

ABSTRACTS
American Dairy Science Association
American Society of Animal Science

Monday, July 7, 2008
SYMPOSIA AND ORAL SESSIONS

Late-Breaking Original Research: Late-Breaking Abstract Session

LB1 Dried distiller's grains did not influence fecal shedding of *Escherichia coli* O157:H7 in experimentally inoculated feedlot steers. N. S. Roberson*, M. E. Jacob, T. G. Nagaraja, and J. S. Drouillard, *Kansas State University, Manhattan*.

In previous experiments we observed increases in fecal shedding of *E. coli* O157 when distiller's grains (wet or dry) were added to finishing cattle diets. Additionally, compared to flaked grain diets, we noted that feeding dry processed grains resulted in lower *E. coli* O157 shedding rates. This led us to hypothesize that supplying starch to the hindgut may create an environment that is inhospitable for colonization by *E. coli* O157, which could be exploited as a preharvest intervention strategy to reduce pathogen shedding. We tested this hypothesis using Holstein steers (n=31) that were stratified by initial BW (213.5 ± 20 kg) and assigned randomly, within strata, to diets consisting (DM basis) of a steam-flaked corn base with 0 or 25% dry-rolled corn (DRC) and 0 or 25% dried distiller's grains with solubles (DDG) in a 2 × 2 factorial arrangement. Steers were transitioned to high-concentrate diets (6% roughage) over a period of 23 d and fed their final finishing diets for 29 d before being relocated to individual feeding pens within a biosecurity level 2 facility. After 2 d of acclimation to the facility, cattle were orally dosed with 3.2 × 10⁹ CFU of a 5-strain mixture of nalidixic acid resistant *E. coli* O157:H7. Fecal samples were collected 3 times per wk for 6 wk to determine the prevalence and concentration of NaIR *E. coli* O157:H7. After 42 d calves were euthanized, and contents of the rumen, cecum, colon, and rectum were collected, along with rectoanal mucosal swabs (RAMS). Concentrations of NaIR *E. coli* O157:H7 were determined by spread plating diluted samples (feces or gut contents) on selective sorbitol MacConkey agar containing nalidixic acid. For samples below the detection limit (<10²/g), an enrichment procedure was used to determine whether or not samples were positive for NaIR *E. coli* O157:H7. Adding 25% DDG or DRC to flaked corn diets did not alter fecal concentrations (P > 0.1) or prevalence of *E. coli* O157:H7 (P > 0.19) in gut contents of experimentally challenged feedlot steers, and thus failed to corroborate findings of previous experiments.

Key Words: *E. coli* O157:H7, Distiller's Grains, Dry-Rolled Corn

LB2 Blood collection in ambulatory, unrestrained cows using the IceSampler™ system. M. McGee*, K. Moulton, K. Graves, J. Edwards, and S. Willard, *Mississippi State University, MS State*.

Collecting blood samples from livestock poses unique challenges when trying to measure stress hormones. Remote blood collection would permit lessened human interaction and sampling within diverse management environments. The IceSampler™ blood collection system (ICE) is designed to promote a hands off approach to blood collection. Our objective was to test the effectiveness of ICE for the collection of blood samples from unrestrained cattle. Successive (n = 9), 16-sample ICE sessions were initiated using 2 Holstein cows with the ICE system to examine uniformity of blood tube volume and timing precision of sample collection. Cows were catheterized and outfitted with the ICE system. The ICE system was then programmed to sample at 15 min to 1 hr intervals. A stress response was artificially induced post-ICE initiation (ACTH challenge; 0.125 IU/kg BW), and cows allowed to roam freely until sampling was completed. When the sequence was completed, the ICE was replenished with new blood tubes and re-launched. The Holstein cows (n=2) fitted with samplers were used for all sampling sessions. Analysis of blood tube volume, sampling time precision, sampler mechanics (e.g. failed tubes) and cortisol (CORT) were used for statistical analysis. Intra-sampling coefficient of variation (CV%) for precision of sampling time was 0.13%; with only 1.8% of recorded sampling events indicating a deviation from expected sampling time (±5 sec in both cases). Intra-sampling CV% for tube blood volume within sampling run was 25.17%, however across sampling runs the inter-sampling CV% for tube blood volume collected was 83.47%; indicating a high degree of variation in sample volume collection (possibly due to catheter rather than ICE performance). Of 9 sampling sessions, 7 were successful (77.8%). Of the n=112 expected blood samples from the seven completed sessions, n=102 blood samples were collected (91.1%). Elevated CORT post-ACTH was evident in ICE samples, and were greater (P < 0.05) than baseline CORT at 3.5 h post-ACTH (0.22 ± 0.03 ug/dl; Range: 0.001 to 0.69 ug/dl). Automated blood sampling in ambulatory, unrestrained cows with ICE was effective, however efforts to improve uniformity of blood volume collection and greater successful sampler completion are needed.

