769 Effect of short-term supplementation and temporary weaning in hepatic gene expression in Hereford cows grazing native pasture. A.L. Astessiano*[1], F. Bialade[1], M.P. Grignola[1], J. Laporta[1], C. Viñoles[2], and M. Carriquiry[1], *[1]School of Agronomy, UDELAR, Montevideo, Uruguay, [2]National Research Institute for Agriculture, Tacuarembo, Uruguay.*

Short-periods of improved nutrition associated with temporary weaning increased early pregnancy rates in grazing conditions, but the underlying mechanisms involved in this response remain unknown. Primiparous beef cows (n = 25; 388 ± 7 kg BW and 3.6 ± 0.2 units BCS) in anestrus were used in a randomized block design with a 2x2 factorial arrangement of short-term supplementation, with 2.5 kg/cow of whole rice middlings (90.3%DM, 10%CP, 9%EE, 14%NDF; SUP, n = 12 vs. CON, n = 13) for 23 d, and temporary weaning, by applying nose plates to calves for 14 d (with, n = 13 vs. without, n = 12), before initiation of the breeding period (103 ± 1 d postpartum) to study hepatic expression of GH-IGF axis genes. Liver biopsies were obtained at the initiation and end of the treatment period. The abundance of mRNA of growth hormone receptor (GHR), GHR-1A, insulin-like growth factor-I (IGF-I), IGF binding proteins-2 (BP2),-3 (BP3), and insulin receptor (INSR) were measured by real time RT-PCR normalized by hypoxanthine phosphoribosyltransferase and β-actin as endogenous control genes. Means from a mixed model analysis were considered to differ when $P < 0.05$. Neither short-term supplementation nor temporary weaning affected cow BCS. Expression of GHR and IGFI mRNA were not affected by any of the factors evaluated in this study while the expression of INSR mRNA tended be greater ($P = 0.11$, 2.96 vs. 1.83 ± 0.55) in temporary weaned than suckled cows. Expression of BP3 and BP2 mRNA was greater in SUP than CON cows (1.38 vs. 0.85 ± 0.003 and 18.50 vs. 12.63 ± 0.04, respectively). In addition, BP2 mRNA was less in temporary weaned than suckled cows (12.60 vs. 18.53 ± 0.04). The BP3/BP2 ration was not affected by short-term supplementation but was greater in temporary weaned than suckled cows. Short-term supplementation and temporary weaning before initiation of the breeding season could affect IGF availability through changes in hepatic IGFBP synthesis.

Key words: mRNA, suckling management, nutritional treatment

770 Feeding distillers grains as an energy source to gestating and lactating heifers: Impact on ovarian function and reproductive efficiency. P. J. Gunn*[1], J. P. Schoonmaker[1], R. P. Lemenager[1], and G. A. Bridges[2], *[1]Purdue University, West Lafayette, IN, [2]University of Minnesota, Grand Rapids.*

Angus-cross beef heifers pregnant to a single sire (n = 80; BCS = 5.1 ± 0.03; BW = 518 ± 6 kg) were used to assess the effects of feeding dried distillers grains with solubles (DDGS) as an energy source during late gestation and early lactation on follicular development, cyclicity and fertility. At 192 d in gestation, heifers were stratified and allotted by BW and BCS to receive one of 2 isocaloric dietary treatments: a control diet of corn silage and haylage (CON; 10% CP prepartum; 11.8% CP postpartum) or corn residue and DDGS (DG; DDGS at 1.2% BW per d; 15.7% CP). Treatments concluded and cattle were commingled 30 d after synchronization with the 5 d CO-Synch + CIDR timed-AI protocol (118 ± 0.1 d postpartum; DPP). BW and BCS were assessed every 28 d during treatment. At 32 ± 0.2 DPP, 1 follicular wave was mapped via ultrasonography in 10 anestrous heifers per treatment. Starting 40 DPP, blood samples were taken every 10 d until synchronization to determine return to cyclicity via progesterone. Plasma urea nitrogen (PUN) was assessed in blood samples taken at AI. Categorical and continuous data were analyzed with the GLIMMIX and MIXED procedures of SAS, respectively. Dominant (15 ± 0.7 vs. 13 ± 0.6 mm) and secondary (11 ± 0.5 vs. 9.0 ± 0.4 mm) follicle diameter was greater ($P \leq 0.05$) and wavelength (8.9 ± 0.6 vs. 7.5 ± 0.5 d) tended ($P = 0.08$) to be greater in DG than CON, respectively. Percentage of cyclic heifers at estrous synchronization did not differ (89%), but DG (58 ± 2 d) tended ($P = 0.10$) to resume estrous activity at fewer DPP than CON (63 ± 2 d). PUN concentrations at AI were greater ($P < 0.01$) in DG (17.1 ± 0.6 mg/dL) than CON (6.6 ± 0.3 mg/dL). Timed-AI pregnancy rates were numerically ($P = 0.30$) greater in DG (28/36, 78%) than CON (22/33, 67%). Breeding season pregnancy rates did not differ between treatments (99%). In summary, feeding DDGS at 1.2% of BW per d to first-parity heifers resulted in greater dominant follicle growth during the postpartum anestrous period, marginally hastened resumption of estrous cycles, and did not detrimentally impact AI pregnancy rates.

