

Physiology and Endocrinology: Effects of Environment and Handling on Performance

372 Effects of female holding temperature and post-ovulatory oocyte ageing on egg survival in Pilot Peak Lahontan cutthroat trout, *Oncorhynchus clarki henshawi*. J. P. Bigelow*^{1,3}, M. M. Peacock², W. M. Rauw², and L. Gomez-Raya², ¹U.S. Fish and Wildlife Service, Gardnerville, NV, ²University of Nevada, Reno.

Twenty, 3-year-old females were held at 12.4 °C, and 20 females at 7.2°C from December 18 through the time of ovulation and hand spawning at the hatchery. Females were partially spawned one, four, and seven d post ovulation. Eggs were fertilized with milt from 3-year-old males held in 12.4°C water (one male per female) and then incubated at 12.4°C. All egg batches were enumerated by hand at the eyed-stage of development when dead eggs were removed. Normal appearing fry reaching the yolk sac resorption stage of development were counted 41 d post fertilization. Percent survival was calculated against the total number of eggs for each batch. Mean egg survival was 168% higher for females held at 7.2°C rather than 12.4°C when eggs were collected within one day of ovulation. The effect of water temperature on egg survival was highly significant ($P < 0.001$) indicating that reproduction might be reduced in rivers and lakes affected by global warming. Two females in the 12.4°C group exhibited egg survivals higher than the mean survival in the 7.2°C group, suggesting a possible role for individual genetic variability in temperature tolerance. There was no significant effect of oocyte ageing up to one week post ovulation at either temperature. Relative fecundity was lower in the 12.4°C group, and was positively correlated to egg survival in that treatment, suggesting impeded ovulation at the higher temperature. Female length and weight were negatively correlated to egg survival at 12.4°C, indicating reduced heat tolerance for larger fish. These results have implications for management of the captive broodstock, and for reproductive temperature requirements of broodstock progeny spawning in the wild, especially in light of expected global temperature increases.

Key Words: Lahontan Trout, Reproduction, Temperature Tolerance

373 Differential effects of heat stress and reduced nutrient intake on production and metabolism in young growing beef cattle. M. D. O'Brien*, J. B. Wheelock, S. R. Sanders, G. C. Duff, R. P. Rhoads, and L. H. Baumgard, *University of Arizona, Tucson.*

To differentiate between heat stress (HS) and decreased DMI on physiological and metabolic indices in growing beef cattle, we conducted an experiment where a thermal-neutral control group ($n=6$) was pair-fed (PF) to match nutrient intake with heat-stressed Holstein bull calves ($n=6$). Bulls (4-5 mo, 110-160 kg) housed in climate-controlled chambers were fed an 86% concentrate, 14% protein diet and subjected to two experimental periods: 1) thermal-neutral (TN; 18-20°C) and ad libitum intake for 9 d and 2) HS (cyclical daily temps ranging from 29.4 to 40.0°C) and ad libitum intake or PF (TN conditions) for 9 d. During each period, blood was collected daily and all bulls received an iv insulin challenge on d 7 and a glucose tolerance test (GTT) on d 8. Rectal temperatures and respiration rates increased ($P < 0.01$) during HS (39.02 to 40.57°C and 42 to 126 breaths/min). HS reduced (12%) DMI and by design, PF bulls had similar nutrient intake reductions. During period 1, body weight gain averaged 1.25 kg/d and both HS and PF reduced ($P < 0.01$) ADG similarly (-0.09 kg/d). Compared to PF, HS decreased ($P < 0.05$) basal circulating glucose levels (5%) and tended ($P < 0.07$) to increase plasma insulin levels (0.60 vs 0.46 ng/mL), but neither

HS nor PF altered plasma NEFA concentrations (95 μ Eq/L). Although there were no treatment differences, both HS and PF increased ($P < 0.05$) PUN levels (75%) compared to period 1. In contrast to TN ad libitum conditions, both HS and PF had increased (16%) glucose disposal, but compared to PF, HS had a larger (67%; $P < 0.05$) insulin response to the GTT. Neither treatment altered the glucose response to an insulin challenge (area under the curve or fractional rate of glucose clearance). Independent of reduced nutrient intake, HS alters post-absorptive carbohydrate (basal and stimulated) metabolism, characterized primarily by increased insulin levels and insulin response to a GTT. However, HS-induced reduction in feed intake appears to fully explain reduced body weight gain in young Holstein bull calves.