Key Words: Cattle, Blood Sampling, Cortisol

LB3 Comparing the environmental impact of dairy production in 1944 to 2007. J. L. Capper^{*1}, R. A. Cady², and D. E. Bauman¹, ¹*Cornell University, Ithaca, NY*, ²*Monsanto Company Animal Agricultural Group, St Louis, MO*.

All food production practices have an impact upon the environment, yet the public perception is that historical agriculture was inherently more environmentally sustainable than modern production practices. We evaluated the environmental impact of the 1944 US dairy industry, which produced 53 billion kg milk from 25.6 million cows, compared to that of 2007 (84 billion kg of milk produced by 9.2 million cows). Our stochastic model (Capper et al., PNAS 105: in press) integrated resource inputs and waste outputs from dairy animal nutrition and metabolism, herd population dynamics and crop production to quantify environmental parameters using a life cycle assessment approach. Milk yields, BW, population characteristics, diet ingredients and production practices representative of the pasture-based 1944 system and conventional 2007 system were employed. This novel approach, founded upon NRC nutrient recommendations, allowed system environmental impact to be directly related to productive efficiency of the dairy population. Carbon footprint per cow was 26 kg CO₂/d in 2007, compared to 14 kg CO₂/d in 1944; however, emphasizing the critical need to evaluate environmental impact on a food production basis, this was equivalent to 3.6 kg CO₂/kg milk (1944) vs. 1.3 kg CO₂/kg milk (2007). Indexing 2007 to 1.0, the production of one billion kg of milk in the 1944 dairy production system had increased feedstuff, land and water use by factors of 4.5, 16.8 and 2.8, respectively. Furthermore, 2.2-fold increases in N excretion and 3.4-fold increases in P excretion were observed for the 1944 system, which was also associated with considerably higher methane (2.2x) and nitrous oxide (3.3x) emissions per unit of milk produced. Our analysis clearly demonstrates that the considerable improvements in productive efficiency conferred by advances in genetics, nutrition and management have considerably reduced the carbon footprint and mitigated the environmental impact of modern dairy production, thereby improving agricultural sustainability.

Key Words: Environmental Sustainability, Carbon Footprint, Dairy Production

LB4 Moderate excesses of dietary energy markedly increase visceral adipose tissue mass in non-lactating dairy cows. A. Nikkhah^{*}, J. J. Loor, R. L. Wallace, D. Graugnard, J. Vasquez, B. Richards, and J. K. Drackley, *University of Illinois, Urbana*.

Our objective was to determine dietary energy effects on internal fat deposition, visceral tissue mass, dry matter intake (DMI), and blood metabolites in non-lactating Holstein cows. Eighteen non-pregnant dry cows (body condition score, BCS = 3.04 ± 0.25) were divided into 3 BCS groups and within each group were randomly assigned to 2 treatments: either a moderate (M, net energy for lactation, NEL=1.61 Mcal/kg) or a low (L, NEL=1.37 Mcal/kg) energy total mixed ration. The L diet contained 84.6% forage including 41.9% wheat straw, and the M diet contained 74.5% forage with no straw and 50.3% corn silage (DM basis). Cows were fed ad libitum at 0800 h for 8 wk. Feed intake was recorded daily, blood was sampled at wk 2, 4 and 7, and body condition was scored at wk 1, 4 and 7. Cows were slaughtered following the 8-wk period. Visceral organs, mammary gland, and internal adipose tissues were weighed and sampled. A mixed model with fixed effects of diet, block, week (repeated measures) and the interactions, plus the random effect of cow within block by treatment was used to analyze

