58 Temporal variables of the Quarter Horse hunter trot and canter. M. Nicodemus*, *Mississippi State University*, *Mississippi State*.

American Quarter Horse (QH) is the largest breed in the United States with hunter under saddle (HUS) ranking as one of the highest in number of entries for rail classes. However, kinematic research on stock-type horses and on HUS horses is lacking. Research has studied the kinematics of nationally ranked stock-type western pleasure horses finding horses won at competitions while performing gaits that did not follow breed association guidelines. This research assisted in changes to improve upon the gait definitions of the western pleasure horse. Therefore, objectives of this study were to measure the temporal variables of the trot and canter of the QH HUS horse and to define using measured gait variables the gaits that are winning at competitions. 6 registered QH showing in a HUS class were filmed at 60 Hz. Camera was set perpendicular to horse's plane of motion at a distance of 399.2 cm. Horses were filmed throughout the class along one of the long sides of the arena. Trot and canter strides judged as desirable by carded QH judges under breed standards were evaluated using frame-by-frame analysis. Judging guidelines are documented in the 2006 QH rulebook under the HUS section. Strides not considered "desirable" were not included as the study objectives were to only define the locomotion of those horses winning at competitions. Means (SD) were determined for 5 strides for each horse for each gait with stance and limb support given as % of stride. Fore (Right=40±2%, Left=40±3%) and hind (Right=40±3%, Left=40±2%) stance were balanced in the trot, while the diagonal limbs of the canter were balanced (Trailing Fore=46±5%, Leading Hind=46±5%;Trailing Hind=41±3%, Leading Fore=42±4%). Along with suspension and bipedal support, the canter demonstrated periods of single fore (27±4%), single hind (20±3%), tripedal with 2 hind (20±4%), and tripedal with 2 fore (15±4%) supports (Table 1). In conclusion, the understanding of kinematics of the QH HUS horse can assist in performance evaluation. The measured variables from this study can be used to better define the HUS gaits according to QH breed association guidelines.

Table 1: Means (SD) of the temporal variables of the Quarter Horse hunter trot and canter.

	Trot	Canter
Velocity (m/s)	2.83±0.31	3.22±0.33
Stride Duration (ms)	773±43	623±27
Stride Length (m)	2.19±0.25	2.01±0.23
Stride Rate (stride/s)	1.30±0.07	1.61±0.07
Suspension (%)	19±1	7±4
Bipedal Support (%)	81±1	10±5

Key Words: Hunter Under Saddle, Quarter Horse, Temporal Variables

59 Survey of working conditions and management of donkeys in Niono and Segou. M. M. Diarra[1], A. Doumbia[1], and A. K. McLean*[2], [1]*Institut Polytechnique Rural de Formation et de Recherche Appliquèe*, *Katibougou, Mali*, [2]*Michigan State University*, *East Lansing*.

Donkeys, *Equus asinus*, play a vital role in the agriculture based economy of Mali, where they are used primarily by low income farmers for traction and to generate additional income by providing transportation of crops to market and a source of manure for fertilizer. The breakdown of donkeys caused by adverse conditions and poor health can lead to their unavailability for periods lasting from one to six months, often leading to abandonment due to the cost of care and lack of productivity. The objective of this survey was to identify the most common existing causes of poor health and reduced ability to work that could be rectified by better management strategies. The maintenance procedures of 2,656 donkeys in two locations in Mali, Niono (n=1448, 6 mo. duration) and Segou (n=1208, 8 mo. duration) were recorded by a veterinarian. Donkeys were examined monthly and evaluated with respect to their ability to work. Variables analyzed included the number of donkeys per owner, the use of the donkey, quality of harness, daily distance traveled, type of goods transported, hours worked per day, feed and watering practices, problems treated by the owner such as lesions caused by poor harnesses or lameness that impaired ability to work. The most prevalent causes of reduced work output were poorly constructed and fitting harnesses (76%), overloading (51% carried loads over 500 kg, the FAO recommends 400 kg), traveling long distances (79% traveled over 20 km/day), and for long hours (82% worked longer than 6 hr). In Segou (67%) and Niono (75%) of the donkeys had adverse health conditions such as lesions on the withers and shoulders, lameness, parasites, tetanus, trypanosomiasis and inanition. No medical care was provided to 72% of these animals especially with parasites and lesions. Harness quality is believed to be directly related to frequency of the lesions and wounds. These data highlight the need for education on donkey work practices, harnessing, and husbandry to improve the quality of life and work of these essential animals.

