

Physiology and Endocrinology: Health and Immunology

572 Energy-related metabolites and hormones as surrogate markers for chronic wasting disease in cervids. J. R. Olsen^{*1}, R. A. Bessen¹, T. Rocke², S. D. Wright², J. D. Bailey¹, and J. G. Berardinelli¹, ¹Montana State University, Bozeman, ²USGS National Wildlife Health Center, Madison, WI.

Chronic wasting disease (CWD) is a fatal neurodegenerative disease of cervids that can affect neuroendocrine and endocrine function. Currently, detection of CWD requires post-mortem neural and lymph node tissue evaluation. The objective was to evaluate if oral administration of prion-infected brain tissues alters energy-related metabolites and hormones in elk (Elk; *Cervus canadensis*), mule deer (MD; *Odocoileus hemionus*), and white-tailed deer (WTD; *Odocoileus virginianus*) as a reliable and rapid pre-clinical diagnostic panel for CWD. The null hypotheses were that serum concentrations of glucose, NEFA, ghrelin, glucagon, leptin, cortisol, insulin, thyroxine (T4), and tri-iodothyronine (T3) do not change over a 24-mo interval after oral inoculation with prion-infected cervid brain tissues. Blood samples were collected at time 0, and for animals sacrificed for blood and tissue collection, at 6, 12, 18, and 24 mo after inoculation. Glucose and NEFA concentrations were determined by colorimetric assays. Ghrelin, glucagon, leptin, cortisol, T3, and T4 concentrations were determined using RIA. Insulin concentrations were determined by ELISA. After inoculation, all animals were immunohistochemically positive for PrP^{CWD} in neural and lymph node tissues. Glucose and NEFA concentrations decreased ($P < 0.05$) after inoculation for all species. Ghrelin and leptin concentrations tended to decrease ($P < 0.10$) and T4 concentrations increased ($P < 0.05$) after inoculation in Elk but not in MD or WTD. Glucagon concentrations tended to increase ($P < 0.10$) in WTD but not in Elk or MD. In conclusion, progression of CWD seems to have cervid-specific effects on energy metabolites and conspecific effects on certain hormones. Further research is necessary in order to develop a pre-clinical panel of metabolite and hormone markers leading to a reliable, rapid, and effective method for identifying CWD in cervids.

Key Words: Chronic Wasting Disease, Hormones, Cervids

573 Intrauterine detection and *in vitro* characterization of *Escherichia coli*-Xen14: A model for monitoring infections of the bovine reproductive tract. J. Curbelo^{*}, K. Moulton, S. Laird, D. Moore, S. Bowers, and S. Willard, Mississippi State University, Mississippi State.

Intrauterine infections in the bovine can have detrimental effects on reproductive performance, and *Escherichia coli* (*E. coli*) is a primary causative pathogen. Our objectives were to characterize the photonic properties of *E. coli*-Xen14 (a stably transformed *E. coli* containing the *lux* operon), and conduct photonic imaging of *E. coli*-Xen14 from within the excised bovine uterus. *E. coli*-Xen14 (Xenogen) was grown for 24 h in LB broth with or without Kanamycin (KAN; 30 μ g/mL) and placed in an incubated shaker at 37°C. Inoculums were placed in 96-well plates for imaging, and photonic emissions collected for 2 s. Following imaging, inoculums were sub-cultured over 7 d, and plated daily (on LB agar plates with or without KAN) to determine the CFU/ml and ratio of photonic emitters vs. non-emitters. Excised bovine reproductive tracts (n = 4 tracts; 3 replicates per tract) were acquired and *E. coli*-Xen14 placed in a 1 mL tube for photonic imaging (5 s) pre- and post-insertion