Key words: beef heifer, DDGS, fertility

771 Comparison of Brahman females evaluated for residual feed intake (RFI) as heifers and reevaluated for RFI as gestating cows. B. L. Bradbury*[1,2], S. L. Morgan[1,2], A. N. Loyd[1,2], D. A. Neuendorff[1], A. W. Lewis[1], J. P. Banta[1], D. G. Riley[2], T. D. A. Forbes[3], T. H. Welsh Jr.[2], and R. D. Randel[1], *[1]Texas AgriLife Research, Overton, [2]Texas AgriLife Research, College Station, [3]Texas AgriLife Research, Uvalde.*

Use of residual feed intake (RFI) as a tool to identify feed efficient beef cattle is increasing. This study was designed to examine the relationship between postweaning RFI and mature RFI in Bos indicus females. Mature cow RFI data was collected over 2 years on 2 different cohorts of cows that were previously evaluated for RFI postweaning. In 2009 and 2010, 37 (3–7 yr of age) and 41(2–3 yr of age) cows, respectively, in their first trimester of gestation (affirmed by palpation) were retrained to eat from Calan gates system and evaluated for RFI. Cows were fed twice daily (0800 h and 1600 h) at 2.6% BW for 70 d with BW recorded weekly. Body condition scores were recorded weekly in 2009 and at d 0 and d 70 in 2010. Females were classified according to their RFI values, with a negative RFI = efficient and a positive RFI = inefficient. Residuals for average daily feed intake (ADFI) by heifer and cow (n = 78) were generated using a mixed model. Sire (n = 16) was included as a random effect in both models. Fixed effects included year of record for heifers (2004–2009: $P < 0.001$) and for cow (2009 and 2010; $P < 0.001$). Heifer pen (n = 11: $P = 0.0008$) was nested within year. Cow age (2, 3, 4, 5, 6, or 7 yr; $P < 0.001$), lactation status (lactating or not; $P = 0.07$), and pen (n = 11; $P < 0.001$) were included as nested within year. Regression coefficients of ADFI on ADG and mid-test weight (MTW) for heifers were −0.15 ± 0.03 kg ($P = 0.0002$) and 0.13 ± 0.002 kg ($P < 0.0001$), respectively. Regression coefficients of ADFI on MTW, ADG, and days pregnant were 0.09 ± 0.02 kg ($P < 0.001$), 0.76 ± 0.29 kg ($P = 0.01$), 0.01 ± 0.003 kg ($P = 0.007$), respectively for cows. The Pearson correlation coefficient (r = −0.24, $P = 0.0348$) indicates that heifer RFI may not be an accurate predictor of RFI as a mature cow in the first trimester of gestation.

Key words: RFI, cow, repeatability

772 Effect of temperament on response to cannulation and glucose challenge in Brahman heifers. B. L. Bradbury*[1,2], L. C. Caldwell[2], A. W. Lewis[1], D. A. Neuendorff[1], R. C. Vann[3], T. H. Welsh Jr.[2], and R. D. Randel[1], *[1]Texas AgriLife Research, Overton, [2]Texas AgriLife Research, College Station, [3]MAFES-Brown Loam Experiment Station, Raymond, MS.*

Temperamental cattle have greater serum concentrations of cortisol (CS) which mediates glucose (GLU) metabolism. The objective was to determine the effects of temperament on blood GLU and insulin (INS) following a stressor and a subsequent infusion of dextrose. Brahman heifers (200–300 kg) were evaluated for temperament and 6 calm (C) and 6 temperamental (T) heifers were fitted with jugular catheters and placed in individual stalls. Blood samples were collected at cannulation and then at 0, 30, 60, and 90 min. At 90 min after cannulation dextrose was infused via the cannula at 0.5 mg/kg BW. Blood samples were collected at −5, 0, 10, 15, 20, 30, 40, 60, 80, 100, 120, 140, 160, 180 min relative to the time of dextrose infusion. CS and INS were assayed by RIA and GLU by colorimetry. CS, GLU, INS, insulinogenic index and their interactions with time and temperament were analyzed by GLM for repeated measures. Peak INS concentration, time to peak, GLU disappearance and time to half life were analyzed using GLM procedures. Following cannulation T heifers had elevated GLU (P = 0.0005) and CS (P = 0.0238). There was a significant temperament by time interaction (P = 0.0434) influencing INS following cannulation. During the challenge a temperament by time interaction affected CS (P = 0.0041), GLU (P = 0.0428), and INS (P = < 0.0001). Glucose concentrations were significantly higher in T heifers (P = 0.0011) at half life (P = 0.0092), and time to half life was significant (P = < 0.0001) between temperaments. Peak INS concentrations (mIU/mL) for the C and T heifers were 54.5 ± 7.6 and 27.2 ± 7.6, respectively. Insulinogenic index was affected by temperament (P = 0.0173) and there was a temperament by time interaction (P = 0.0003). These data indicate that temperament (P = 0.0282) has an impact on CS secretion following cannulation stress which subsequently results in elevated GLU and INS concentrations. Temperament modifies metabolic regulatory responses in heifers and this altered metabolism of temperamental cattle may partially explain their decreased productivity.