the data. The M group had greater (P<0.001) DMI (15.7 vs. 10.9 ± 0.6 kg/d) and NEL intake (25.3 vs. 14.9 Mcal/d), and higher (P<0.05) blood β-hydroxybutyric acid (0.46 vs. 0.35 ± 0.03 mmol/L) and cholesterol (119.6 vs. 97.8 ± 4.5) than the L group. Omental (28.7 vs. 17.5 ± 1.3 kg, P<0.01), mesenteric (22.0 vs. 12.1 ± 2.4 kg, P<0.01), and perirenal (9.9 vs. 6.0 ± 1.2 kg, P<0.05) adipose masses were greater in M than in L group. Blood glucose, urea, albumin, protein, and minerals, body weight and BCS, and weights of liver, gastrointestinal tract, heart, kidney and mammary tissue did not differ between treatments. Internal adipose masses and BCS were correlated (r>0.75, P<0.05) within both groups. Therefore, a moderate degree of overfeeding during an 8-wk non-lactating period resulted in >70% increase in internal fat depots. The similar BCS of M and L cows plus the positive relationship between BCS and internal fat mass in both groups suggest that BCS as a visual measure of external fat accretion provides little information on internal fat stores. The internal fats may be of substantial significance to hepatic lipidosis and periparturient health.

Key Words: Dietary Energy, Dry Cow, Visceral Fat

LB5 Impacts of L-arginine on ovarian function and reproductive performance in ewes. J. S. Luther^{*1}, E. J. Windorski¹, C. S. Schauer², J. D. Kirsch¹, K. A. Vonnahme¹, L. P. Reynolds¹, J. S. Caton¹, and G. Wu³, ¹*North Dakota State University, Fargo*, ²*Hettinger Research Extension Center, North Dakota State University, Hettinger*, ³*Texas A&M University, College Station*.

The objective was to determine if arginine supplementation enhances ovarian function and prevents early reproductive losses in sheep. In April of 2008, Rambouillet ewes of a similar BW (68 ± 1.8 kg) and age (4.7 ± 0.32 yr) received L-arginine HCl (equivalent to 27 mg of L-arginine/kg of BW, ARG, n = 20) or saline (CON, n = 20) i.v. once daily from d 0 (estrus) to d 15 postestrus. Daily blood samples were obtained from 5 ewes / group immediately after treatment (0 h) to assess progesterone (P4) concentrations and at -0.5, 0, 0.5, 1, 2, 4, 8, and 24 h on d 12 to determine concentrations of arginine. Ovarian hemodynamics (d 12) and reproductive losses (d 25 and 45) were determined with color-Doppler and B-mode ultrasonography, respectively. On d 12, serum concentrations of arginine (nmol/ml) were elevated in ARG vs. CON ewes at 0 (5043 ± 1015.2 vs. 355 ± 18.8, P < 0.001), 0.5 (896 ± 76.8 vs. 290 ± 16.7, P < 0.001), 1 (474.4 ± 30.4 vs. 231 ± 12.5, P < 0.001), 2 (471 ± 33.7 vs. 272 ± 30.3, P < 0.005), and 4 h (358 ± 26.6 vs. 279 ± 23.2, P < 0.05), but were similar (P > 0.05) at -0.5, 8 and 24 h. Resistance index in the ovarian artery on d 12 was reduced in ARG vs. CON ewes (0.42 ± 0.009 vs. 0.50 ± 0.035, P < 0.05). Despite similarities in the number of corpora lutea (CL) per ewe (ARG, 1.8 ± 0.20 and CON, 1.8 ± 0.20; P > 0.05), ARG ewes had greater P4 concentrations throughout treatment compared to CON ewes (53.6 ± 1.66 vs. 41.3 ± 2.65 AUC, respectively, P < 0.004). Although pregnancy rate was not influenced (ARG, 55% and CON, 60%; P > 0.05), ARG ewes had more embryos per ewe (1.6 ± 0.15 vs. 1.3 ± 0.13, P < 0.05) and less CL not represented by embryos (0.18 ± 0.122 vs. 0.58 ± 0.155, P < 0.05) compared to CON ewes at d 25 of pregnancy. As pregnancy progressed to d 45, the difference in the number of CL not represented by embryos was even greater (P < 0.03) in CON (0.75 ± 0.227) vs. ARG ewes (0.18 ± 0.122). In summary, early reproductive losses can be prevented, at least in part, by treatment with arginine. Decreased ovarian vascular resistance and increased concentrations of P4 may result in a more ideal environment for early embryonic survival.

