

766 Use of N fertilization versus interseeded legume—Forage characteristics and stockers performance. M. H. Ramos*¹, J. W. Lehmkuhler², and K. A. Albrecht³, ¹University of Missouri, Columbia, ²University of Kentucky, Lexington, ³University of Wisconsin, Madison.

Due to increasing prices of N an experiment was conducted to compare the response of stocker beef animals grazed on an interseeded legume to a pasture with N application. The legumes interseeded were Kura Clover with Soft Leaf Fescue, White Clover with Soft leaf fescue and Soft leaf tall fescue only. During all three years of the experiment no differences in dry matter availability ($P > 0.05$) were observed between treatments, with DM production of legumes being lower ($P < 0.05$) than grass during 2006 but not ($P > 0.05$) during 2007. Both NDF and ADF of grass was higher ($P < 0.05$) than legumes during 2006 but no differences were measured the other two years. The IVDMD was higher ($P < 0.05$) for legumes than grass during 2006 with a tendency to follow the same pattern in 2005 but not ($P > 0.05$) during 2007. Lignin, CP, and ASH were not different ($P > 0.05$) among treatments. No significant differences ($P > 0.05$) were observed between treatments for ADG and gain/ha during the 2005 grazing season. End weights and ADG were higher ($P < 0.05$) for the legume treatments than the fescue treatment during 2006 although no significant difference ($P > 0.05$) was measured between treatments for gain/ha in 2006. End weights were not significantly ($P < 0.05$) different between treatments for the 2007 grazing season. It can be concluded that pastures containing a mixture of grass and legume, with the legume representing at least 40% of the mixture, will have better forage quality (lower NDF and higher IVDMD) while still providing the same amount of dry matter compared with pastures that contain only grass and nitrogen fertilizer. Pastures that contain a mixture of legume will allow for higher ADG when compared with pastures that contain grasses only and that can or cannot be translate in higher gains/ha.

Key Words: grass, legume, nitrogen

767 Performance of Holstein steers, beef steers and beef heifers under rotational grazing. M. H. Ramos*¹, J. W. Lehmkuhler², and K. A. Albrecht³, ¹University of Missouri, Columbia, ²University of Kentucky, Lexington, ³University of Wisconsin, Madison.

A grazing experiment was conducted where Holstein steers, beef steers and beef heifers (both Angus crossed) were intensively grazed during the grazing season of 2005, 2006 and 2007. Animals had access to pasture of tall fescue, soft leaf tall fescue, orchardgrass (all received nitrogen) and soft leaf tall fescue with Kura clover and white clover. All three types of animals were implanted with growth promoting implants during the first two years but not 2007. The initial weight of animals were not different ($P > 0.05$) for 2006, for 2005 heifers started heavier than steers which were heavier than Holsteins, and for 2007 Holstein started the experiment heavier than heifers which were heavier than steers. Since beginning weight was different it was used as covariate in the Statistical model. For two out of three years Holstein steers gained as well ($P < 0.05$) as beef steers and heifers, which were similar. In one year beef steers had higher ADG than Holsteins and heifers. End weight was not different ($P > 0.05$) during 2005, Holstein steers finished as heavy ($P > 0.05$) as beef steers and both were heavier than heifers in 2006. In 2007 Holstein steers finished as heavy as beef heifers but lighter than beef steers. It can be concluded that Holsteins steers have the potential to perform as well as beef steers under managed intensive grazing.

Key Words: grazing, Holstein, beef

Horse Species

768 The welfare of horses during transport. J. Woods*, *J. Woods Livestock Services.*

In the past three years, we have seen an increasing focus on the welfare of horses during transport. This trend is due to a combination of several factors. First, the closing of the three remaining horse slaughter plants in the United States has forced horses to be transported further distances to Canada and Mexico. Second, these closures and current economic restraints have increased the number of unwanted and abandoned horses throughout North America. And finally, several animal rights groups have launched campaigns focusing on the transport of all livestock. With the increase of horses being transported north, Canada has come under even more of a microscope regarding the welfare of the horses not only within our borders, but also those crossing into our country. This increasing scrutiny has brought the horse industry together and to the table to work with enforcement agencies, animal welfare groups, processors and transporters to help ensure our horses are being transported humanely and safely, no matter their destination. Out of this collaboration has also come a campaign to take responsibility for the welfare of horses during transport clear back to the farm through education and awareness to stop the transportation of unfit animals.