Key Words: Donkeys, Mali, Survey

60 11 β- hydroxysteroid dehydrogenase type 1 activity in equine adipose tissue. F. H. G. Farias*, P. J. Johnson, V. K. Ganjam, and D. H. Keisler, *University of Missouri*, *Columbia*.

Enzymatic 11βHSD1 amplification of glucocorticoid concentration in adipose tissue has been associated with obesity, diabetes, hypertension, dyslipdemia, and cardiovascular disease in humans and mice. Furthermore, mice that over-express 11βHSD1 activity in adipose tissue exhibit characteristics of visceral obesity and metabolic syndrome. Analogous to the growing problem of obesity and related problems in humans, the incidence of obesity and related problems are on the rise in the horse industry. In horses, obesity predisposes to greater risk for laminitis, infertility, insulin resistance, and equine metabolic syndrome. Our objective was to determine if 11βHSD1 activity exists in horse adipose tissue and, if present, to quantitate the amount of activity in abdominal vs. subcutaneous fat depots. Our hypothesis was that 11βHSD1 is present in horse adipose and that its activity is more abundant in abdominal vs. subcutaneous fat depots. Thus, samples of abdominal (retro-peritoneal) and subcutaneous (base of the tail) adipose tissue were collected from 23 horses. Horse body condition scores were categorized as obese (7-9), subtle overweight (6), normal (4-5), and thin (1-3). Fat samples from each adipose depot were submitted for immuno-histochemistry procedures to detect the presence of 11βHSD1 in abdominal and subcutaneous adipose tissue. In addition, radiometric assay procedures were also used to reaffirm the presence and quantitate the activity of 11βHSD1 in abdominal and subcutaneous

adipose tissue locations. Data were analyzed by PROC GLM and PROC MIXED of SAS, significance was set at P<0.05. We found no difference in 11βHSD1 activity between subcutaneous and abdominal adipose tissue nor did its activity correlate with body condition scores. These data provide evidence that 11βHSD1 activity is present in horse subcutaneous and abdominal adipose tissue, but these data fail to provide evidence that body condition score and 11βHSD1 activity are correlated as reported to occur in humans.

Key Words: Horses, 11β-HSD

61 Glucose/insulin responses of weanling horses fed forage based total mixed ration cubes versus hay/concentrate rations. S. L. Ralston*[1], H. Anderson[2], and R. Johnson[3], [1]*Rutgers*, *New Brunswick, NJ*, [2]*IdleAcres*, *Cokato, MN*, [3]*Nutrena*, *Minnetonka, MN*.

