ABSTRACT: In the hindgut of a horse, changes in the bacteria levels through dietary disruption, seasonal changes, stress, or age can lead to colic and laminitis, causing lameness or even death in severe cases. In this study, we profiled bacterial communities from fecal samples collected and submitted by horse-owners participating in the Equine Microbiome Project (EMP) and correlated differences in community structure with feed type, specifically horses eating exclusively hay, pasture, a hay-concentrate mix, or a combination of pasture, hay, and concentrate as reported in EMP metadata surveys. Feed categories were based on reported diet, and no surveys reported feeding a hay and pasture diet, thus the absence of a hay/pasture group. To participate in the EMP, horse owners submitted a fresh fecal sample collected in a provided kit according to standard instructions, and were required to complete an informational survey including horse diet, past medical history, and other metadata. Genomic DNA from fecal samples from 184 horses were analyzed using the 16S rRNA gene. Sequences were clustered against the Greengenes database, and beta diversity was calculated using weighted UniFrac metric in QIIME. Significant differences in bacterial community structure of pasture fed horses were found using PERMDISP (999 permutations, p-value < 0.05). Spearman rank correlation (999 permutations, p-value < 0.05) identified Christensenellaceae, Oscillospira, and Prevotella taxa to be more highly abundant in only pasture whereas RFN20, Streptococcus, and Lactobacillus taxa were differentially represented in hay/concentrate. These results point to functional differences in these communities that could lead to understanding how diet affects normal microbiome structure and hypotheses regarding functional differences leading to equine digestive disorders such as colic, laminitis, and Equine Metabolic Syndrome.
ABSTRACT: Dietary calcium can interact with fatty acids present in supplemental oil, forming indigestible soaps that can ultimately reduce the energy digestibility of the supplemental oil. As the amount of dried distillers grains with solubles (DDGS) corn oil has increased (DDGS corn oil is produced using fermentation that could increase fatty acid content), determining the metabolizable energy of DDGS corn oil in comparison to soybean oil in diets containing either low (chick Ca concentrations) or high (increased Ca to support egg production) calcium is important. Commercial male broiler chicks were raised for 28 days on diets including 0, 3, 6, or 9% of soy or DDGS corn oil in diets containing 0.9 or 2.0% Ca. These concentrations of Ca were selected to mimic commercial concentrations for chicks or to add a maximum dietary Ca concentration without negatively affecting growth performance. This resulted in 14 treatments of 9 replicate cages with 5 chicks (630 total chicks). Body weight, feed intake, feed conversion ratio, and mortality were measured. Excreta from day 28 was collected and was analyzed for gross energy, titanium and nitrogen to calculate the nitrogen corrected apparent metabolizable energy (AMEn) of the oils. All remaining birds were euthanized and four birds from each replicate were used for Dual-energy X-Ray Absorptiometry (DXA) body composition analysis. Although previous experiments had shown that 2.0% Ca was tolerable to chicks, there was a significant reduction in body weight with the chicks fed the 2.0% Ca (826.2 g/chick) in comparison to the chicks on the 0.9% Ca diet (1151.3 g/chick). There were no significant differences among chicks fed the various dietary oil concentrations (983.7 g/chick). In both dietary Ca concentrations, additional supplemental fat increased the fat mass of the birds (131.0g, 156.0g and 175.2g, respectively for the 3, 6, and 9% diets). Fat mass, as determined by DXA analysis, does appear to correlate with dietary oil concentration and is proposed as a supporting measurement for AMEn determination to better understand the true utilization of dietary oil by the birds.
ECONOMIC ANALYSIS OF FEEDING COSTS FOR DIETS INCLUDING CORN SILAGE OR SORGHUM SILAGE AS THE MAIN FORAGE SOURCE

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ABSTRACT: The objective of this study was to evaluate the cost of diets for high-producing cows including either corn silage (CS) or sorghum silage (SS) as the main forage source. A data base was generated for the nutritional composition of SS, and included: dry matter (DM; n=22), ash (n=16), crude protein (CP; n=23), ether extract (EE; n=13), neutral detergent fiber (NDF; n=25), acid detergent fiber (ADF; n=21), acid detergent lignin (ADL; n=18), starch (n=11), and in vitro dry matter digestibility (IVDMD; n=5). The nutritional composition of CS was obtained from the dairy NRC (2001). Diets were formulated with CPM Dairy Ration Analyzer using least cost optimization. Diets were formulated for a 635-kg Holstein cow producing 40 kg of milk (3.5% fat, 3.1% protein). Formulation constraints included: 100% of predicted DM intake, 100-110% of metabolizable energy requirement, 95-103% of metabolizable protein requirement, 28-33% dietary NDF, 30-40% dietary non-fiber carbohydrates, and 50-60% of dietary forage. Ration formulation was performed under 7 scenarios: very low, low, middle and high grain prices, with SS prices to be either 85, 70, or 55% of the price of CS. When the price of SS was 85% of that of CS, it was cheaper to include CS in the diets, likely explained by the greater inclusion of expensive grain in diets including SS. When the price of SS was 70% of that of CS, marginal differences in diet costs were observed between CS and SS. When the price of SS was 55% of that of CS, it was more expensive to include CS in the diets. In conclusion, SS had to be 30% cheaper than CS to obtain diets of similar composition and cost.
