

# Physiology and Endocrinology: Nutritional Effects on Reproduction and Development

**M277 Effects of body weight loss on serum progesterone concentrations of non-lactating dairy cows.** R. Rodrigues\*<sup>1</sup>, C. Trevisanuto<sup>1</sup>, T. Leiva<sup>1</sup>, M. Barbosa<sup>1</sup>, R. Cooke<sup>2</sup>, and J. Luiz Vasconcelos<sup>1</sup>, <sup>1</sup>FMVZ - UNESP, Botucatu, SP, Brazil, <sup>2</sup>Oregon State University, Burns.

The objective of this study was to evaluate serum concentrations of nonesterified fatty acids (NEFA), cortisol, insulin, and progesterone (P4) of dairy cows maintaining or mobilizing body weight (BW). Eleven non-lactating, non-pregnant, and ovariectomized Gir × Holstein cows were stratified by BW and body condition score (BCS), and randomly assigned to one of 2 treatments on d -7 of the study: 1) BW loss (6 cows; LOSS) and 2) BW maintenance (5 cows; MAINT). Treatments were achieved through a grazing schedule utilizing 3 different pastures (A, B, and C). From d -7 to d 1 of the study, all cows were maintained in pasture A (adequate forage availability; 12 kg of dry matter/cow daily). From d 2 to d 30, LOSS cows were maintained in pasture B (minimal forage availability; less than 1.0 kg of dry matter/cow daily), whereas MAINT cows were maintained in pasture C (adequate forage availability; 12 kg of dry matter/cow daily). From d 3 to d 30 of the study, cows from both treatments were re-grouped daily into pasture A from 0600 to 1200 h to allow LOSS cows to consume, on average, 4.5 kg/d of forage dry matter. From d -66 to d 3 of the study, all cows were inserted with CIDR to promote P4 uptake by adipose tissues, which was replaced every 14 d and removed on d 3. Cow BW and BCS were assessed on d 0 and 30. Blood samples were collected daily, from d 0 to d 30, at 0600 and 1200 h. Changes in BW and BCS were greater in LOSS cows compared with MAINT cows (-0.95 vs. -0.07 kg of BW/d, SEM = 0.216; -0.30 vs. 0.00 of BCS change, SEM = 0.092). Within samples collected at 0600 h, serum NEFA concentrations were greater in LOSS cows compared with MAINT. Similarly, serum P4 concentrations were typically greater in LOSS cows compared with MAINT. Serum cortisol concentrations were also greater for LOSS compared with MAINT cows, but only on d 6, 28, and 29 of the study. In conclusion, data from this study indicates that BW loss increases circulating concentrations of P4 in non-lactating ovariectomized dairy cows, and this outcome can be mainly attributed to fat mobilization and consequent release of P4 stored in adipose tissues.

**Key Words:** adipose tissues, progesterone, weight loss

**M278 Effects of maternal metabolizable protein supplementation in late gestation on uterine and umbilical blood flows in sheep.** L. E. Camacho\*<sup>1</sup>, L. A. Lekatz<sup>1</sup>, M. L. VanEnom<sup>2</sup>, C. S. Schauer<sup>2</sup>, K. R. Maddock Carlin<sup>1</sup>, and K. A. Vonnahme<sup>1</sup>, <sup>1</sup>Center for Nutrition and Pregnancy, Department of Animal Sciences, North Dakota State University, Fargo, <sup>2</sup>Hettinger Research Extension Center, North Dakota State University, Hettinger.

To examine effects of maternal MP supplementation in late gestation on uterine and umbilical blood flows, multiparous ewes (n = 11) were assigned to receive either 75% (LOW, n = 4), 100% (CON, n = 4), or 125% (HIGH, n = 3) of MP requirements from d 100 until d 130. At surgery on d 130, uterine blood flow was measured by Transonic Doppler flow probes and umbilical blood flow was measured using color-Doppler US. Throughout surgery, maternal blood pressure was monitored. After determination of blood flow, fetal and placental tissue were collected and weighed. Data were analyzed with PROC GLM and means separated with LSMeans. Data were considered significant if ( $P < 0.05$ ). Fetuses from HIGH ewes were heavier ( $P \leq 0.04$ ) than fetuses

