



Effects of Feed Form on Growth and Stomach Ulcers in Yearling Horses

Stephanie N. Warren, Pedro DePedro Gonzalez, DVM and Kevin H. Kline, PhD

Departments of Animal Sciences and Veterinary Clinical Medicine, University of Illinois, Urbana, Illinois 61801



INTRODUCTION

When selling yearlings at auction, larger horses (heavier weights, taller wither heights) are generally more profitable¹. Achieving rapid growth, however, may be associated with metabolic disorders², osteochondrosis, epiphysitis, angular limb deformities and stomach ulcers have been associated with high starch diets used to achieve rapid growth^{3,4,5}, and abnormal cartilage growth has been linked to insulin levels^{6,7}. If starches and sugars must be fed, they should be evenly distributed throughout the day. One method of achieving more diet consistency is to provide feed as a combined hay/grain cube. A previous study found that a complete pelleted diet of 50% grain and ground hay cubes improved weight gain over an identical diet of 50% grain and hay cubes fed separately. However, horses on both treatment diets had stomach ulceration⁵.

OBJECTIVE

This study was designed to test the hypothesis that yearling horses fed a complete ration (C), consisting of 75% alfalfa hay cubes and 25% ground oats fed together as a complete cube, will have higher average daily gain (ADG), dry matter and crude protein digestibility, and gain to feed ratio (G/F) than yearlings fed a diet of 75% alfalfa hay cubes and 25% ground oats fed separately (HG). It was also hypothesized that neither treatment diet would cause significant gastric ulceration.



Figure 1: Normal margo plicatus in a horse; the mucous membrane between the glandular and epithelial portions of the stomach.



Figure 2: An ulcer along the margo plicatus in a horse's stomach

REFERENCES

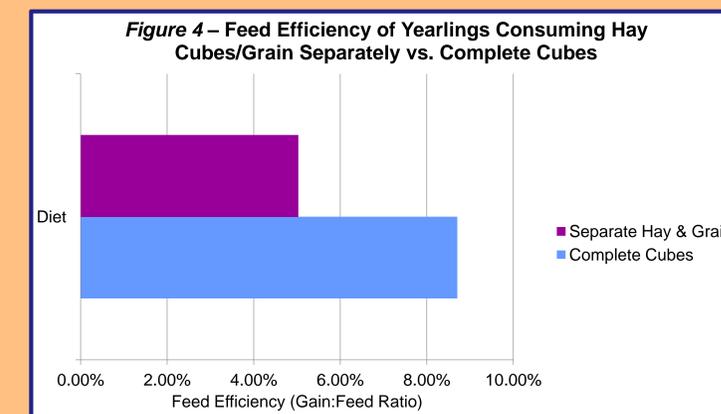
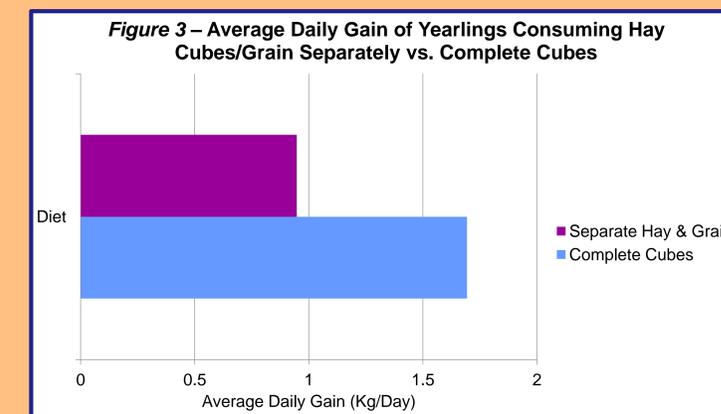
- Pagan JD, Koch A, Caddel S, Nash D. Size of Thoroughbred yearlings presented for auction at Keeneland Sales affects selling price. Proceedings of the Nineteenth Equine Science Society Symposium, 2005: 224-225
- O'Donohue DD, Smith FH, Strickland KL. The incidence of abnormal limb development in the Irish thoroughbred from birth to 18 months. Equine Vet J 1992;24:305-309.
- Glade MJ, Belling TH. Growth plate cartilage metabolism, morphology and biochemical composition in over and underfed horses. Growth 1984;48:473-482.
- Savage CJ, McCarthy RN, Jeffcott LB. Effects of dietary energy and protein on induction of dyschondroplasia in foals. Equine Vet J 1993;16:74-79.
- Flores RS, Byron CR and Kline KH. Effects of Feed Type on Average Daily and Gastric Ulcer Development in Weanling Horses. Proceedings of the Twenty First Equine Science Society Symposium. 2009:152-155.
- Glade MJ, Kanwar YS, Stern PH. Insulin and thyroid hormones stimulate matrix metabolism in primary cultures of articular chondrocytes from young rabbits independently and in combination. Connect Tissue Res 1994;31:37-44.
- Alarid ET, Schlechter NL, Russell SM, Nicholl CS. Evidence suggesting that insulin-like growth factor-I is necessary for the trophic effects of insulin on cartilage growth in vivo. Endocrinology 1992;130:2305-2309.
- AOAC. 1984. Official methods of analysis (14th Ed.) Association of Official Analytical Chemists, Washington D.C.
- J.D. Pagan. Measuring the digestible energy content of horse feeds. In: Pagan JD, ed. Advances in Equine Nutrition. United Kingdom: Nottingham University Press; 1998: 71-76.
- MacAllister CG, Andrews FM, Deegan E, Ruoff W, Olovson SG "A scoring system for gastric ulcers in the horse" *Eq Vet Journal*, 1997. 29: 430-433.