Key Words: transportation, horse, welfare

769 Expression of intestinal monosaccharide transporters and the sweet taste receptor in equine small intestine. D. Arora*, M. Al-Rammahi, K. Salmon, C. Proudman, and S. Shirazi-Beechey, *University of Liverpool, Liverpool, UK.*

Glucose and sodium are co-transported by the Na⁺-glucose cotransporter, SGLT1, across the luminal membrane of intestinal absorptive cells (enterocytes). Na⁺ and glucose exit the cell across the basolateral membrane of enterocytes by Na⁺/K⁺-ATPase and the monosaccharide transporter, GLUT2, respectively. Co-transport of water along with Na⁺ and glucose accounts for 50% of the total water absorption across the intestinal luminal membrane. It has been shown that expression of SGLT1 is upregulated in response to increased luminal monosaccharide concentration. This upregulation is achieved through a signalling pathway initiated by the gut sweet taste receptor. Aim: To determine if the gut sweet taste receptor and the signalling elements involved in SGLT1 upregulation are expressed in equine intestine. Intestinal tissue samples from 8 horses, maintained on either a forage pasture or grain based diet, and euthanased for conditions other than intestinal disease were used. Histological examination confirmed the integrity of the tissue. Using immunohistochemistry with antibodies to equine SGLT1 and GLUT2, it was shown that, in all dietary conditions, SGLT1 is expressed on the brush border and GLUT2 on the basolateral membranes of entire villus enterocytes indicating that the transcellular route for absorption of glucose in equine intestine is accomplished by lumenally located SGLT1 and basally residing GLUT2. Furthermore, utilising

antibodies to equine T1R2 + T1R3 (the sweet taste receptor subunits) and their partner G-protein, gustducin, it was demonstrated that the sweet taste receptor is located in the enteroendocrine cells of equine small intestine. The presence of the sweet taste receptor in the equine gut provides a potential route for manipulating the capacity of the gut to absorb glucose and water, with attendant promise to enhance energy and hydration for racing horses.

Key Words: intestine, glucose transporters, sweet taste receptor

770 Fatty acid synthesis in equine adipose and liver tissue explants.

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Glucose and acetate can both be used to synthesize fatty acids with difference in preference noted between species. Ruminants preferentially use acetate, while humans and pigs preferentially use glucose - a difference that may be due to variations in gastrointestinal physiology. Equids possess the ability to absorb both dietary glucose from the small intestine and acetate from the hindgut, thus both substrates should be available for lipogenesis. Additionally, fatty acid synthesis can occur in either adipose or liver tissue. The objective of this study was to determine tissue depot and substrate preference for fatty acid synthesis in horses. Adipose (subcutaneous and mesenteric) and liver tissue was collected immediately post-euthanasia from six horses (3 BCS=7-8; 3 BCS=3) in order to determine substrate preference and tissue lipogenic activity. Tissue slices (100-150 mg) were incubated for two hours in buffer containing 1 μ Ci of either [U -¹⁴C]D-glucose or sodium [1 -¹⁴C] acetate. Incubations were carried out at 37°C in a shaking water bath. Following incubations, total lipids were extracted and incorporation of radiolabel into fatty acids was measured. Data were analyzed using mixed models ANOVA. Lipogenesis was greater in the adipose depots than liver ($P = 0.002$). Within depot, glucose and acetate were used equally by both mesenteric and subcutaneous adipose tissue. Adiposity did not affect lipogenesis in mesenteric adipose; however, lipogenesis was reduced in the subcutaneous adipose of BCS 3 animals ($P < 0.001$). Lipogenesis in the liver was not affected by adiposity, but there were substrate differences, with acetate used to a greater extent than glucose ($P = 0.021$). In conclusion, horses primarily synthesize free fatty acids in adipose tissue and are capable of using both glucose and acetate as substrates. The low capacity of the liver to synthesize free fatty acids may suggest that this organ functions primarily in gluconeogenesis.