Insulin resistance (IR), resulting in hyperinsulinemia, has been documented in young horses fed high starch/sugar feeds (NSC 20% or higher). Hyperinsulinemia has been reported to be correlated with an increased incidence of developmental orthopedic disease(DOD). To test the hypothesis that rations with low NSC (<20%) such as forage based total mixed ration (TMR) cubes or Safe Choice® (SF, Nutrena ®(Minnetonka, MN) may reduce IR in weanling horses, a series of three trials were conducted (2004-2006). Each year 12 weanlings were fed either TMR cubes (Next Generation, IdleAcres, Cokato, MN) free choice (TMR, n=6 per year) or Nutrena ®(Minnetonka, MN) Life Design ®Youth ® (HS:2004, 2005) or SF (LS:2006) to provide 50% of the calories recommended for growth with adlib grass/alfalfa hay (n=6 per year) for 6 weeks. Hay and cube orts were recorded. Horses were fed in individual stalls overnight and turned out in dry lot paddock 0830-1600h daily. Horses were visually monitored for epiphysitis and flexure deformities, rated in a scale of 0-4, and radiographs were taken if indicated. Insulin sensitivity was assessed with a low dose oral dextrose challenge (LDOD: 0.25 gm dextrose/kg BW) before treatments were initiated and after 6 weeks on treatments (PostTX). Glucose/insulin responses to equicaloric amounts of TMR and concentrates were measured PostTX in all years. Glucose/insulin data were compared within and between years by ANOVA for repeated measures factoring effects of treatment, individual and year where appropriate (Statistixs for Windows, Analytical software) and Students T-test where appropriate. Nutrient content of the rations differed between and within years (Table 1). No DOD>1 was observed in 2004. In 2005 two IR horses had DOD>2 before the treatments were initiated, one was placed on TMR, the other on HS. The one on TMR had a DOD score of <2 within 2 weeks of feeding, the one on HC had a score>2 throughout the study. In 2006 2 horses had DOD>2 but only one was IR. Bothe were fed TMR but had no change in DOD score. Glucose responses to the PostTX LDOD did not differ between treatments in the first two years but insulin responses tended (P<0.1) to be higher in HS fed horses, suggesting reduced insulin sensitivity. Glucose/insulin responses to HS were higher than TMR or LS. In 2006 TMR fed horses had higher (P<0.05) glucose and insulin responses those fed LS but both tended (P<0.1) to be lower than in previous years. Restriction of NSC may increase insulin sensitivity in weanling horses but will not prevent or resolve all DOD. Young horses with DOD are not always IR.

Table 1. Nutrient Content of Rations consumed (DM basis)

	HC04*	TMR04	HC05*	TMR05	HC06*	TMR06
Mcal/kg	2.4	2.2	2.2	2.2	2.6	2.4
%CP	14.0	18.7	11.0	16.7	14.7	15.6
%NSC	20.0	16.5	20.0	13.0	15.4	15.0

*based on total hay/concentrate consumed per day

Key Words: Horse, Insulin, Growth

62 Metabolic and digestive profiles of horses grazing spring pasture. B. McIntosh*[1,2], D. Kronfeld[1], R. Geor[1], W. Staniar[1], and P. Harris[3], [1]*Virginia Polytechnic Institute and State University*, *Blacksburg*, [2]*Blue Seal Feeds, Inc*, *Londonderry, NH*, [3]*WALTHAM Centre for Pet Nutrition*, *Melton Mowbray, United Kingdom*.

Laminitis often occurs in the spring and may be associated with dietary nonstructural carbohydrates (NSC). A 36 h study in April 2005 took examined the effects of forage NSC on grazing horses in Virginia. Fourteen mares were randomly assigned to grazing (housed on a 5-ha pasture predominantly tall fescue; n = 10) or control (stabled and fed timothy/alfalfa hay; n = 4) groups. The mares were 11±5 yr old, weighed 596.0±14.5 kg, and body condition scores ranged from 4.5 to 7.5 (on a scale of 1 to 9). Plasma glucose, insulin and L-lactate concentrations, and fecal pH and volatile fatty acids (VFA) were measured hourly. Hay samples and hourly pasture samples were analyzed (Dairy One, Ithaca, NY) for starch and sugar, where sugar is water soluble carbohydrates (and includes fructans), and NSC was the sum of starch and sugar. Data were tested for normality and repeated measures ANOVA with post tests were performed. The NSC content of the hay was 8.9±0.05 % DM, and pasture NSC content ranged from 15.8 to 25.3 % DM. Grazing horses had higher overall insulin and glucose than control horses (P < 0.05). Mean insulin concentrations in grazing horses displayed a circadian pattern that correlated to NSC levels in the forage (r = 0.60, P = 0.008). Plasma L-lactate was higher in grazing horses (0.64 mmol/L) than control horses (0.40 mmol/L) (P < 0.001). Fecal pH was lower in grazing horses (pH 6.9) than control horses (pH 7.2) (P = 0.008). Fecal VFA, including acetic acid, butyric acid, D- and L-lactic acid were higher in grazing horses compared to control horses (P < 0.05). The alterations in metabolic and digestive variables observed in grazing horses may reflect increased intake and digestion of hydrolysable and rapidly fermentable carbohydrates that were present in spring forages. Changes in carbohydrate metabolism and digestion in grazing horses during spring may increase risk of laminitis via exacerbation of insulin resistance and rapid fermentation in the hindgut.

