Common Risk Factors for Colic<sup>21,24,25,26</sup>**

Dietary	Management
Recent change in batch of hay	Recent change in housing
Recent change in type of grain or concentrate fed	Increased hours spent in a stable
Decreased exposure to pasture	Administration of an anthelmintic during the prior 7-day period
Feeding >6 pounds of oats/day	Failure to receive regular deworming
Feeding large concentrate meals	Failure to receive regular dental care
Feeding hay from round bales	Regular exercise vs. always pastured
Feeding <1% BW forage per day	Recent change in exercise program
Feeding poor quality forage	
Feeding primarily alfalfa hay high in crude protein and minerals (enteroliths)	

in the colder months when some horses drink significantly less water.

**Inflammation of the Intestinal Tract and Hindgut Dysfunction**

Many medical conditions, including inflammatory bowel disease, chronic diarrhea, right dorsal colitis, and colonic ulcers, feature some level of inflammation of the intestinal tract and hindgut dysfunction, and the recommended dietary strategies to address symptoms in horses with diagnosed or suspected inflammatory bowel conditions or other related disturbances of the hindgut are similar. The basic feeding objectives when addressing bowel inflammation and hindgut dysfunction are 1) reduce the mechanical and physiologic demand on the colon, and 2) promote mucosal healing. A reduction in mechanical load can best be accomplished by reducing or eliminating long-stemmed forage from the ration for a period of 3 to 8 months, with the length of time being dictated by the response of the horse. Eliminating long-stemmed forage and feeding a low bulk ration will substantially reduce total dry matter intake and reduce ingesta particle size, helping to alleviate mucosal trauma. Select a high-quality pelleted complete feed with built-in forage fortified with vitamins, minerals, and additional amino acids (commercially available senior horse feeds work well) in order to provide an easily digestible ration that meets all the horse’s nutrient requirements. Dividing the daily ration into small, frequent meals (4 to 6 per day) will promote consistent intake and encourage normal gastrointestinal motility. In some cases, a small amount of high-quality forage may be included in the ration, but only if the horse can tolerate it. Alfalfa hay should be used with caution in horses with chronic diarrhea, as alfalfa is known to have a laxative effect in some horses. Forage selection recommendations for chronic colic also apply to horses with bowel inflammation. The horse can also be allowed to graze small amounts of fresh grass (10- to 15-minute intervals, 4 to 6 times daily). Intermittent psyllium mucilloid supplementation is recognized as a management tool to reduce sand accumulation in the horse’s digestive

tract, but daily supplementation has been suggested to further promote ingesta passage and reduce mucosal trauma. Studies in other species have shown that the endogenous production of the short-chain fatty acid, butyrate (a product of the microbial fermentation of psyllium), may aid in mucosal healing, therefore psyllium supplementation warrants consideration in the treatment of equine gastrointestinal disease.<sup>3</sup> Although controlled studies are lacking, some reports have identified recommended daily feeding rates for psyllium to be 1) 100 grams per day, and 2) 5 tablespoons every 12 to 24 hours, to promote mucosal healing and repair in colitis cases.<sup>27,28</sup> The implementation of a low-bulk ration can sometimes be met with owner resistance, but discussing the rationale behind this approach and explaining the temporary nature of the feeding plan can help to increase owner compliance and overall success. Long-stemmed forage can be gradually reintroduced to the ration once symptoms have improved, to identify how much and what type of forage the horse can best tolerate on a long-term basis. It is important to continually monitor these horses closely, as they seem to be more sensitive to dietary and management changes.

**4. Conclusion**

Following basic nutrition principles that promote optimal digestive health when feeding performance horses will serve to support athletic performance and prevent digestive disturbances. When an equine athlete is not meeting performance expectations and/or experiences symptoms related to poor digestive health, the evaluation of feeding and management practices, and making appropriate adjustments, will support any necessary medical treatment and improve overall outcome.

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*Declaration of Ethics*

The Author has adhered to the Principles of Veterinary Medical Ethics of the AVMA.



*Conflict of Interest*

The Author is employed as an equine nutritionist for Purina Animal Nutrition, a commercial horse feed manufacturer.

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<sup>a</sup>Equi-Analytical, Ithaca, NY; www.equi-analytical.com.