Key Words: horse, lipid

771 Effects of the insulin sensitizing drug, pioglitazone, on genes regulating glucose and fat metabolism in horses. J. K. Suagee*¹, R. J. Geor³, L. J. McCutcheon³, J. G. Wearn², M. V. Crisman², B. A. Corl², and M. W. Hulver¹, ¹Virginia Polytechnic Institute and State University, Blacksburg, ²Virginia-Maryland Regional College of Veterinary Medicine, Blacksburg, ³Michigan State University, East Lansing.

Pioglitazone hydrochloride (PG), a thiazolidinedione antidiabetic agent, improves insulin sensitivity in humans by enhancing glucose and free fatty acid uptake from plasma and reducing pro-inflammatory cytokine expression. As a synthetic ligand for the peroxisome proliferator-activated receptor- γ (PPAR γ), PG alters the expression of genes involved in glucose and lipid metabolism and inflammation in skeletal muscle and adipose tissues. Our objective was to determine the influence of

10 d of PG treatment on 1) the expression of genes regulating glucose and lipid metabolism in equine adipose and skeletal muscle tissue and 2) lipopolysaccharide (LPS) induced insulin resistance. Sixteen mature (8 – 21 yr), non-pregnant mares with an average (\pm SEM) BCS of 5.9 \pm 0.8 were used for this study. Treatment ($n=8$) horses received a 1 mg/kg dose of PG at 0700 hr, p.o. for 14 d. Muscle (mid gluteal) and adipose (nuchal crest) tissues were collected on d 0, 11, and 13. On d 12, all horses received an infusion of LPS (35 ng/kg, i.v., over 30 min). Following RNA isolation, 30 ng of total RNA was used in a one step PCR reaction to determine gene expression changes of glucose and lipid metabolism genes (GLUT4, GLUT1, insulin receptor [INSR], FATP, CD36, and PPAR γ). Fold changes were calculated as $2^{-\Delta\Delta Ct}$ and all data were analyzed using the mixed models procedure of SAS. Treatment with PG increased expression of muscle INSR ($P = 0.023$) and GLUT1 ($P = 0.053$), and adipose tissue FATP ($P = 0.034$). Infusion of LPS decreased expression levels of GLUT4 in muscle ($P = 0.054$) in both groups and in adipose of control animals ($P = 0.026$). Pioglitazone potentially increases mechanisms of insulin and non-insulin mediated glucose disposal in muscle, and free fatty acid uptake in adipose tissue, in addition to protecting against LPS induced reductions in insulin mediated glucose uptake into adipose tissue.

Key Words: horse, glucose, lipid

772 The use of a handheld glucometer for measuring glucose concentrations from whole blood collected from the horse. C. D. Gunkel*, J. S. Drouillard, and T. L. Slough, Kansas State University, Manhattan.

The objective of this experiment was to determine if a handheld glucometer could be used to accurately measure blood glucose concentrations in horses. Six four-year-old Quarter horse geldings (488 \pm 20 kg BW) were used in the study. Horses were fed a diet consisting of ad libitum native prairie hay and 2.25 kg/d of concentrate. Half of the concentrate was fed in the morning, and the remainder was fed in the afternoon. Whole blood was collected in vacuum tubes via jugular catheter on two consecutive days at 30-min intervals for 4 h, beginning 1 h before introduction of concentrate feeding, thus resulting in a total of 120 individual samples. Approximately 10 μ L of whole blood was utilized to obtain glucose readings using a One Touch Ultra handheld glucose monitor. The remaining blood was centrifuged at 876 \times g for 10 min. Serum then was separated and frozen at -21°C. Serum was later thawed and subjected to a glucose assay performed with an Auto Analyzer 3 digital colorimeter. The glucose measurements obtained with the One Touch Ultra and the Auto Analyzer 3 were compared by repeated measures using a mixed model analysis of covariance, with glucose measurements obtained from the Auto Analyzer 3 as the response, measurements obtained with the One Touch Ultra as the covariate, horse as a random effect, and sampling day as a fixed effect. Initially, first order autoregressive covariance structure was utilized, but serial correlation between times was not significant. Residuals were found to normal. Whole blood glucose measurements determined on the One Touch Ultra system and serum glucose measured with the Auto Analyzer 3 were correlated ($R^2 = 0.48$; $P < 0.0001$). Serum glucose concentration from the Auto Analyzer 3 can be estimated as: $3.61 + 0.3814 \times$ whole blood glucose concentration from the One Touch Ultra. While the exact concentrations obtained by the standard colorimetric assay and the One Touch Ultra were not identical, both methods detected similar trends. Thus, the One Touch Ultra is a convenient method of monitoring blood glucose in the field.

