M81 Jogging temporal variables as performed under 2005 stock horse breed association guidelines. J. Booker and M. Nicodemus*, *Mississippi State University*, *Mississippi State*.

In 2005, stock horse breed associations updated the western pleasure gaits definitions in order to discourage excessive slow gaits being performed in the show arena. Earlier jogging kinematics research found the gait more closely resembled an adaptation of a slow walk. Study objectives were to measure the temporal variables of the jog as performed according to 2005 stock horse breed association guidelines. 4 registered stock horses competitively showing in their respective breed associations were filmed at 60 Hz. 4 strides of a sound, consistent jog for each horse were evaluated frame-by-frame for hoof contacts and lift-offs. The jog had a lateral footfall sequence with a mean stride duration of 921 ± 34 ms and a velocity of 1.10 ± 0.09 m/s. The stride length was 1.10+0.10 m. Paired t-tests confirmed gait symmetry, as there was no significant differences ($p > 0.05$) found between the left and right limbs during the stance phase. The majority of the stride was spent in stance (Fore: 68+4%; Hind: 61+4%) with the horse spending a more significant amount of time on the fore than the hind limbs. Lateral advanced placement was 46+9% of the stride and was significantly longer than diagonal (7+4%), which indicated diagonal couplets instead of diagonal pairs. Lateral advanced lift-off (46+5%) was significantly longer than the diagonal (3+3%) with 44% of the strides being performed with the diagonal limbs coming off the ground at the same time. The longest limb support phase of the jog was diagonal bipedal (80 ± 8%) followed by tripedal support with two forelimbs (19 ± 8%), quadrupedal (17 ± 8%), and tripedal with two hind limbs (4 ± 8%). The horses spent more time being supported by the forelimbs, as the tripedal support with two forelimbs was significantly longer than the tripedal with two hind. There was no period of suspension. These findings suggest that even with current changes in judging standards the jog being performed in the show arena is not similar to that of a trot; but rather, the jog may be more closely paired with that of the 4-beat stepping gaits of the gaited horse.

Key Words: Temporal Variables, Jog, Stock Horse

M82 Assessment of calcium, phosphorus, and oxalate intake and excretion by horses grazing Kikuyu grass pastures in Hawaii. V. S. Gusman[1], J. R. Carpenter*[1], S. C. Miyasaka[1], and B. W. Mathews[2], [1]*University of Hawaii*, *Honolulu*, [2]*University of Hawaii*, *Hilo*.

Tropical "hazardous grasses" as classified by USDA (oxalate abundance) are currently continuously grazed year round by Hawaii's horses. Kikuyu grass (Pennisetum clandestinum) is an aggressive African species found in Hawaii in the dry/semi-moist habitats (~500-2000 m elevation). Significant evidence of skeletal problems ("Big head") occurs in Hawaii's horses. Objectives of this study were to evaluate various kikuyu grass pastures on the islands of Hawaii and Maui, determine the types and levels of any supplements fed, examine the Ca, P, and oxalate composition of both the kikuyu grass and total diets, and identify relationships between Ca, P, and oxalate of diets and feces. Trial used 20 horses of various breeds (14-22 yrs of age), and from 4 sites per island (2-3 horses per site). Weight of each supplement fed was recorded for each site. Kikuyu intake (DM) was fixed at 1.75% of body weight. Hand plucked kikuyu grass, representative samples of pasture supplements (alfalfa cubes, timothy hay, or guinea grass), and freshly excreted fecal samples were taken at each site during 4 seasons. Samples were dried (50°C) and ground, then analyzed for minerals (ICPES), nutrients (NIRs), and total and soluble oxalates (HPLC). Ca and P levels (DMB), and Ca:P ratio ranged from 0.25-1.06%, 0.18-0.36% and 0.80 to 3.01:1, respectively. Mean Ca and P levels for both kikuyu grass and total diet did not differ (P>.05) with season or location. The average Ca:P ratios for islands and sites did not differ, but values ranged from 1.08 to 1.91 and were below the NRC guide of 2:1. Total (T) and soluble (S) oxalates, and Ca:T and T:S of Kikuyu did not differ between islands, seasons or sites; but, insoluble oxalate differed (P<.01) with island, and Ca:T and T:S of total diet differed (P<.001) with season. Fecal oxalates did not vary between location but did vary (P<.01) between season. Total oxalates were found to be well beyond safe feeding levels (>0.5%) with 0.84 % on the Big Island and 0.76% on Maui. Even after supplement, critical levels of >0.5% T were still seen on both islands and in all seasons.

