

Role of Diet and Feeding in Normal and Stereotypic Behaviors in Horses

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KEYWORDS

- Equine behavior • Diet • Crib-biting • Stereotypy • Weaning
- Tryptophan • Insulin

In this article, the authors review the effects of diet on equine feeding behavior and feeding patterns, before considering the evidence that diet affects reactivity in horses. A growing body of work suggests that fat- and fiber-based diets may result in calmer patterns of behavior, and possible mechanisms that may underpin these effects are discussed.

In contrast, the authors highlight the current lack of evidence that herbal- or tryptophan-containing supplements influence equine behavior in any measurable way. The role of diet in the development of abnormal oral behaviors, particularly the oral stereotypy crib-biting, is discussed, and suggestions for future work are presented.

NORMAL BEHAVIOR

Modern Husbandry and Feeding Patterns

Surprisingly few studies have directly examined the effects of diet and feeding on behavior. Relative to the natural grazing state, modern nutritional management is associated with substantial changes in the nature, quantity, and frequency of feed consumption in horses, and it can be hard to separate diet from other aspects of management. For example, horses receiving a substantial proportion of their energy requirements as discrete meals of concentrate feeds are likely to be those that are regularly stabled. Stabling reduces opportunities not only for foraging but for various other behaviors in the horse's normal repertoire, such as locomotion and social contact. Behavioral changes associated with diet are likely to be confounded by frustration, excess energy reserves, or lack of stimulation. Experiments comparing groups of horses kept under similar conditions or examining the behavior of the same individuals over time can help to illustrate how diet and feeding patterns might alter behavior.

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Many of these suggest that even if the provision of concentrate feeds removes the physiologic need to forage throughout the day, the motivation may remain. Through a series of experimental manipulations using fistulae and injection of nutrients, Ralston¹ concluded that oropharyngeal stimuli (taste, chewing, and smell), nutrient feedback, and changes in energy availability (measured as glucose and insulin levels) all exert some degree of control over feeding behavior in horses. Horses given ad libitum access to concentrate feed ate around 10 meals per day and engaged in multiple “nibbling” bouts (<150 g) between meals, which were rarely separated by more than 3 hours.² Behaviors like coprophagy (ingestion of feces), wood-chewing, and bed-eating are often considered to be aberrant but may simply reflect motivation to feed outside of mealtimes because of cues from gut fill, time since the last meal, or a drop in blood glucose. These behaviors may specifically represent attempts to ingest fiber because they are often ameliorated by greater provision of roughage. Bed-eating is most common in horses bedded on straw and those lacking access to fibrous feed.³ Horses fed an all-concentrate diet spent significantly more time engaged in wood-chewing and coprophagy than horses fed only hay.⁴ When Zeyner and colleagues⁵ varied the amount of hay provided in addition to oats, they observed restless and nervous behavior in the horses with the lowest intake. Behavior was “quieter” and aggressive behavior at feeding time and coprophagy were eliminated when the diet contained more hay. In this particular study, total caloric intake was lower in horses fed less hay; thus, hunger may also have been an important determinant of behavior.

The common perception that excess energy from concentrate feeds causes “fizzy” or unwanted excitable behavior⁶ may have a basis in digestive processes. Large high-starch meals result in marked fluctuations in plasma glucose and insulin after feeding,^{7–9} which are likely to cause peaks and troughs of energy. Low-fiber high-starch diets are also associated with several digestive and metabolic disorders.¹⁰ Many problems seem to stem from the horse being unable to regulate gut acidity during digestion and absorption.¹¹ After ingesting large cereal-based meals, the higher proportion of dry matter in the stomach contents slows the mixing of feed and gastric juice, leading to the potential for dysfermentation in the stomach.¹² The vastly decreased time spent chewing (compared with a grazing lifestyle) exacerbates matters by reducing opportunities to moisten food with alkaline saliva. As a consequence, large starchy meals can result in discomfort and even gastric colic¹³ and are associated with gastric ulceration.¹⁴ Large meals can overwhelm the capacity of the stomach and small intestine and increase transit rates of digesta; this leads to intense episodes of hydrolysable carbohydrate fermentation in the hindgut and a drop in pH.^{4,15,16} Discomfort caused by the overflow of undigested carbohydrates into the hindgut has been linked with increased anxiety and aggression in rats¹⁷ and with abnormal oral behaviors in horses. The latter was reduced by dietary supplementation with virginiamycin, an antibiotic that altered fecal pH.¹⁸ Presumably, selective bacterial proliferation was halted, preventing rapid fermentation of sugar and starch.

Effects of Dietary Carbohydrate, Fiber, and Oil on Behavior

Although mimicking the natural eating patterns of the ancestral horse by providing prolonged access to a low-nutrient diet of hay or pasture seems to be desirable, horses in heavy work may not be able to sustain requirements for energy or specific nutrients through forage alone. Another approach to easing problems caused by meal feeding, limited roughage, and high starch levels is the replacement of some carbohydrates with fiber and oil as an energy source. This may be beneficial in minimizing glycemic and insulinemic fluctuations,¹⁹ with more energy coming from gradual

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