

# Feeding and microbial disorders in horses: 1-effects of an abrupt incorporation of two levels of barley in a hay diet on microbial profile and activities

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## Abstract

Cecal and colonic fluid samples collected from three ponies were analyzed to determine the effects of an abrupt incorporation of barley in a hay diet on their microbial and biochemical characteristics. Three diets based on meadow hay and rolled barley were tested in a 3×3 Latin square experiment: 100% hay (100:0, 114 gDM/KgBW0.75/day), 70% hay—30% barley (70:30, 69gDM/KgBW0.75/day) and 50% hay—50% barley (50:50, 58gDM/KgBW0.75/day). Enumeration of total anaerobic and aeroanaerobic bacteria, lactate-utilizing and cellulolytic bacteria, lactobacilli and streptococci, as well as pH, lactate and VFA concentrations, were determined before and five hours and 29 hours after the abrupt incorporation of barley in the hay diet. Whatever the amount of barley incorporated, an increase of total anaerobic bacteria, lactobacilli and streptococci, in the cecum and in the colon, was reported 29 hours after the changing of diet. Lactateutilizing and cellulolytic bacteria were not significantly modified five hours and 29 hours after the ingestion of a new diet. However a decrease of [(acetate+butyrate)/propionate] ratio was registered while lactate concentration increased although pH remained fairly constant through the changing of diet. The colon appeared to be the main site affected by the abrupt incorporation of readily fermentable carbohydrates in the diet. Thus, this section of the digestive tract needs further exploration to establish the linkage between the changes of the ecosystem as reported here, and the apparition of intestinal disorders.

## **Feeding and microbial disorders in horses: Part 3—Effects of three hay:grain ratios on microbial profile and activities**

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### **Abstract**

Cecal and colonic fluid contents were collected from three ponies and analyzed to determine the effects of three hay:barley ratios on their microbial and biochemical characteristics. Three diets based on chopped meadow hay and rolled barley were tested in a 3×3 Latin square experiment: 100% hay (100:0, 114gDM/KgBW0.75/day), 70% hay-30% barley (70:30, 69gDM/KgBW0.75/day) and 50% hay-50% barley (50:50, 58gDM/KgBW0.75/day). Enumeration of total anaerobic and aero-anaerobic bacteria, lactate-utilizing and cellulolytic bacteria, lactobacilli and streptococci, as well as pH, lactate and VFA concentrations, were determined after 14 days adaptation to the new diet. In the large intestine, the concentrations of total bacteria were higher with the diets containing barley than with the hay diet, whereas cellulolytic bacteria were depressed with the concentrate diets. As the proportion of barley increased, concentration of lactate-utilizing bacteria, lactobacilli and streptococci increased in the colon while it did not interfere significantly on these populations in the cecum. These changes of the microflora were associated with a significant decrease in intestinal pH and [(acetate+butyrate)/propionate] ratio, and a numerical increase of lactate concentration.

### **In vitro evaluation of intraluminal factors that may alter intestinal permeability in ponies with carbohydrate-induced laminitis**

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**Objectives**—To study the in vitro effects of cecal contents incubated with corn starch on colonic permeability in horses.

**Animals**—4 healthy adult ponies.

**Procedure**—Mucosal specimens were obtained from the right ventral colon and mounted in Ussing chambers. Changes in short circuit current, conductance, and large-molecule permeability in response to addition of cecal contents and cecal contents incubated with corn starch were evaluated for 120 minutes.

**Results**—Incubation of cecal contents with corn starch for 8 hours resulted in a decrease in cecal content pH and an increase in lactic acid concentration. These changes were similar to those reported in vivo for ponies given corn starch. Exposure of colonic mucosa to cecal contents incubated with corn starch resulted in an increase in tissue conductance and permeability of technetium Tc 99m pentetate, compared with mucosa exposed to cecal contents alone.

**Conclusions and Clinical Relevance**—In vitro exposure of colonic mucosa to cecal contents incubated with starch resulted in increased paracellular permeability. Fermentation of excessive

amounts of carbohydrate in the intestinal lumen of horses may directly induce increased intestinal permeability associated with carbohydrate-induced laminitis. (*Am J Vet Res* 2000;61:858–861)

# Feeding and digestive problems in horses. Physiologic responses to a concentrated meal.

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[Vet Clin North Am Equine Pract](#). 1990 Aug;6(2):433-50.

## **Abstract**

The association of feeding practices with the development of digestive disorders in horses has long been recognized, although the underlying mechanisms had been barely considered. The physiologic consequences of meal frequency may help to explain the relationship and prove to be of major significance in the induction of many conditions. Many Equidae kept for performance and leisure activities are fed high-energy, low-forage rations twice daily, with limited access to hay or grazing. Rapid ingestion of such meals stimulates a copious outpouring of upper alimentary secretions and results in transient hypovolemia (15% plasma volume loss). Subsequent activation of the renin-angiotensin-aldosterone system (RAAS) contributes to the preservation of circulatory status. Large meals may accelerate digesta passage to the cecum and, thereby, increase soluble carbohydrate availability for large intestinal fermentation. Intense periods of fermentation develop that require significant shifts of fluid into the colonic lumen. This is followed by net fluid absorption, which, in part, is dependent on postprandial increases of aldosterone. Potential consequences of these events include (1) imbalances in the RAAS response, which may promote conditions favorable to gastrointestinal disturbance, notably large intestinal impaction, and (2) changes in the gastrointestinal microflora, which may affect the intraluminal endotoxin pool and the population of enterotoxin-producing bacteria. In contrast to episodic feedings, similar changes are absent or greatly attenuated under simulated grazing conditions (for example, small, frequent meals). Thus, modification of management practices to facilitate a more continuous feeding pattern may significantly reduce the incidence of digestive problems in the stabled horse.