Key Words: Equine, *Pennisetum clandestinum*, Macro-Minerals and Oxalates

M83 Fermentation in equine cecal cultures fed low and high starch diets with or without an enzyme supplement. P. M. Yocum*[1], V. Fellner[1], S. J. McLeod[1], and M. Schuler[2], [1]*North Carolina State University*, *Raleigh*, [2]*Enzitech, LLC*, *Troy, VA*.

An *in vitro* batch culture study was conducted to determine the effects of starch and enzyme supplement on fermentation by equine cecal microorganisms. Fresh cecal contents were transported to the lab, filtered and added into beakers containing a pre-weighed amount of substrate. The substrate was incubated for 12, 24 or 48 h. Dietary ingredients included corn, oats, alfalfa pellets and a vitamin mineral premix. Diets fed were: 1) Low Starch (10% Corn; LS), 2) High Starch (70% Corn; HS), 3) LS + 50 mg Equigest, 4) HS + 50 mg Equigest, 5) LS + 100 mg Equigest, and 6) HS + 100 mg Equigest. Data were analyzed as a completely randomized block design with a factorial arrangement of treatments. At 12 h, the HS diet lowered ($P<0.05$) total short chain fatty acids (SCFA) (91 µmol/ml) the acetate to propionate ratio (2.7) and methane (358 nmol/ml) compared to the LS diet (100 µmol/ml, 2.9 and 730 nmol/ml, respectively). Total SCFA concentration was greatest ($P<0.05$) in the LS + 50 mg Equigest and HS + 100 mg Equigest diets. At 48 h, total SCFA concentration did not differ between the low and high starch diets. The HS diet increased ($P<0.05$) propionate (46 µmol/ml) and lowered the acetate to propionate ratio (2.1) when compared to the LS diet (35 µmol/ml and 3.0, respectively). Isobutyrate and isovalerate, were significantly greater in the LS compared to the HS diet. Both methane and culture pH were lower ($P<0.05$) with the HS diet. Addition of 50mg of Equigest resulted in the greatest increase ($P<0.05$) in concentrations of total SCFA, propionate, butyrate and isovalerate compared to all other diets. Data suggest that the effect of the enzyme supplement varies with time of incubation and level of starch in the diet. Presence of Equigest enzyme extracted more energy from the feed and increased acetate concentration in cecal cultures receiving excess starch in the high corn diets.

Key Words: Cecal Fermentation, Starch, Enzyme

M84 Pedigree effects on semen parameters in Tennessee Walking Horse stallions. P. E. Roberson*, F. Harper, and C. J. Kojima, *The University of Tennessee*, *Knoxville*.

The Tennessee Walking Horse (TWH) industry is an integral factor in the economy of the state of Tennessee. Breeders of TWH have expressed concern that level of inbreeding and pedigree (line effects) are adversely affecting fertility rates among stallions. A study was conducted to test the hypothesis that certain semen characteristics are influenced by pedigree in TWH breeding stallions. Semen characteristics from eleven stallions (collected throughout the 2004 breeding year) were analyzed. The variables were as follows: concentration (CON; million sperm/mL); volume (VOL; mL); percent motility (MOT); and total motile sperm (TMS; CON × VOL × MOT). Pedigree analysis revealed that the stallions were derived from 4 distinct pedigree lines (denoted here as LINES A, B, C and D). Inbreeding coefficients were calculated for each stallion (16.4 ± 1.8, mean ± SEM). The statistical model included age of the stallion in years (AGE) and inbreeding coefficient (F) as covariates and season of collection (3 month intervals;QTR) and LINE as main effects. Analysis of variance was followed by Fisher's LSD test. For all variables tested, no significant difference due to QTR was observed. There were significant effects of LINE on VOL ($P < 0.0001$), CON ($P = 0.0005$), and TMS ($P < 0.005$). There was no significant

difference observed in MOT due to LINE (P > 0.05). As the sample sizes are quite small (line D is represented by one sire), additional data are needed to confirm these results. These preliminary data indicate that variability seen in semen characteristics may be explained by pedigree when sire, age, season of collection, and level of inbreeding are accounted for.