from LOW ewes with fetuses from CON ewes being intermediate. Total placental wt was not different ( $P = 0.41$ ) among treatments. Uterine blood flow had a tendency ( $P = 0.07$ ) to be greater in the LOW group compare with HIGH (818.0 vs.  $447.3 \pm 105.3$  mL/min) with CON being intermediate. Uterine blood flow per fetus wt was increased ( $P < 0.02$ ) in LOW ewes compare with CON and HIGH (0.42 vs. 0.22 and  $0.12 \pm 0.07$  mL/min/g). Umbilical blood flow per fetus wt was not affected ( $P = 0.14$ ; 0.20, 0.14, and  $0.08 \pm 0.04$  mL/min/g for LOW, CON, and HIGH, respectively) by MP supplementation. Maternal blood pressure did not differ ( $P = 0.19$ ) among groups. However, unprotected LSD means (used only in blood pressure analysis) showed that LOW ewes had increased ( $P \leq 0.01$ ;  $150.5 \pm 13.5$  mmHg) blood pressure compared with HIGH ( $113.6 \pm 11.0$  mmHg) and CON ( $124.8 \pm 11.0$  mmHg). Factors influencing uteroplacental blood flow appear to be associated with maternal MP intake and have yet to be determined.

**Key Words:** metabolizable protein, umbilical blood flow, uterine blood flow

**M279 Effects of maternal protein supply on offspring somatotrophic axis: Serum IGF-binding proteins-2 and -3 in pigs at weaning and market weight.** A. Ooster\*<sup>1</sup>, U. Müller<sup>1</sup>, H. Sauerwein<sup>1</sup>, I. Lang<sup>2</sup>, M. Peters<sup>2</sup>, C. Rehfeldt<sup>2</sup>, and C. C. Metzges<sup>2</sup>, <sup>1</sup>University of Bonn, Bonn, Germany, <sup>2</sup>Leibniz Institute for Farm Animal Biology, Dummerstorf, Germany.

Fetal growth is reflected in size at birth possibly associated with post-natal metabolic function and health. The GH/IGF axis is affected by intrauterine growth retardation and might be permanently readjusted. We aimed to characterize the plasma concentrations of IGF binding proteins (IGFBP) 2 and 3 in offspring of gilts fed with diets differing in protein content. Isoenergetic diets with low, adequate or high CP contents (6, 12 or 30%) were fed to a total of 40 gilts throughout pregnancy. At birth the piglets were cross fostered to nursing sows fed a 12% CP gestation diet and then a standard lactation diet. From weaning (d 28) to slaughter (d 185) offspring received standard fattening diets. Serum collected at d 28 and 185 from 144 piglets was assessed for IGFBP using a non-radioactive Western ligand blotting protocol optimized to yield quantitative data. The chemiluminescence signals were densitometrically evaluated and the bands corresponding to IGFBP-2 and -3 were compared. Maternal feeding group, sex, litter size and weight at birth classes and the respective interactions were considered fixed. Values were compared by t-test at d 28 and 185. At d 28 and 185, IGFBP-3 was not affected by either factor tested. For IGFBP-2, there were trends for feeding group and birth weight differences ( $P = 0.093$  and 0.057, respectively) on d 28, without any interactions. Piglets from sows fed 6% CP had less IGFBP-2 than those from the 12% diet ( $P = 0.037$ ). At d 185, IGFBP-2 was not affected by either factor tested. IGFBP-3 increased ( $P < 0.05$ ) from d 28 to 185 in all groups, whereas IGFBP-2 was decreased ( $P < 0.05$ ) solely in pigs from sows fed at 12% but remained unchanged in offspring from sows fed at 6 or 30% protein. Carry-over effects of maternal feeding during gestation on offspring IGFBP-2 resulting in divergent concentrations at weaning and in altered patterns of age-related changes are thus indicated.

**Key Words:** somatotrophic axis, IGFBP, pig

**M280 The impact of maternal obesity on offspring hypothalamic-pituitary-adrenal axis response to stress.** N. M Long<sup>\*1</sup>, A. B. Uthlaut<sup>1</sup>, P. W. Nathanielsz<sup>2</sup>, and S. P. Ford<sup>1</sup>, <sup>1</sup>Center for the Study of Fetal Programming, Animal Science Department, University of Wyoming, Laramie, <sup>2</sup>Center for Pregnancy and Newborn Research, Department of Obstetrics and Gynecology, University of Texas Health Sciences Center, San Antonio.