into the uterine horns. The CFU/ml did not differ ($P > 0.05$) over time with or without KAN presence; remaining stable with 99.93 and 99.98% photonic emitters, respectively. However, RLU/s were lower ($P < 0.0001$) in the presence of KAN than Controls (629.8 \pm 117.7 vs. 3,012.0 \pm 423.5 RLU/s, respectively). Photonic emissions from *E. coli*-Xen14 imaged within the uterine horns resulted in a 4,847.1 \pm 215.3 RLU/s loss ($P < 0.05$) through the uterine horns, or an efficiency of photonic detection of 3.98 \pm 0.007% of the original (pre-) emission intensity. The concentration of photonic *E. coli*-Xen14 detected through the uterine horns was 662.5 \times 10⁶ \pm 149.0 \times 10⁶ CFU/ml, with a uterine horn wall thickness of 6.2 \pm 4.2 mm. In summary, *E. coli*-Xen14 remained stable with respect to the percentage of photonic emitters with or without KAN (used to selectively culture *E. coli*-Xen14), however KAN presence suppressed photonic activity. Imaging of *E. coli*-Xen14 was feasible through the bovine uterine horns *ex vivo*, suggesting that further development of this model may facilitate the monitoring of pathogen presence within the reproductive tract of the bovine *in vivo*.

Key Words: Biophotonics, Uterus, *E. coli*

574 WITHDRAWN.

575 Early weaning alters the acute phase immune response to an endotoxin challenge in beef cattle. J. A. Carroll^{*1}, J. D. Arthington², and C. C. Chase, Jr.³, ¹Livestock Issues Research Unit, USDA-ARS, Lubbock, TX, ²University of Florida-IFAS, Range Cattle Research and Education Center, Ona, FL, ³SubTropical Agricultural Research Station, USDA-ARS, Brooksville, FL.

Previous research indicates that early weaning prior to shipment can reduce transportation-induced increases in acute phase proteins (APP), and can increase subsequent performance in the feedlot. These data suggest that the combination of weaning and transport stress may compromise the immune system of calves, thus hindering subsequent performance and health. Therefore, our objective was to determine if the innate immune response of early weaned calves (EW; 80 d of age) differed from normal weaned calves (NW; 250 d of age) in response to an endotoxin challenge. Eighteen EW (n = 8) and NW (n = 10) Brahman \times Angus calves (233 \pm 5 kg BW) were used. Prior to the study, calves were maintained on pasture with supplement. All calves were acclimated to their study pens for 1 wk prior to a lipopolysaccharide (LPS) challenge. One d prior to LPS challenge, calves were fitted with an indwelling jugular catheter. Blood samples were collected at 30-min intervals from -2 to 8 h. At 0 h, all calves received an i.v. infusion of LPS (1.0 μ g/kg BW). Serum samples were stored at -80°C until analyzed for cortisol (CS), tumor necrosis factor-alpha (TNF), interleukin-1 beta (IL-1), IL-6, interferon-gamma (IFN), ceruloplasmin (Cp) and haptoglobin (Hp). While LPS increased serum CS ($P \leq 0.001$) no weaning effect ($P \geq 0.15$) was observed. A weaning group \times time interaction ($P \leq 0.04$) was observed for TNF, IL-1, IL-6 and Cp such that concentrations of these indices were greater in the NW compared to EW calves. For Hp, a weaning effect ($P \leq 0.03$) was observed with NW having greater average Hp concentrations compared to EW calves. Interestingly, the weaning group \times time interaction ($P \leq 0.001$) for IFN revealed greater IFN in EW opposed to NW calves. Based upon these

data, the innate immune system of **EW** calves appears to be less naïve than that of **NW** calves. Additionally, the differential IFN responses indicate that the immune system of **EW** calves may be more effective at recognizing and eliminating endotoxin. These data suggest that an altered innate immune system may be responsible for the improved feedlot performance previously reported in **EW** calves.

Key Words: Cattle, Immunity, Early Weaning

576 Relationship of temperament and circulating concentrations of cortisol, total protein, and immunoglobulin G with growth in Angus crossbred calves. K. R. Parker^{*1}, S. T. Willard², A. N. Musselwhite², R. D. Randel³, T. H. Welsh⁴, and R. C. Vann¹, ¹MAFES/Brown Loam Experiment Station, Raymond, MS, ²Mississippi State University, Starkville, ³Texas AgriLife Research, Overton, TX, ⁴Texas A & M University, College Station.