Key Words: Horse, Forage, Laminitis

63 Fatty acid content of grass and legume hays commonly fed to horses. L. K. Warren* and J. Kivipelto, *University of Florida*, *Gainesville*.

Recent interest in supplementing equine diets with omega-3 (n-3) fatty acids (FA) for their potential anti-inflammatory benefits has generated the need to better characterize the FA composition of basal feeds. While flaxseed and marine-derived oils are potent sources of n-3 FA,

a limited amount of data suggest that forages may be a reasonable source of alpha-linolenic acid (C18:3). However, the FA composition of different forages is not well described. The objective of this study was to characterize the FA composition of several grass and legume hays commonly fed to horses. Different sources of each of the following 5 hays were examined: timothy (n=8), orchardgrass (n=6), Coastal bermudagrass (n=10), alfalfa (n=8) and perennial peanut (n=6). Hays were analyzed for FA composition, total fat, crude protein, NDF and ADF. Data were analyzed by ANOVA to compare differences between individual hay varieties, grass vs. legume hays and warm- vs. cool-season grass hays. Across all hays, C18:3 made up the greatest ($P<0.01$) portion of the total fat content of hay (39.1±1.9 g/100 g fat), followed by C16:0 (23.8±0.9 g/100 g fat) and C18:2 (21.2±0.9 g/100 g fat). Other FA detected in all hays included C18:0, 18:1, 20:0, 22:1 and 24:1, each ranging from 0.02 to 4.1 g/100 g fat. Grass hays tended to contain a higher ($P<0.10$) proportion of C18:0 than legume hays, but no other differences in FA content were detected between these hays. The total fat content of legume hays (6.9±0.6%) was higher ($P<0.05$) than that observed for grass hays (3.8±0.3%), suggesting that while the FA composition of legume hays does not differ greatly from grass hays, legume hays may provide a greater total quantity of C18:3. Warm-season grass hay tended to be higher ($P<0.10$) in C16:0 and C18:0 and lower ($P<0.10$) in C18:3 than cool-season grass hays. Individual grass hay varieties did not differ in total fat content. Across all hays, a negative correlation was found between C18:3 and ADF content ($r=-0.58$; $P<0.05$), which indicates n-3 FA content of hay may decline when forage is harvested for hay at a more mature stage. Ultimately, consumption of commonly available hays of good to moderate quality will result in a greater intake of n-3 FA (C18:3) over omega-6 FA, regardless of the type of hay.

Key Words: Omega-3 Fatty Acids, Alpha-Linolenic Acid, Forage

64 Effect of season, forage maturity and grazing on the fatty acid composition of bahiagrass pasture. L. K. Warren* and J. Kivipelto, *University of Florida*, *Gainesville*.