THE EFFECTS OF CONTINUOUS VS. ROTATIONAL GRAZING SYSTEMS ON FORAGE SOLUBLE CARBOHYDRATE CONTENT AND BLOOD GLUCOSE AND INSULIN CONCENTRATIONS IN HORSES

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ABSTRACT: Grazing is an important aspect of equine nutrition, considering the major component of a horse’s diet is forage. Due to a lack of horse grazing data, equine pastures have been managed based off of results from ruminant pasture research; this is a problem due to the distinctive physiological and grazing behavioral differences between ruminants and horses. Specifically, horses will selectively choose grasses, and directly break down and absorb the nutrients in their hindguts, as opposed to having them metabolically altered if they were foregut fermenters. The objective of this study was to determine the horses’ metabolic response to the soluble carbohydrates in the forage of continuous vs. rotational grazing systems. Continuous fields lead to overgrazed pasture, indicating the grasses have higher reserves of soluble carbohydrates because of the stressed conditions. On the other hand, rotational grazing offers a period of rest and regrowth after intensive grazing and thus, not in a constant stressed state. Therefore, our hypothesis is that horses in the rotational grazing systems will have lower blood glucose and insulin responses due to the lower soluble carbohydrates in the forage. Twelve horses were housed on 4-1.6 ha pastures (n=3). Two rotational systems were partitioned into four separate sections of 0.4 ha each and a central dry lot containing a shelter, water source and hay feeders. Two continuous fields allowed access to the entire field containing a shelter, water source and hay feeders year round. Prior to each trial rotational horses were grazing at least 8 days continuously. Sampling of blood and forage was performed every 4 hrs over a 24-hr period in June, August, and October 2015 starting at 0800; for 16 hrs prior horses were kept in stalls and fed a moderate quality grass hay. Blood was analyzed for plasma glucose and insulin; forage was analyzed for water and ethanol soluble carbohydrates (WSC and ESC, respectively). Data were analyzed using a repeated measures ANOVA in SAS with significance set at P < 0.05. For ESC and WSC there was significant effect of sample, month, grazing system and their interactions. Plasma glucose and insulin had a significant effect of sample, month and their interaction, but no effect of grazing system. In conclusion, while diurnal variations were detected, and the forage had significant differences between grazing system, they were not large enough to elicit a significant difference in blood glucose and insulin response in the horses.
ABSTRACT: Ten semi-feral Shetland-type foals and eight domesticated Standardbred foals were studied to evaluate the effect of domestication on the development of the equine gut microbiome in their first seven weeks of life. Factors such as gender, housing condition, grazing habits and diarrhea occurrences were also recorded and assessed. The gut microbiome was sampled once a week using rectal swabs and genomic DNA was extracted and microbial communities were determined using amplification of the V4-V5 variable region of the 16S rRNA gene and sequenced using Illumina MiSeq. QIIME was used for microbial data processing and analysis. Significant differences in microbial composition were found amongst age groups (ANOSIM, n=40, p<0.05). Preliminary analysis of differences in microbial composition between semi-feral (n=32) and domestic (n=8) foals and between housing condition were not found to be significant, however, further analysis will be conducted using a larger sample size and a more equal representation of the different groups. This study may provide insight into how domestication affects the horse’s gut microbial community, specifically during early development in which the foal is highly susceptible to bacterial infection and gut dysbiosis.