Multiparous Ramboulet × Columbia crossbred ewes were fed either 100% of NRC recommendations (Control, C) or 150% of NRC (Obese, OB) from d 60 d before mating until lambing. Lambs born to these dams (10 OB, 5 wethers, 5 ewes; and 8 C, 3 wethers and 5 ewes) were maintained as a group before and after weaning and fed a similar diet until 19 mo of age when they received jugular catheters and were subjected to a corticotrophin releasing hormone (CRH)/arginine vasopressin (AVP) challenge, an ACTH challenge, and an isolation stress test, on separate occasions. ACTH and cortisol responses to the isolation stress test and CRH/AVP challenge and cortisol responses to ACTH challenge were determined. Cortisol was quantified via RIA and ACTH was quantified using an Immulite 1000. Hormone data were analyzed using repeated measures analysis utilizing the MIXED procedure of SAS. Offspring from OB mothers tended ( $P = 0.06$ ) to have a greater ACTH response after an intravenous CRH/AVP injection than offspring from C mothers ( $1234 \pm 143$  vs.  $817 \pm 157$  pg/mL, respectively). The cortisol response of offspring to a CRH/AVP or ACTH challenge was not influenced by maternal nutrition ( $P < 0.46$ ), and averaged  $4.77 \pm 0.2$  and  $1.94 \pm 0.01$  µg/dL. The ACTH response following the isolation stress test was also similar ( $P = 0.82$ ) for OB and C offspring ( $147 \pm 20$  pg/ml). Cortisol response during the isolation stress test was also similar between C and OB offspring ( $P = 0.64$ ,  $5.25 \pm 0.3$  µg/dl). These findings suggest that maternal obesity before and during gestation does not affect stress responses by the offspring, but has an impact on hypothalamo-pituitary-adrenal sensitivity. The lack of differences in cortisol release under the influence of difference concentrations of ACTH during the CRH/AVP challenge could indicate adrenal dysfunction in OB offspring.

**Key Words:** maternal obesity, offspring, stress response

**M281 Effects of two-stage and total vs. fenceline weaning on the physiology and performance of beef calves.** C. Campistol<sup>\*1</sup>, H. G. Kattesh<sup>1</sup>, J. C. Waller<sup>1</sup>, E. L. Rawls<sup>1</sup>, J. D. Arthington<sup>2</sup>, T. E. Engle<sup>3</sup>, and J. A. Carroll<sup>4</sup>, <sup>1</sup>University of Tennessee, Knoxville, <sup>2</sup>University of Florida - IFAS, Range Cattle Research and Education Center, Ona, <sup>3</sup>Colorado State University, Fort Collins, <sup>4</sup>Livestock Issues Research Unit, USDA-ARS, Lubbock, TX.

Calves weaned using a 2-stage method, where nursing is prevented between cow-calf pairs before separation (Stage 1), experience less weaning stress after separation (Stage 2) based on behavior and growth measures. The aim of this study was to document changes in various physiological measures of stress in calves weaned using the 2-stage with total separation or temporary fenceline contact. Steer calves ( $n = 48$ ;  $314.1 \pm 20.5$  kg), housed on pasture with their dams, were blocked by initial BW and assigned randomly during Stage 1 to be fitted with a nose-flap weaning device (YD) or no device (ND) for 7 d preweaning. During Stage 2, calves (12 YD and 12 ND/group) were weaned by fenceline (Group 1) or total separation to a distant pasture (Group 2). After 7 d, Group 1 calves were moved to a pasture lot adjoining Group 2. Calves were weighed and bled on d -7, 0, 3, 7 (d of weaning), 10, 14, 21, and 42, and injected with ovalbumin on d 0. Blood was analyzed for total cortisol, IgG to ovalbumin, interferon-gamma (IFN-γ), haptoglobin (HAP), ceruloplasmin (CER), hematocrit (Hct), and neutrophil:lymphocyte ratio (N:L). Weight gain was similar ( $P = 0.74$ )

among steers regardless of Stage 1 treatment. The YD calves had higher ( $P < 0.05$ ) Hct than ND calves during Stage 1. Weight gain was greater ( $P < 0.01$ ) in Group 1 versus Group 2 on d 14–42. Ovalbumin-specific IgG increased ( $P < 0.01$ ) in all calves by d 10 unrelated to Stage. Both HAP and CER increased ( $P < 0.01$ ) by d 3 in response to ovalbumin. Between d 7 and 10, CER, IFN-γ, and N:L increased ( $P < 0.05$ ) in ND but not YD calves. In conclusion, 2-stage weaning may improve calf well-being when fenceline separation is employed.