Key Words: horse, glucose, glucometer

773 The effect of consuming endophyte-infected tall fescue on lameness in the horse. K. C. Gradert*¹, J. M. Bormann¹, S. F. DeWitt², L. W. Lomas³, J. M. Kouba¹, and T. L. Slough¹, ¹Kansas State University, Manhattan, ²Woodside Equine Clinic, Ashland, VA, ³Southeast Agricultural Research Center, Parsons, KS.

The objective of this study was to assess the effect of endophyte-infected tall fescue consumption on equine soundness. Researchers have shown a vasoconstrictive effect of ergovaline on equine tissue *in vitro*. If circulation to the hoof is reduced *in vivo* then soundness may be compromised. Animals consisted of 12 clinically sound, three-year-old American Quarter horses with a mean BW of 459 ± 31 kg. They were blocked by weight, sex, and HYPP status and divided into two cohorts: control horses (n = 6) received an endophyte-free diet (E-) and treatment horses (n = 6) received an endophyte-infected (E+) diet. Fescue seed was integrated into the concentrate at a rate sufficient to bring daily ergovaline consumption in the E+ diet to a minimum of 0.20 ppm. The E- concentrate contained an equal amount of endophyte-free fescue seed. Horses had *ad libitum* access to native prairie hay. From d 30 to d 60 the native hay was replaced by a low- (E-) or high-endophyte (E+) variety of fescue hay. Based on assumed daily DM consumption of 2% BW, inclusion of fescue hay brought total dietary ergovaline consumption to 0.19 ppm (E-) and 1.04 ppm (E+). Lameness exams were conducted by a DVM blinded to treatment and occurred on d 0, d 30, d 60 and d 90. Animals were trotted in a straight path, tested for hoof sole and frog sensitivity, and lunged in both directions on a concrete surface. Horses on the E+ diet tended (P = 0.06) to have increased hoof sensitivity to hoof testers on d 60 compared to E- horses. While numerically there appeared to be a treatment effect, limited numbers of observations resulted in no significant difference between groups. Further research with increased numbers of horses or increased treatment duration may better elucidate whether the consumption of endophyte-infected fescue has a negative impact on equine soundness.

Key Words: lameness, fescue, horse

774 The use of thermal imaging to monitor temperature in the hoof of horses consuming endophyte-infected tall fescue. K. C. Gradert*¹, J. M. Bormann¹, S. F. DeWitt², L. W. Lomas³, J. M. Kouba¹, and T. L. Slough¹, ¹Kansas State University, Manhattan, ²Woodside Equine Clinic, Ashland, VA, ³Southeast Agricultural Research Center, Parsons, KS.