Key Words: Arginine, Sheep, Embryo Survival

LB6 Feed withdrawal alters intestinal electrophysiology and nutrient flux in the equine gastrointestinal tract. B. E. Aldridge, T. Lescun, and J. S. Radcliffe*, *Purdue University, West Lafayette, IN.*

Horses are routinely subjected to short term feed withdrawal (FW) pre- or post-surgery to prevent anesthetic complications. However, removing nutrients from the gastrointestinal lumen may negatively impact gut health, leading to increased disease susceptibility. Therefore, 13 horses were used to determine the effects of a 24 h FW on gut barrier function, active nutrient transport, SGLT1 expression and gastrointestinal morphology. Following 0 (n = 6) or 24 (n = 7) h of FW, horses were euthanized and segments of proximal jejunum (13.7 m proximal to the ileo-cecal junction), distal jejunum (9.1 m proximal to the ileo-cecal junction), ileum (5 cm proximal to the ileo-cecal junction) and right ventral colon (30 cm distal to the cecal-colonic junction) were removed for histology (proximal jejunum and ileum), mRNA expression of the Na-dependent glucose transporter, SGLT1, and for use in modified Ussing chambers. Ileal villus heights ($P < 0.002$) and crypt depths ($P < 0.02$) were larger than in the proximal jejunum, but no differences were observed between fed and non-fed horses. Similarly, quantification of SGLT1 expression using qRT-PCR resulted in no differences ($P > 0.10$) between fed and non-fed horses. This is not surprising, given the short duration of feed removal and the fact the rapid SGLT1 regulation occurs through protein mobilization as opposed to transcriptional regulation. The change in short circuit current (I_{sc} , $\mu A/cm^2$) was determined for intestinal tissue mounted in modified Ussing chambers following the addition of glucose, phosphorus, glutamine and gly-sar as an indicator of active nutrient absorption. The most significant finding was a 116% increase in active glutamine absorption in the proximal jejunum of non-fed horses compared to fed horses ($P < 0.01$). A 48.2 and 70.7% increase in active glutamine absorption was also observed for the distal jejunum and ileum, respectively, but only approached a trend ($P < 0.15$). Glutamine is used as an energy substrate by enterocytes, and data from this experiment indicates that a 24 h feed withdrawal results in an upregulation of active glutamine absorption, which is most prominent in the proximal small intestine.

Key Words: Equine, Intestine, Feed Restriction

LB7 Is exsanguination blood lactate concentration a good indicator of pre-slaughter pig handling? L. N. Edwards*¹, T. Grandin¹, T. E. Engle¹, M. J. Ritter², A. Sosnicki³, and D. B. Anderson¹, ¹*Colorado State University, Fort Collins*, ²*Elanco Animal Health, Greenfield, IN*, ³*PIC, Hendersonville, TN.*