**Key Words:** beef cattle, two-stage weaning, stress

**M282 Effects of dietary n-3 fatty acids on timing of estrus onset and LH surge in synchronized estrous cycles of dairy cows.** M. Zachut<sup>\*1,2</sup>, H. Lehrer<sup>1</sup>, A. Arieli<sup>2</sup>, L. Livshitz<sup>1</sup>, and U. Moallem<sup>1</sup>, <sup>1</sup>Agriculture Research Organization, Bet Dagan, Israel, <sup>2</sup>Faculty of Agriculture, Hebrew University, Rehovot, Israel.

In a previous study conducted in our lab we observed a delay in behavioral-estrus manifestation in cows fed flaxseed, which contained a high proportion of 18:3n-3. The objectives were to examine the effect of dietary extruded flaxseed (EF) on the interval between PGF<sub>2α</sub> injection and LH surge in synchronized estrous cycles. Multiparous Israeli-Holstein dry cows (256 d pregnant) were assigned to 2 treatments (i) control ( $n = 22$ ) were fed a dry cow diet and postpartum (PP) lactating cow diet, which consisted of 5.8% ether extracts and (ii) EF ( $n = 22$ ) supplemented prepartum with 1 kg/d per cow of EF providing 141 g/d of 18:3n-3, and PP to 100 d in milk (DIM) a diet consisted of 9.2% EF providing on average 382 g/d of 18:3n-3. At 40 DIM ovaries were monitored by ultrasound to ensure normal cyclicity. Cows received a GnRH analog injection at d 0, and 7 d later were monitored by ultrasound for corpus luteum (CL) presence. Cows that had CL were injected with PGF<sub>2α</sub> (d 7) followed 2 d later (d 9) by GnRH injection. Seven d later (d 16) cows were injected with PGF<sub>2α</sub> to stimulate luteolysis and 5-d period of intensive follow-up was conducted. Cows were observed continuously (24 h a day) for onset of behavioral-estrus signs and thereafter blood samples were taken every 3 h during 24 h for LH detection. A total of 38 successful estrous cycles (16 controls and 22 EF) were obtained in 2 sessions. Interval from PGF<sub>2α</sub> injection to behavioral-estrus onset was not significantly different (57.3 and 59.4 h for control and EF, respectively). LH peak in the controls occurred on average 5.8 h after estrus-onset, as compared with 7.6 h in the EF ( $P < 0.03$ ). Interval from PGF<sub>2α</sub> injection to LH peak tended to be longer in the EF than in controls (67.0 and 62.1 h, respectively;  $P < 0.07$ ). These results imply that dietary n-3 fatty acids may delay timing of LH peak, perhaps due to changes in the secretion of prostaglandins E<sub>2</sub> that are involved in ovulation control.

**Key Words:** omega-3, LH surge

**M283 The effects of ancient Mediterranean aphrodisiac capari (Capparis ovata Desf.) on some reproductive parameters of Lohmann roosters.** A. Ata, M. S. Gulay<sup>\*</sup>, and O. Yildiz-Gulay, Mehmet Akif Ersoy University, Faculty of Veterinary Medicine, Burdur, Turkey.

The focus of this research was to determine the effects of dietary supplementation of capari on some spermatological parameters in Lohmann roosters. Twenty-four week old roosters were randomly assigned to control and capari treatment groups (8 per group) and fed a standard diet. Roosters in control group received 10 mL of tap water, whereas roosters in treatment group received 1 g/kg of caper in 10cc tap water daily by oral gavages for 39 d (3 spermatogenesis duration). Semen was collected from each rooster by abdominal massages weekly and sperm analyses were performed on individual semen samples collected

39 d after introduction to capari. There were no difference between control and caper treated roosters on semen volume ( $44.3 \pm 13.4$  vs.  $62.8 \pm 11.3 \mu\text{L}$ ), semen pH ( $8.24 \pm 0.11$  vs.  $8.25 \pm 0.14$ ), percent morphologically normal sperm ( $89.2 \pm 3.0$  vs.  $92.3 \pm 2.7\%$ ), percent live spermatozoa by eosin-nigrosine staining mixture ( $87.4 \pm 1.3$  vs.  $88.3 \pm 1.3\%$ ), respectively. On the other hand, daily caper treatment increased

the progressive motility ( $85.0 \pm 0.84$  vs.  $87.6 \pm 0.70\%$ ,  $P < 0.04$ ) and sperm concentration ( $3.78 \pm 0.59$  vs.  $5.45 \pm 0.41 \times 10^9 \text{ mL}$ ,  $P < 0.04$ ). The results indicated that there is a merit to use dietary supplementation of capari to improve spermatological performance of roosters.

**Key Words:** caper, rooster, spermatological parameters