Although low in total fat, a limited amount of data suggest forage may serve as a significant source of alpha-linolenic acid (C18:3) in equine diets. However, the fatty acid (FA) composition of common pasture forages has not been widely described. The objectives of this study were to characterize the FA composition of bahiagrass pasture selected by grazing horses and to determine the effect of season and cumulative growth on pasture FA composition. Over a 24-mo period, 3 replicates of each of 3 types of pasture samples were obtained at 1-mo intervals: grasses on or near areas where there was recent evidence of grazing by horses (GRAZE), grasses obtained from the same plots each month (MONTH), and grasses obtained from different plots each month that were allowed to accumulate up to 12 mo of growth (ACCUM). Both MONTH and ACCUM samples were obtained from areas on pasture that were restricted from grazing. MONTH was used to assess change in FA composition for new growth occurring in each 1-mo interval. ACCUM was used to determine changes in FA content as pasture forage grew and matured. All samples were obtained from an 8.1-ha, mixed-cultivar bahiagrass (*Paspalum notatum*) pasture that continually housed the same 6 mature geldings. Differences in FA content between sample types and with season were determined by ANOVA. On average pasture contained 4.1±0.2% total fat. Across all months and sample types, C18:3 made up the largest proportion of the total fat in forage ($P<0.01$), followed by C16:0 ($P<0.01$) and C18:2 ($P<0.01$). Other FA detected in pasture included C17:0, 18:0, 18:1, 20:0, 22:1 and 24:1, each ranging from 0.1 to 5 g/100 g fat. On average C18:3 was higher ($P<0.01$) in GRAZE (56.4±2.2 g/100 g fat) and MONTH (54.7±2.3 g/100 g fat) than ACCUM (39.8±4.2 g/100 g fat), whereas C18:2 made up a greater ($P<0.01$) proportion of the fat in ACCUM (21.5±1.1 g/100 g fat) compared to GRAZE (15.2±0.6 g/100 g fat) and MONTH (16.8±0.6 g/100 g fat). Season ($P<0.05$) affected C18:3 and C18:2 content of MONTH and ACCUM samples, with higher levels observed from April to July. ACCUM samples contained higher ($P<0.01$) C17:0, 18:0, 18:1 and 20:0 than GRAZE and MONTH, indicating a rise in these FA as bahiagrass pasture matures.

Key Words: Alpha-linolenic acid, Omega-3 fatty acids, Warm-season forage

Immunology - Livestock and Poultry I

65 An initial evaluation of the pathogenesis of Turkey-origin avian reovirus in poults. C. Stephens*[1], M. Pantin-Jackwood[2], E. Spackman[2], and J. M. Day[2], [1]*University of Georgia*, *Athens*, [2]*Southeast Poultry Research Labs, USDA*, *Athens, GA*.

Enteric disease causes poor performance in turkey flocks and, consequently, production losses in the industry. The pathogenesis of enteric viruses is not well understood and needs to be studied to further understand the nature of enteric disease. A virus isolated in 2003 from the intestines of poorly performing commercial turkeys in North Carolina (NC/SEP-R44/03) was selected for this study. In a previous study, this virus induced both humoral and cell-mediated immunosuppression in two-day-old poults. Three-week-old Broad Breasted White turkeys were inoculated by oral gavage with NC/SEP-R44/03, and the sham inoculated birds were inoculated with sterile phosphate buffered saline. Both the sham inoculated birds and the infected birds were weighed at days 0, 9, and 16 days post inoculation (DPI) to evaluate body weights. At 8 and 15 days PI, ten sham birds and 10 inoculated birds were selected to study the cutaneous basophil hypersensitivity (CBH) response; a measure of cell-mediated immunity. Another 20 birds were selected to study the humoral immune response by evaluating their antibody titers to Newcastle disease vaccine. Serum was collected from these birds at 21 and 42 DPI, and the antibody titers were determined by ELISA and were compared between the sham inoculated birds and the virus inoculated birds. Poults were periodically necropsied and examined for clinical signs of enteric disease. The spleen, bursa, and thymus were collected for histopathological analysis. No clear differences between the treatment groups in bodyweight, CBH response, and antibody response were observed; however, gross lesions consistent with enteric disease were observed at 8 and 15 days PI. Gross lesions included gas-filled, fluid filled intestines with undigested feed, and ceca with frothy contents. Enlarged bursas of fabricius with bursal 'cores' were also observed. In conclusion, older turkeys, in contrast with younger turkeys, do not appear to suffer immunosuppression with reovirus; however, enteric disease is observed.

Key Words: Turkey, Reovirus, Pathogenesis