The objective of this research was to characterize the relationship of pre-stun animal handling to exsanguination blood lactate concentration (LAC) in a commercial pork processing plant. The two studies, Exp. 1 (n=76) and Exp. 2 (n=140), differed in facility design. Animal behavior and handling were scored in the crowd pen and single-file chute up to the V-restrainer. Measurements included jamming, rearing, turning back, backing up, rooting behavior, vocalization, electric prod use and duration of time spent in the handling area. Scores were tabulated as the number of times each animal experienced a handling event. Lactate concentration was measured using a hand-held lactate meter on exsanguination blood following electric stunning. Data were analyzed using Pearson correlations to determine the relationship between behavior and LAC. In Exp.1, results indicated positive correlations between LAC and jamming ($r = 0.23$, $P < 0.05$), backing up ($r = 0.27$, $P < 0.05$) and rearing ($r = 0.25$, $P < 0.05$). In Exp. 2, data were collected in two

sections: the crowd pen and the single-file chute. In the crowd pen, LAC was positively correlated to electric prod use ($r = 0.18$, $P < 0.05$) and vocalization in response to prod use ($r = 0.28$, $P < 0.05$). In the single-file chute, LAC was positively related to jamming ($r = 0.24$, $P < 0.05$) and vocalization ($r = 0.16$, $P < 0.05$). Single degree of freedom contrasts were used to compare LAC based on the presence or absence of handling events. In Exp. 1, animals that experienced one or more of the following events: electric prod use, jamming, rearing and/or backing up, had a greater ($P < 0.05$) LAC than animals that did not experience these events. The same relationships were observed between LAC and the listed handling events in Exp. 2 in the single-file chute ($P < 0.05$). In the crowd pen, animals prodded or vocalizing with prodding had greater LAC ($P = 0.03$ and $P = 0.07$, respectively) than animals that did not. This is the first time that specific animal handling events have been related to LAC in a commercial setting. Data support the on-line measurement of LAC to monitor the quality of animal handling during the period immediately prior to stunning.

Key Words: Lactate, Pig Handling, Slaughter

LB8 The effect of the autosort system on swine well-being. A. E. DeDecker*, J. M. Suchomel, and J. L. Salak-Johnson, *University of Illinois, Urbana.*

Limited data exist on the impact that autosort, a new, behavior-based production system, has on pig well-being. The objectives of this study were to evaluate a) how different autosort floor layouts affect wean-to-finish pig behavior and physiology (Exp1) and more specifically b) how different food court layouts affect pig well-being (Exp2). At weaning, an average of 622 pigs per treatment, were randomly assigned to a water court (WC;20% floor space), food court (FC;40% floor space), or fast lane (FL;12.5% floor space per zone) autosort layout, or conventional large pen (CV;control). Physiological measures were evaluated via blood samples pre- and post-transportation. Live behavioral observations were registered during a 3-wk training period and at loading. Scan sampling was used to determine the total number of pigs performing specific behaviors at a time. Data were analyzed using Proc GLM and MIXED with repeated measures and Chi-Square (SAS). In Exp1, cortisol levels were higher among CV pigs than among autosort pigs pre-transportation ($P < 0.001$). IGF-1 levels were higher in the FC than all other treatments pre-transportation, while there was a difference in pre- to post- transportation in the FC ($P < 0.04$). White blood cell counts and neutrophil-to-lymphocyte ratio were greater ($P < 0.06$) in CV pigs pre- and post- transportation than in certain autosort layouts. Number of pigs engaged in and time spent eating or drinking as well as training, and loading behaviors were significantly affected by treatment ($P < 0.05$). In Exp2, preliminary data indicate that pigs in a FC layout are less difficult and require less time to load than pigs from large and small CV pens ($P < 0.05$). Number of rears and prod use were greater in pigs from small CV pens than all other treatments ($P < 0.05$). During training, behaviors were different among treatments ($P < 0.05$). Floor layout influenced white blood cell counts and percent lymphocyte pre- and post-transportation ($P < 0.05$). These data indicate that autosort layouts can affect behaviors and physiological measures throughout the wean-to-finish phase, thus impacting swine well-being. Therefore, by using these measures we can determine which autosort layout is optimal.

Key Words: Autosort, Cortisol, Well-Being