Key Words: Heat Stress, Beef, Insulin

374 The influence of bovine temperament on rectal temperature and stress hormones in response to transportation. N. C. Burdick*¹, J. A. Carroll², R. D. Randel³, R. C. Vann⁴, S. T. Willard⁵, L. C. Caldwell¹, J. W. Dailey², L. E. Hulbert², and T. H. Welsh, Jr.¹, ¹AgriLife Research, Texas A&M System, College Station, TX, ²USDA-ARS Livestock Issues Research Unit, Lubbock, TX, ³AgriLife Research, Texas A&M System, Overton, TX, ⁴Mississippi State University, Raymond, ⁵Mississippi State University, Mississippi State.

This study was designed to determine the influence of bovine temperament on rectal temperature (RT), cortisol (CS) and epinephrine (EPI) secretion in response to transportation. Brahman bulls (10 months of age) were selected from the spring 2007 calf crop 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; $n=5$; 0.75 m/s EV and 1 PS), intermediate (I; $n=8$; 1.59 m/s EV and 2.25 PS), and highest (T; $n=4$; 3.59 m/s EV and 5 PS) scores were used for this study. Prior to transportation (departure) blood was collected and serum and plasma harvested. Bulls were also fitted with RT devices that recorded at 1-min intervals. Bulls were then loaded on a trailer and transported 770 km. Upon arrival similar blood samples were collected. Serum CS and plasma EPI concentrations were determined by RIA and EIA, respectively. RT data were summed into 10-min intervals prior to statistical analysis. Data were analyzed by ANOVA using Statview (SAS) and Pearson's correlation coefficients calculated. At departure there was no effect of temperament on CS concentrations ($P > 0.05$). Concentrations of EPI were lower in C (110.21 \pm 20.52 pg/mL) and I (133.46 \pm 27.91 pg/mL) when compared to T bulls (359.85 \pm 112.50 pg/mL $P=0.01$). There was no difference due to temperament between departure and arrival concentrations of CS or EPI ($P > 0.05$). During transport, RT peaked within 20 min (max RT) before decreasing to baseline values ($P < 0.01$). C bulls (39.35 \pm 0.01°C) had lower RT when compared with I (39.61 \pm 0.02°C) and T bull (39.63 \pm 0.02°C; $P=0.06$). Moderate-to-high positive correlations were detected among: max RT and EV ($r=0.62$; $P < 0.01$); EV and departure EPI ($r=0.64$; $P < 0.01$); EV and arrival EPI ($r=0.58$; $P=0.01$); and EV and arrival CS ($r=0.55$; $P < 0.01$). There was a tendency for a positive correlation between max RT and departure EPI ($r=0.46$; $P=0.06$). In conclusion, max RT was reached within 20 min of onset of transportation. Temperament and adrenal function were predictive of RT changes due to transportation.

Key Words: Bovine Temperament, Transportation, Rectal Temperature

375 Effects of acclimation on performance, physiologic responses, and puberty attainment of Brahman-crossbred heifers. R. F. Cooke*^{1,2}, B. R. Austin², J. V. Yelich², and J. D. Arthington¹, ¹University of Florida - IFAS, Range Cattle Research and Education Center, Ona, ²University of Florida - IFAS, Animal Sciences, Gainesville.