The purpose of this study was to determine the relationships among cortisol, total protein (PRT), and immunoglobulin G (IgG) concentrations, temperament and growth in beef calves (n:bulls=114, heifers=82). Plasma was collected for determination of concentrations of IgG and PRT at 24 h, 48 h, 14 d, and 84 d after birth. Calves were classified by IgG as follows: calves with IgG concentrations 1 SD below the mean were considered low (L), those 1 SD above the mean were considered high (H), all others were considered moderate (M). Temperament testing consisted of pen score (PS) and exit velocity (EV; m/s) and was conducted at 28 d pre-weaning, weaning, 28 and 56 d post-weaning, and yearling. Calves were assigned temperament groups (TPG=EV+PS/2) as follows: calves 1 SD below the mean were considered calm (C), calves 1 SD above the mean were considered temperamental (T), all others were considered intermediate (I). Serum concentrations of cortisol were determined at 28 d pre-weaning, weaning, 28 and 56 d post-weaning. Growth traits included: BW taken at all time periods, and ultrasound measurements; ribeye area (REA), intramuscular fat (IMF), rib fat thickness (FT), and rumpfat (RF), which were taken at weaning, 56 d post-weaning, and yearling. There was a day x TPG interaction for REA and REA/cwt with C and I calves increasing ($P < 0.05$ and $P < 0.08$, respectively) from 56 d post-weaning to yearling, whereas T calves decreased. IMF, FT and RF differed ($P < 0.05$) from 56 d post-weaning to yearling, but did not differ ($P > 0.10$) by TPG. PRT was higher ($P < 0.001$) for H than L IgG calves, and was positively correlated with concentrations of IgG ($r = 0.51$; $P < 0.001$); both PRT and IgG decreased ($P < 0.001$) over time from day 14 to 84. PRT did not differ ($P > 0.10$) among TPG classifications, however cortisol was greater ($P < 0.001$) for T than C calves. In summary, temperament influenced some growth traits (REA and REA/cwt), and secretions of cortisol. Plasma PRT was not influenced by temperament, but was positively correlated to concentrations of IgG. [USDA-NRI: 2005-35204-15737]

Key Words: Temperament, Total Protein, Beef Calves

577 Influence of bovine temperament, transportation, and lipopolysaccharide challenge on ultrasound body composition traits. R. C. Vann^{*1}, N. C. Burdick², J. A. Carroll³, R. D. Randel⁴, S. T. Willard⁵, L. C. Caldwell², J. W. Dailey³, L. E. Hulbert³, A. N. Loyd², and T. H. Welsh, Jr.², ¹MAFES-Mississippi State University, Raymond, ²AgriLife Research, College Station, TX, ³USDA-ARS Livestock Issues Research

Unit, Lubbock, TX, ⁴AgriLife Research, Overton, TX, ⁵Mississippi State University, Starkville.

This study was designed to determine the influence of bovine temperament on ultrasound body composition traits in response to transportation and endotoxin challenge. Brahman bulls (10 mo of age) were selected based on temperament score which was an average of exit velocity (EV; objective measure) and pen score (PS; subjective behavior score). The bulls with the lowest (C; n = 8; 0.87 m/s EV and 1 PS), intermediate (I; n = 8; 1.59 m/s EV and 2.25 PS), and highest (T; n = 8; 3.70 m/s EV and 4.88 PS) scores were used for this study. Prior to transportation (departure), after transportation (770 km) and post-lipopolysaccharide (LPS) challenge BW and ultrasound body composition measurements for longissimus muscle area (LMA), percent intramuscular fat (%IMF), rib fat (FT) and rump fat (RFT) were collected. Data were analyzed using PROC Mixed of SAS for repeated measures where appropriate. Body weights decreased (average 18.6 ± 5.5 kg) for all temperament groups from date of departure through post-LPS challenge ($P < 0.001$). A temperament score x day interaction ($P < 0.05$) for LMA was evident with the T bulls (0.41 ± 0.22) having a greater change in LMA from departure to post-LPS challenge compared to C (0.24 ± 0.24) and I (0.25 ± 0.22) bulls. There was a numerical trend for bulls classified as T (-0.15 ± 0.11) to have the smallest decrease in %IMF compared to the C (-0.41 ± 0.11) or I (-0.43 ± 0.11) bulls due to transportation or post-LPS challenge. FT was reduced (average 0.015 ± 0.009 cm) due to transportation for bulls in all temperament classifications ($P < 0.03$). Bulls classified as T (0.005 ± 0.003) had the smallest reduction ($P < 0.07$) in FT compared to the C (-0.001 ± 0.003) or I (-0.004 ± 0.003) bulls post-LPS challenge. While many of the observed changes in ultrasound body composition traits due to transportation and post-LPS challenge in the present study were minimal, we did observe some trends indicating a bovine temperament effect. Further research is needed with larger numbers of animals to fully elucidate these potential effects.