Number of sires	2	3	5	1
Mean F	22.5	10.0	18.2	15.2
Mean AGE	12.0	17.0	12.6	28.0
Mean VOL	89.2^{A}	69.6^{B}	$56.6^{B,C}$	39.0^{C}
Mean CON	$113.3^{B,C}$	171.8^{A}	$128.2^{A,B}$	67.8^{C}

Mean values shown with uncommon superscripts within a row differ (P < 0.05).

Key Words: Horse, Semen, Inbreeding

Nonruminant Nutrition: Additives and Supplements

M85 A strawberry flavor in drinking water and feed improves water intake and growth of pigs at weaning. E. Roura*[1], D. Solà-Oriol[2], and D. Torrallardona[2], [1]*LUCTA SA*, *Barcelona, Spain*, [2]*IRTA*, *Centre Mas Bové, Reus, Spain*.

A two-phase trial was conducted to study the effects of a strawberry flavor (flavor) and a high intensity sweetener (HIS) in drinking water and feed on the performance of weanling pigs. Eighty 21 day-old Landrace piglets (6.6 ± 1.40 kg) were distributed in 24 pens with three or four pigs, each provided with an independent water container. In phase I, all pigs were offered the same unflavored diet for a period of 14 days but four treatments were administered in the water: either with no additions (C), or with flavor (A), with HIS (S) or both flavor and HIS (AS). In phase II (day 14 to 27), the animals in each treatment were divided into two groups receiving unflavored water but offered either flavored or unflavored feed. At the end of phase I, average water intake was 618, 681, 642 and 645 g/p/d, and weight gain was 168, 199, 189 and 180 g/p/d for groups C, A, S and AS, respectively. Thus, group A compared to C showed 10% (P > 0.1) and 18% (P < 0.1) higher water intake and weight gain, respectively. In addition, feed to gain ratio during the same period was better (P < 0.05) for A (1.37) than that for C (1.63) and intermediates for S (1.45) and AS (1.50). No differences in feed intake were observed. Statistics of phase II suffered from a low number of replicates. Nevertheless, it seems relevant (P < 0.01) that the group receiving flavor+HIS through water in phase I followed by flavor+HIS through feed in Phase II increased body weight gain by 18% over those receiving flavored water in Phase I and unflavored feed in Phase II. Thus, in phase II, the withdrawal of flavor in water together with not adding flavor in feed resulted in the lowest performance. Overall, these results suggest that water intake after weaning is encouraged with the use of flavor, and that this has beneficial effects on piglet performance. After the withdrawal of flavor in water, improving piglet performance might be linked to flavoring also the feed. The interaction between flavoring drinking water and flavoring feeds at weaning merits further studies.

Key Words: Water Intake, Piglet Weaning, Flavor

M86 Effect of oregano, cinnamon and chili pepper herbal extracts as growth promoters on growth performance of young pigs. G. Velazquez[1], A. G. Borbolla*[1], G. Mariscal-Landin[2], T. Reis de Souza[3], and A. Pinelli[4], [1]*Universidad Nacional Autonoma de Mexico*, *Mexico City, Mexico*, [2]*INIFAP CENID Fisiología*, *Ajuchitlan, Queretaro, Mexico*, [3]*Universidad Autonoma de Queretaro*, *Queretaro, Queretaro, Mexico*, [4]*Centro de Investigación en Alimentación y Desarrollo A.C.*, *Mexico City, Mexico*.