Key words: cattle, temperament, glucose

773 The role of parathyroid hormone and calcitonin in the prevention of hypocalcemia under induced metabolic acidosis in cattle. E. M. Rodríguez*[1], A. Bach[1,2], and A. Arís[1], *[1]Department of Ruminant Production, IRTA, Caldes de Montbui, Spain, [2]ICREA, Barcelona, Spain.*

Metabolic acidosis ameliorates parturient hypocalcemia by increasing plasma concentrations of 1,25-dihydroxyvitamin D (1,25-D) in cows. Under acidosis, it has been reported in other mammals that parathyroid hormone (PTH) function is enhanced through an upregulation of PTH receptor (PTHR) and increasing 1,25-D levels. The objective of this study was to evaluate the PTH/PTHR concentrations under an acidic state in cattle and to assess changes in calcitonin (CALC), also involved in calcium homeostasis with opposite effects to PTH. Twenty-four Holstein bulls (497 ± 69 kg of BW and 341.5 ± 10.5 d of age) were randomly assigned to 2 treatments [acidosis (ACI), or control (CON)]. Acidosis was induced by oral administration of ammonium chloride (2.5 Eq/day) during 10 d and animals were then slaughtered following commercial practices. Blood samples were taken before slaughter, and samples of urine, kidney, and thyroid gland were harvested immediately after sacrifice. Blood and urine pH were measured immediately after collection. Expression of CALC, CALC receptor (CALCR), PTH and PTHR from kidney and thyroid gland was measured by qRT-PCR. CALC activity under acidotic conditions was tested in vitro using human breast T47D cultures expressing CALCR. Data was analyzed with an ANOVA using the treatment as the main effect. As expected, blood pH was lower (P<0.001) in ACI than CON bulls (7.57 vs. 7.64 ± 0.02). Urine pH was lower (P<0.01) in ACI than CON bulls (5.95 vs. 7.38 ± 0.13). No differences were detected on CALC and PTH expression or on PTH serum concentrations. Expression of PTHR in kidney was greater (P<0.05) in ACI than CON bulls. Furthermore, CALC activity in vitro at pH 7.4 was greater (P<0.01) than that found at more acidic or alkaline pHs. In conclusion, PTH function is enhanced in metabolic acidosis by an increased expression of PTHR in kidney, and whereas CALC/CALCR expression is not affected, its binding activity may be hampered. These findings demonstrate that, in an acidic state, PTH and CALC are complementary hormones promoting increased blood calcium levels.

Key words: hypocalcemia, calcitonin, parathyroid hormone

774 Molecular control of puberty as affected by nutrition and leptin infusion in zebu heifers. J. Diniz-Magalhães*, M. V. Carvalho, A. B. S. Machado, M. A. V. Silva Júnior, and L. F. P. Silva, *Universidade de São Paulo, Pirassununga, São Paulo, Brazil.*