SURVEY OF PERFORMANCE HORSE NUTRITION IN SHOW HUNTERS AND JUMPERS IN NORTHERN VIRGINIA

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ABSTRACT: Nutrition is a critical part of the well-being and success of performance horses. The nutritional knowledge of owners, riders, grooms, and trainers is therefore important to the performance of competition horses. The objective of this study was to characterize the nutrition practices and management of hunter/jumper competition horses. A total of 125 individuals were surveyed at the Upperville Colt and Horse Show and HITS Culpeper Series during June and July 2016. Of the horses surveyed, the average age was 9.88 yr, with a range of 1 to 26 yr; there were 91 geldings, 30 mares, and 1 stallion. Approximately 56% of the horses were classified as jumpers, 48% as hunters, with the remaining horses categorized as equitation or other. Most of the horses surveyed were warmblood breeds (88%) and Thoroughbreds (12%). Sixty percent of surveyed individuals brought hay to the shows, while 36% purchased hay at the show. The majority of the horses (89.6%) were fed commercial concentrates and had access to pasture when at home (96%) for an average of 9.5 hours a day. However, only 58% of the available pastures had adequate grass forage for nutrition (at least 10.16 to 15.24 cm tall). Approximately 62% of the horses received one or more dietary supplement, including electrolytes, chondroprotectives, probiotics, and various others on a regular basis. While 58% of the individuals were concerned about equine obesity, 23% were concerned about ulcers, 14% with laminitis and insulin resistance, and 14% with colic. The majority of those surveyed (72%) had no concerns about colic, laminitis or insulin resistance, ulcers, tying up, or other nutritional related diseases in horses, despite the frequent travel and potential sudden feed changes associated with horse showing. Most of the individuals referred to multiple sources for information regarding equine nutrition, including trainers (n=75), veterinarians (n=71), feed companies (n=18), nutritionists (n=13), the internet (n=10), and other (n=1). However, 10 individuals (8%) reported using no outside sources of information when making decisions on nutrition and feeding practices. This survey identified nutrition practices and management of performance horses. The survey shows communication between veterinarians, nutritionists, and horse owners could be improved, bettering the health of the horse.
ABSTRACT: Whereas VFA production profile may be affected by product concentrations, this experiment assessed the effect of sodium acetate (NaOAc, 50 mM) addition on VFA and gas profile during in vitro fermentation. Rumen fluid samples (n=16) with 1% timothy hay were incubated with or without 50 mM NaOAc addition. Tubes were equilibrated with a 50/50 gas mixture of CO₂ and N₂, and incubated at 39°C while shaking with 20-ml syringes attached to collect gases. VFA and gas production were measured at 0, 4, 16, 24, and 48 h. Means for treatments with acetate addition vs. control are reported when different (P <0.05). Gas production is expressed in mmol/L of rumen fluid and VFA production is expressed as change in concentration (mM). Addition of acetate decreased gas production between 4–16 h (11.7 vs. 15.3 mmol/L of rumen fluid; SE±1.13). Acetate addition decreased acetate production at each interval, 0–4 h (-4 vs. 14 mM, SE±3.7); 4–16 h (11 vs. 26 mM; SE±4.5); 16–24 h (15 vs. 31 mM; SE±4.9); and 24–48 h (22 vs. 36 mM; SE±4.2). Acetate addition decreased propionate production from 0–4 h (4 vs. 6 mM; SE±0.5). Ratio of produced acetate:propionate (A:P) decreased from acetate addition for all intervals, 0–4 h (-0.8 vs. 2.4, SE±0.96); 4–16 h (1.1 vs. 2.3; SE±0.41); 16–24 h (1.1 vs. 2.3; SE±0.34); and 24–48 h (1.3 vs. 2.2; SE±0.23). The A:P ratio being close to 1 may be a result of acetate production being inhibited by NaOAc addition. NaOAc addition did not affect butyrate production, but decreased ratio of produced acetate:butyrate (A:B) for each interval. The A:B for 0–4 (-2.9 vs. 5.5; SE±2.6), 4–16 (2.0 and 5.0; SE±0.89), 16–24 (2.3 vs. 5.1; SE±0.74) and 24–48 (3.0 and 5.2; SE±0.54) hour intervals were lower for the NaOAc treatment. Acetate addition decreased total VFA production by treatment. Between 0–4 h total VFA production was 3 mM (NaOAc) vs. 23 mM (no acetate); SE±3.8. This trend continued between the 4–16 h (28 vs. 45 mM; SE±4.8) interval. Addition of NaOAc to rumen fluid decreased subsequent production of acetate more than other VFA, and decreased gas production.