The objective of this study was to evaluate the effects of acclimation on growth, plasma concentrations of progesterone (P4) and cortisol, and puberty attainment of Brahman-crossbred heifers. Over 2 consecutive years, 80 heifers were initially evaluated for puberty status via trans-rectal ultrasonography (d 0 and 10) and for temperament by measurements of chute score, pen score, and exit velocity (d 10) within 30 d after weaning. On d 10, heifers were stratified by puberty status, temperament and BW, and randomly assigned to control or acclimation treatment. Heifers were maintained in bahiagrass (*Paspalum notatum*) pastures and received a blend of soybean hulls and cottonseed meal at a daily rate of 2.7 kg of DM per heifer throughout the experimental period (d 0 to 130). The acclimation process (d 11 to 40) consisted of bringing heifers to the cowpens 3 times weekly, where heifers were exposed to common handling practices and returned to pastures within 2 h. Heifer puberty status, evaluated via plasma P4 concentrations and trans-rectal ultrasonography, and BW were assessed on d 40 and 50, d 80 and 90, and d 120 and 130. Blood samples were also collected prior to (d 10) and at the end of the acclimation process (d 40) for determination of plasma P4 and cortisol concentrations. Heifer temperament was assessed again on d 40 of the study. No treatment x year interaction was detected. Acclimated heifers had decreased ($P < 0.05$) BW gain compared to control heifers (0.50 vs. 0.58 kg/d, respectively). Attainment of puberty, however, was increased ($P < 0.01$) for acclimated heifers. A treatment x day interaction was detected ($P < 0.05$) for plasma cortisol and P4 (within prepubertal heifers only) concentrations because heifers from both treatments had similar concentrations on d 10, but acclimated heifers had decreased concentrations of these hormones compared to control heifers on d 40 (3.6 vs. 5.2 ng/mL of cortisol, respectively; 0.50 vs. 0.91 ng/mL of P4, respectively). Results from this study indicated that although acclimation decreased BW gain, it enhanced the attainment of puberty of Brahman-crossbred heifers.

Key Words: Brahman-Crossbred Heifers, Acclimation, Puberty

376 Effects of acclimation on performance, physiologic responses, and pregnancy rates of Brahman-crossbred cows. R. F. Cooke*^{1,2}, D. B. Araujo^{1,2}, G. C. Lamb³, and J. D. Arthington¹, ¹University of Florida - IFAS, Range Cattle Research and Education Center, Ona, ²University of Florida - IFAS, Animal Sciences, Gainesville, ³University of Florida - IFAS, North Florida Research and Education Center, Marianna.

The objective of this study was to evaluate the effects of acclimation on performance, plasma concentrations of hormones and metabolites, and pregnancy rates of Brahman-crossbred cows. Approximately 30 d after weaning (August), 238 Brahman x British and 164 Braford cows were stratified, within breed, by temperament (measurements of chute score, pen score, and exit velocity), BW and BCS, and randomly allocated to 14 groups (Braford = 8; Brahman x British = 6). Groups were randomly assigned to control or acclimation treatment. Cows were maintained in bahiagrass (*Paspalum notatum*) pastures and received a blend of cane molasses and urea at a daily rate of 1.8 kg of DM per cow beginning in December. Cows were acclimated from August to February, and the acclimation process consisted of visiting groups twice weekly and hand-offering approximately 50 g of range cubes per cow. On February, cow temperament, BW and BCS was again assessed and cows were exposed to mature bulls for 90 d. Blood samples were collected at the beginning of the acclimation period and also breeding season for determination of cortisol, IGF-I, ceruloplasmin, and haptoglobin concentrations. Pregnancy was determined via trans-rectal ultrasonography 70 d after the end of breeding season. Within Braford cows, a treatment effect was detected ($P < 0.01$) for pregnancy rates because acclimated cows conceived earlier and at greater number compared to control cows. When data were combined between treatments and breeds, the probability of pregnancy increased linearly ($P < 0.05$) as temperament score and concentrations of ceruloplasmin, haptoglobin, and cortisol (Braford cows only) obtained at the beginning of the breeding season decreased. Probability of pregnancy was affected quadratically ($P < 0.05$) by BCS and IGF-I concentrations also assessed at the beginning of the breeding season. In conclusion, acclimation increased pregnancy rates of mature Braford cows, whereas measurements and physiologic responses associated with temperament and energy status appear to influence the probability of cows to conceive and maintain pregnancy during the breeding season.

Key Words: Brahman-Crossbred Cows, Acclimation, Pregnancy