The aim of this work was to evaluate the effect of oregano, cinnamon and chili pepper herbal extracts (HE) as growth promoters on live weight (LW), daily weight gain (DWG), daily feed intake (DFI) and feed conversion (FC) of pigs weaned at 19 days of age during 35 days (weaned stage) after weaning (divided into two feeding phases). Eighty-four pigs were randomly assigned to four treatments (tx): negative control (NC), diet with no growth promoter added; positive control (PC), diet with carbadox as growth promoter; negative control + 150 ppm of HE (NC150), diet NC with the addition of 150 ppm of HE; and negative control + 300 ppm of HE (NC300), diet with the addition of 300 ppm of HE. The pigs were distributed into 24 pens (three or four pigs/pen and six pens/tx). A randomized complete block design with covariable (initial weight) was used for the data analysis. The blocking factor was the week of weaning. The experimental unit was the pen for DFI and FC; and the pig for LW and DWG. Phase I lasted 14 days after weaning and Phase II for 21 days. The PC had higher LW (P < 0.001) compared with NC150, NC300 and NC (14.5 vs. 13.0, 12.5 and 11.9 kg, respectively). On week two of phase II, NC150, NC300 and PC showed higher DWG (P < 0.05) compared with NC (516.2, 477.9 and 525 vs. 398.8 g, respectively). The DFI for PC in both phases were higher (P < 0.05) compared with the rest of experimental groups. FC was lower (P < 0.005) for the NC300 and PC groups compared with NC and NC150 (2.0, 1.7 vs. 2.4 and 2.5, respectively) during phase I. In phase II, FC was lower (P < 0.005) in NC150, NC300 and PC compared with NC (1.3, 1.3, 1.4 vs. 1.6, respectively). The use of herbal extracts in young weaned pigs statistically imitates some of the parameters achieved when the antibiotic-origin growth promoter, carbadox, is used in the fed.

Key Words: Herbal Extracts, Growth Performance, Weaned Pigs

M87 Intestinal morphology of weaned pigs fed diets containing herbal extracts as growth promoters. G. Velazquez[1], A. G. Borbolla*[1], G. Mariscal-Landin[2], T. Reis de Souza[3], and A. Pinelli[4], [1]*Universidad Nacional Autonoma de Mexico*, *Mexico City, Mexico*, [2]*INIFAP CENID Fisiología*, *Ajuchitlan, Queretaro, Mexico*, [3]*Universidad Autonoma de Queretaro*, *Queretaro, Queretaro, Mexico*, [4]*Centro de Investigación en Alimentación y Desarrollo A.C.*, *Mexico City, Mexico*.

The aim of this work was to evaluate the effect of herbal extracts (HE) used as growth promoters on villous height (VH) and crypt depth in the duodenum (D), jejunum (J) and ileum (I) of fifty-two weaned (22 d) pigs. At day of weaning (d 0), four pigs (d 0 pigs) were randomly chosen and slaughtered to obtain basal levels of VH and CD from D, J and I. The remaining pigs were randomly assigned to four treatments: negative control (NC), diet without any growth promoter; positive control (PC), diet with carbadox as growth promoter; negative control + 150 ppm of HE (NC150), NC diet with the addition of 150 ppm of HE; and negative control + 300 ppm of HE (NC300), diet with the addition of 300 ppm of HE. Pigs were allocated in 16 pens (four pens/treatment). A split plot experimental design was used for data analysis. At days 7, 14 and 21 postweaning, four pigs from each treatment were randomly killed to obtain intestinal samples. The experimental unit was the pig, and the analysis unit was the villous. Fourteen days after weaning, VH in D, J, and I of all pigs regardless of treatment decreased 60% (P < 0.01) when compared with the VH at d 0. At day 21, however, DVH (P < 0.05), JVH (P < 0.07) and IVH (P < 0.09) were highest for NC150. CD increased (P < 0.005) in all treatment groups regardless of treatment when compared to CD of pigs at d 0. CD in D and I were equal (P > 0.05) for all treatments at d 7 and d 14. JCD was the lowest (P < 0.05) in PC, NC150 and NC300. At d 21, DCD was similar (P > 0.05) among treatment groups. JCD was lowest (P < 0.01) in CN300 pigs when compared with CD of the PC pigs (95 vs. 130 µ). In I, NC150, NC300 and PC had the lower (P <