Key Words: Temperament, Ultrasound Body Composition, Transportation

578 Influence of temperament on behavioral, physiological and endocrine responses of cattle to a provocative challenge with lipopolysaccharide (LPS). L. H. Hulbert^{*1}, J. A. Carroll¹, J. W. Dailey¹, R. D. Randel², T. H. Welsh, Jr.³, L. C. Caldwell^{2,3}, N. C. Burdick³, R. C. Vann⁴, and S. T. Willard⁵, ¹Livestock Issues Research Unit, USDA-ARS, Lubbock, Texas, ²Texas AgriLife Research and Extension Center, Texas A&M System, Overton, ³Texas AgriLife Research, Texas A&M System, College Station, ⁴MAFES, Mississippi State University, Raymond, ⁵MAFES, Mississippi State University, Mississippi State.

Previous studies have indicated that an animal's temperament can influence its health and productivity. Therefore, our objective was to evaluate the effect of temperament on rectal temperature (RT), sickness score (SS) and adrenal function of yearling bulls in response to a LPS challenge. Brahman bulls (10 mo of age) were selected based on temperament score; an average of exit velocity (EV) and pen score (PS) determined at 177.08 ± 3.23 d of age. Bulls were ranked into 3 groups: calm, lowest score (C; n=8; 0.87 m/s EV and 1 PS), intermediate (I; n=8; 1.59 m/s EV and 2.25 PS), and temperamental, highest score (T; n=8; 3.70 m/s EV and 4.88 PS). Bulls were fitted with indwelling jugular catheters and RT devices that recorded RT at 1-min intervals. The next day blood samples were collected at 30-min intervals from -2 to 8 h relative to an i.v. infusion of LPS (0.5 µg/Kg BW) at 0 h. Serum was stored at -80°C

until analyzed for cortisol and epinephrine. RT data were summed into 10-min intervals for statistical analysis. SS were defined as follows: (1) on side with labored breathing; (2) clinical signs, increase respiration; (3) calm, but head distended; (4) appeared normal; and (5) active/agitated. SS were obtained from 30 min post-LPS until all animals scored at least 4. Cortisol concentrations increased during the first 2 h post-LPS, and remained elevated for 6 h post-LPS ($P \leq 0.01$). LPS-induced cortisol concentrations were not affected by temperament ($P = 0.55$). Concentrations of epinephrine peaked 1 h post-LPS with C bulls having

a greater peak epinephrine (849.2 ± 107.1 pg/mL) than I (352.5 ± 87.1 pg/mL) and T bulls (417.2 ± 90.7 pg/mL; $P \leq 0.01$). SS revealed that T bulls showed less signs of sickness 30 min to 3 h post-LPS than I and C bulls ($P \leq 0.01$). I bulls had the greatest increase ($P \leq 0.01$) in RT ($1.74 \pm 0.23^\circ\text{C}$ at 240 min) compared to C ($1.45 \pm 0.36^\circ\text{C}$ at 260 min) and T bulls ($0.86 \pm 0.13^\circ\text{C}$; at 230 min). Based on our data, temperamental bulls appear to be more resilient to immunological challenges and calm bulls appear to be more susceptible.

Key Words: Bovine Temperament, Behavior, Rectal Temperature