MATERIALS AND METHODS

Fourteen yearling Standardbreds, seven fillies and seven colts of similar weight, sex, age, and growth potential, with an average age of 8 months, and an average initial weight of 294 kg, were used to compare differences in ADG and G/F when fed a complete cubed diet (C), or a diet in which the alfalfa hay cubes and oats were fed separately (HG). The forage in both the plain hay cubes and the complete cubes was 80% alfalfa and 20% endophyte-free tall fescue. Diets were fed for 75 days, during which horses were fed no additional feeds, and had free-choice access to water, mineral blocks, and exercise. Horses were weighed on an electronic platform scale before the study and weekly for its duration. Upper gastrointestinal tract endoscopies were performed on all horses at the start and end of the study. Seven horses were randomly assigned to each diet and fed twice daily at 7:00 and 19:00 at a rate of 1.5% body weight as-fed. Horses were housed and fed in individual pens of 500 square feet with identical feeders. At each feeding, leftover feed was recovered and weighed to determine consumption. Feed samples were continuously collected and composited. Fecal samples were collected on days 71-75. Feces were composited and stored at -4 degrees Celsius. Collections were oven-dried at 60 degrees Celsius and samples were sent to a laboratory (Equi-analytical labs, Ithaca, NY) for analysis of dry matter (DM), crude protein (CP) and acid insoluble ash (AIA) using AOAC methods⁸. Apparent digestibility was calculated using the equation: $100 \times (1 - (\% \text{ AIA in feed} / \% \text{ AIA in feces})) \times (\% \text{ nutrient in feces} / \% \text{ nutrient in feed})$ ⁹. Differences in digestibility, ADG, and G/F between diets were determined using T tests.

RESULTS AND DISCUSSION

Diet C horses had an ADG (Kg/day \pm SEM) of $1.69 \pm .79$ while diet HG horses had an ADG of $0.95 \pm .18$. Diet C horses had a feed efficiency (G/F \pm SEM) of $.09 \pm .04$ while diet HG horses had a feed efficiency of $.05 \pm .01$. ADG ($P=0.046$) was found to be significantly different ($P<.05$) between the two diets while G/F ($P=0.065$) between the two diets was not significantly different. There were no significant differences between the two diets in DM or CP digestibility. Diet C's DM digestibility was 64.04 ± 6.74 while diet HG's was 66.80 ± 5.76 . Diet C's CP digestibility was 58.29 ± 3.94 while diet HG's was 57.85 ± 2.54 . Initial endoscopies found one horse with a grade 1 ulcer¹⁰. Final endoscopies found no horses with ulcers. No growth abnormalities were observed in horses on either diet.



CONCLUSIONS

The results of this study support the hypothesis that yearling horses fed a complete cubed diet of 75% alfalfa hay and 25% oats would have higher ADG than yearling horses fed a diet of 75% alfalfa hay cubes and 25% oats fed separately. However, the G/F and DM and CP digestibilities between diets were not found to be different. A significant difference in G/F may have been detected had a greater number of horses been used. The significant difference in ADG may be due to consistent grain/hay intake in diet C versus alternating grain and hay intake in diet HG leading to fluctuations in gastrointestinal tract pH and/or microbial populations. It is also possible that small particle size contributed to grain loss in diet HG and thus it was not included in feed waste. The results support the additional hypothesis that neither diet would cause significant gastric ulceration. It is concluded that a complete cube diet of 75% alfalfa hay (80% alfalfa hay, 20% tall fescue) and 25% oats does not cause stomach ulceration while achieving an acceptable growth rate in yearling horses.