The objective was to evaluate blood flow in the hoof of horses consuming endophyte-infected tall fescue. A digital thermography camera was used to measure temperature in the hoof as an indicator of blood perfusion. Twelve clinically sound three-year-old Quarter horses with a mean BW of 459 ± 31 kg were blocked by weight, sex, and HYPP status and divided into two groups: those receiving an endophyte-free diet (E-; n = 6) and those receiving an endophyte-infected diet (E+; n = 6). Fescue seed was fed twice daily to bring daily ergovaline consumption in the E+ diet to a minimum of 0.20 ppm. The E- diet contained an equal amount of endophyte-free fescue seed. Horses had *ad libitum* access to native prairie hay, which was replaced with a high-endophyte (E+) or low-endophyte (E-) fescue hay from d 30 to d 60. Based on assumed daily DM consumption of 2.0% BW, total daily ergovaline consumption was calculated to be 0.19 ppm (E-) and 1.04 ppm (E+). Temperature was recorded at the center of both front hooves just below the coronary band on d 0, d 30, d 60 and d 90. Following the morning meal, ten serial temperature readings were taken on each hoof. On d 60, lower temperatures were noted in horses consuming the E+ diet compared to E- horses (P = 0.04). On d 90, E+ horses had higher hoof temperatures than E- horses (P = 0.03), and the regression coefficient for weight was positive (P = 0.05) indicating heavier horses exhibited higher temperatures compared to lighter horses. Regardless of diet, horses with HYPP status of NH had higher temperature readings on d 60 and d 90 than NN horses (P < 0.04). Adding the fescue hay to the diet prior to the d 60 measurements, and thus increasing total ergovaline content, appeared to alter the hoof temperature response in E+ horses. Consequently, if there is a vasoactive effect of ergovaline, it may be a dose dependent response.

Key Words: thermography, fescue, hoof

Nonruminant Nutrition: Fats and Oils

775 Effect of rice oil supplementation in diets for weaning pigs. G. J. M. M. Lima*¹, L. Wortmann², and A. Mior², ¹Embrapa, Concordia, SC, Brazil, ²Helmut Tessmann Vegetable Oils, Camaquã, RS, Brazil.

Natural vitamin E (E) has been shown to be a superior source for young pigs to synthetic forms. This study was conducted to determine the effects of feeding high nutrient rice oil (RO) for weaned pigs. RO was extracted from bran to preserve E (166.79 mg total E/100 g and 37.47 mg α-tocopherol/100 g). Other natural constituents such as γ-oryzanol (1.1%) and n-3 fatty acids (16.3%) were present, too. Four hundred and thirty two weaned pigs, 21 days old and 6.49 ± 0.30 kg average weight (wt), were allotted to 2 treatments according to a randomized complete block design with 7 blocks, defined by wt and sex. Treatments were: T1- control diet, based on ensiled corn grain, soybean meal, porcine plasma, lactose sources, soybean oil, supplemented with minerals, vitamins and growth promoters, formulated to meet or exceed 1998 NRC levels; T2- same diets of T1, except for the inclusion of 2% RO in partial replacement of soybean oil. Pigs were raised on a three phase feeding program with free access to feed and water until the end of trial (42 days). Diarrhea frequencies were not different between treatments (X² test, P>0.05). Pigs fed T2 diets showed heavier final wt (P=0.02) compared to T1, even when data were adjusted to initial weight (P=0.05) by analysis of covariance. RO dietary supplementation

improved (P=0.02) average daily gain (ADG) and feed consumption (ADFC), but had no significant effect on feed:gain ratio (FCR, P=0.29). It is difficult to delineate the importance of each RO component (E, n-3 fatty acids, γ-oryzanol) for the obtained performance improvement, but these results confirm previous positive effects of supplementing natural E and n-3 fatty acids for young pigs.

Table 1. Effects of partial replacement of soybean oil by rice oil in diets for weaning pigs.

Variable	T1 - 2% SBO	T2 - 2% RO	SEM	CV%	P
Initial wt, kg	6.376	6.601	0.143	5.86	0.31
Final wt, kg	28.610	31.078	0.556	4.93	0.02
Adj. final wt, kg ¹	28.821	30.866	0.559	4.72	0.05
ADG, kg/d	0.442	0.487	0.010	5.60	0.02
ADFC, kg/d	0.893	0.956	0.015	4.19	0.02
Adj. ADFC, kg/d ¹	0.896	0.952	0.016	4.42	0.07
FCR	2.029	1.972	0.035	4.60	0.29

¹ Data adjusted to initial body wt. SEM=Standard error of the mean. CV=Coefficient of variation.

Key Words: swine, γ-oryzanol, n-3 fatty acids