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NUTRITIONAL RISK FACTORS FOR COLIC ON HORSE FARMS: A PROSPECTIVE STUDY

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Colic prevalence and associated risk factors of colic have been studied retrospectively in groups of horses at university or private hospitals (White, 1990). Cases have been compared with control groups of horses treated at the hospital for other reasons. Case selection is influenced by the practice type, economic and prognostic factors determining which cases are treated at the facility. Few studies have examined the incidence of colic in a normal population of horses. Many risk factors have been suggested for colic, but often reports are anecdotal or based on observations of a case population without a comparable control population. Controlled studies comparing exposures have usually been retrospective. Risk factor exposure has been determined by follow-up, and may have problems with recall bias and information availability.

The incidence of colic in the present study was determined for normal horses housed on mid to large size horse farms and followed prospectively for one year. Colic was broadly defined as intestinal diseases presenting with signs of abdominal pain. Certain practices or events involving feeding, exercise, housing, pasturing or of health problems related to the horse's use or the farm management were hypothesized to increase the risk for initiating colic. Exposure to one or more management or nutritional risk factors in the time prior to the colic episode was tested for association with the occurrence of colic. This paper will describe the nutritional risk factor analysis.

MATERIALS AND METHODS

A horse owner list of 1367 farms was generated from equine infectious anemia test applications, county extension mailing lists and veterinary client lists for two adjacent counties in northern Virginia and Maryland. Forty farms with more than 20 horses, and owners willing to participate, were enrolled from a randomly selected sampling from the list. Nine farms were dropped from the study because initial information was not completed. The following information was collected: 1) a horse list including name, birthdate, sex, breed, use, and time enrolled; 2) a farm history questionnaire including population description, land use, employees, feed sources and handling, feeding frequency, water source and availability, pasture type and health practices and history; and 3) a horse profile for each horse including type and amount of feeds, feeding schedule, work schedule, time on pasture and in stall, habits, temperament, most recent deworming and vaccinations, recent injury, surgery or illness and history of previous colic. Hay and concentrates were sampled and submitted for forage analysis. The owner was given a calendar with instructions to record any changes in the initial information or any occurrence of an event from a list of possible events. Farms were visited every three months to collect the calendars and to update the horse list, profile new horses, and collect samples of new types of feed. Fecal and pasture samples were collected from each farm in the spring, summer and fall. Colic was defined and signs listed as part of the initial instructions. The owner was to report by telephone to the investigator if a horse exhibited a behavior indicative of colic. Horses with colic were examined and history and additional samples obtained.

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Total horse-days on the study were computed for each horse to account for horses coming and going from the farms. Incidence density was tabulated for individual risk factors. Bivariate analysis of incidence density ratios (IDR) comparing exposure groups was performed to identify factors associated with colic. Significant factors were determined by logistic regression (Hosmer and Lemeshow, 1989) using identified factors. Analysis was conducted at two levels, the farm and individual horse. Logistic binomial regression with farm as a random variable was performed to control for confounding by farm.

Daily dry matter intake was computed from all grains or concentrates fed each adult horse. Intake for weanlings and yearlings was considered too variable to be meaningful. Dry matter intake of grain/concentrate was divided into four levels: none, low (<2.5 kg/day), middle (2.5-5 kg/day) and high (>5 kg/day) based on terciles of intake. Because amounts of hay and pasture fed were too non-specific to compute valid intake levels, adult horses were grouped according to whether they received no hay, measured hay or free-choice hay. Horses being fed pasture, hay or pasture and hay and no grain were classified as being on a forage diet. Grains and concentrates fed were categorized into four types: sweetfeed, pellet, grain (barley or oats) or mixed feed.

RESULTS

Information about nutrition, management, health, exercise, use, events, and signalment was collected for 1427 horses on 31 farms.

The crude yearly incidence of colic was 10.5 colic cases per 100 horse-years. The incidence density on individual farms varied from 0 to 30 colic cases per 100 horse-years. One third of the farms had incidences of colic above the crude average incidence.

Nutritional factors tested individually that increased incidence density ratios ($P < 0.05$) are shown in Table 1.

Table 1. Significant nutritional risk factors by bivariate analysis

diet(forage, grain/concentrate or pasture combination)
grain/concentrate type
grain feedings/day
grain/concentrate dry matter level
grain/concentrate crude protein level
grain/concentrate digestible energy level
free-choice or measured hay
hay type
hay feedings/day
pasture type
pasture hours/day
treats
bran
additives
vitamin-mineral supplements

The significant factors by logistic regression at the horse level were: the horse receiving more than six treatments for some health problem within the year, age of the horse, history of previous colic and type of grain/concentrate. Odds ratios for grain/concentrates were: pellet=7.5 (95% confidence interval, 1.7-33.5), sweetfeed=7.5 (1.8-31.9), grain=2.5 (0.5-11.7) and mixed=2.9 (0.4-18.8). The nutritional factor most important at the farm level was the frequency of diet changes per horse. Farms with horses that had greater than four changes in type or amount of feed in the year had three times the incidence of colic than farms

with fewer than four changes per horse (P=0.04). No other management risk factor was important at the farm level. Logistic binomial regression did not change the list of important factors.

Adult horses were stratified by grain/concentrate dry matter intake level. Risk for colic increased as intake of grain/concentrate increased (Table 2). Feeds classified as sweet-feeds had higher IDR at all intake levels than feeds classified as pellets, mixed, or grains.

Table 2. Incidence density ratios (IDR) for adult horse grain/concentrate intake levels, relative to no intake (forage only).

Intake Level	IDR (95% confidence interval)
All grain/concentrates	
Low	1.8(0.5-6.2)
Middle	3.4(1.1-10.4)
High	4.4(1.5-12.8)
Sweetfeed	
Low	2.5(0.8-8.5)
Middle	3.7(1.2-11.5)
High	5.6(1.9-16.2)

DISCUSSION

Horses less than two years old, horses with no previous colic, adult horses on forage only (pasture, hay or pasture and hay) and horses with no problems that needed treatment were at the lowest risk for colic. Colic increased as more grain/concentrates and other additives replaced forages in the diet.

Control of confounding factors is important in the assessment of risk factors in this type of study. A horse with colic may be exposed to many related risk factors that were significant in bivariate analysis. Therefore multivariate analysis by logistic regression was used to attempt to determine the risk factors best describing the increase in colic risk. Based on this analysis, intake level and type of concentrate/grain appear to be an important nutritional risk factors for colic.

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