Leptin has been proposed to affect several genes in the hypothalamus to modulate the effect of nutrition on sexual maturation. The objective was to evaluate the effect of oLeptin infusion, and of high or low energy intake, on the expression of oxytocin (OXT), β-arrestin 1 (ARRB1), and insulin-like growth factor binding protein-2 (IGFPB2). Thirty 6 prepubertal Nelore heifers, 18 to 20 mo-old, 275.8 ± 17.2kg BW and BCS of 5 ± 0.5 (1 to 9 scale) were randomly assigned to each of 3 treatments: H (high-energy diet), L (low-energy diet), and LL (low-energy diet + oLeptin). Diets were formulated to promote weight gains of 0.4kg/day (groups L and LL) or 1.2kg/day (H group). Heifers were fed ad libitum once a day, they were weighed and had their BCS evaluated twice weekly. After 21 d of adjustment, heifers in LL group received subcutaneous injections of oLeptin at 4.8µg/kg BW twice a day, for 56 d. Groups H and L received similar injections of 2mL saline solution. Age at puberty was considered to be the age on first detection of a corpus luteum by twice weekly transrectal ultrasonography, confirmed by plasma concentrations of progesterone of >1ng/ml. Twenty 4 heifers were slaughtered at the time of puberty for harvesting of the hypothalamus. Expression of transcripts of OXT, ARRB1 and IGFBP2 was quantified by real-time PCR. Changes in gene expression were calculated by relative quantification with the ΔΔCt method, using the gene 18S ribosomal RNA as the reference gene. ANOVA used the MIXED procedure of SAS considering the fixed effects of treatment, gene and trt × gene, and the random effects of heifer(trt), and heifer × trt(gene). There was no effect of leptin, or of nutrition on expression of OXT and IGFBP2 (P > 0.10) at the time of puberty. Also, leptin infusion did not alter ARRB1 expression. However, high energy intake reduced expression of ARRB1 by 1.5 folds (P = 0.02). ARRB1 acts inhibiting protein-G receptors, such as the neuropeptide Y receptors. Therefore, downregulation of ARRB1 could be associated with lower sensibility of the hypothalamus to NPY action, and consequently with hastening of puberty.

Key words: beta arrestin, hypothalamus, *Bos indicus*

775 Energy balance alters leptin but not adiponectin mRNA in Holstein cows. D. A. Koltes* and D. M. Spurlock, *Iowa State University, Ames.*

Adipokines are recognized as important signaling molecules secreted by adipose tissue that alter metabolic activity in multiple target tissues. Thus, adipokines likely play a critical role in homeorhetic adaptations that occur throughout the transition period and lactation cycle in dairy cows. Currently, the regulation of adipokines in response to changing energy balance is not well characterized. Therefore, the objective of this research was to determine if changes in energy balance status alter the mRNA abundance of 2 important adipokines, leptin and adiponectin, in lactating Holstein cows. Three models of altered energy balance were investigated, including transition from pregnancy to lactation, feed restriction, and administration of recombinant growth hormone (GH), Posilac. Adipose tissue was collected from 26 cows before calving, and at 5, 21, and 150 d in milk. In different experiments, adipose tissue was collected before treatment, and on d 1 and 4 of feed restriction (n = 19) and d 3 and 7 following administration of GH (n = 20). For all experiments, net energy balance was calculated from daily individual feed intake and milk production, and weekly body weight and milk component analysis. Cows in early lactation and under feed restriction experienced a similar decline in net energy balance with a nadir of –7.38 and –8.09 MCal, respectively ($P < 0.01$). Net energy balance also declined with GH administration ($P < 0.01$), but to a lesser degree (0.23 MCal on d 7). Leptin mRNA abundance decreased with the onset of lactation and with feed restriction ($P < 0.05$), and there was a trend for its decrease with GH administration ($P = 0.08$). In contrast, a significant change in adiponectin mRNA abundance was observed only with GH administration, where adiponectin mRNA increased on d 3, but not d 7 relative to pre-treatment ($P < 0.05$). These results show that leptin mRNA consistently decreased with declining energy balance, while changes in adiponectin mRNA were not associated with energy balance status. Thus, altered leptin, but not adiponectin, may represent a mechanism by which adipose tissue signals a need for physiological change during times of negative energy balance.

Key words: growth hormone, feed restricted

776 Effect of a high-energy diet after weaning on luteinizing hormone secretion in Holstein bulls. M. Maquivar*[1], L. A. Helser[2], M. D. Utt[1], L. H. Cruppe[1], F. M. Abreu[1], G. E. Fogle[1], J. M. DeJarnette[2], and M. L. Day[1], *[1]The Ohio State University, Columbus, [2]Select Sires Inc., Plain City, OH.*

Feeding a high energy diet to beef heifers weaned at 2 to 3 mo of age prematurely activates the reproductive axis and results in precocious puberty. The objective of the present study was to evaluate the impact of a high energy diet, initiated approximately 2 mo of age, on secretion of LH in Holstein bull calves. Male calves received 1 of 2 diets beginning at 58 ± 0.7 d of age. Diets were designed to contain the same amount of protein (14.1% CP) but different amount of energy: high energy diet (n = 9, HIGH, 2.2 Mcal/kg NEm and 1.37 Mcal/kg NEg) targeting for ADG of 1.5 kg/d and control diet (n = 10, CONT, 1.70 Mcal/kg NEm and 1.09 Mcal/kg NEg) targeting for ADG of 0.75 kg/d. Monthly serial blood samples (10 min intervals for 8 h) were collected via jugular catheters from 6 bulls in each treatment, to assess patterns of LH secretion at 69, 97, 125, 156, 181 and 210 d of age. The ADG differed among treatments (1.47 ± 0.05 HIGH vs. 0.95 ± 0.04 kg/d CONT, $P < 0.01$). Body weight tended ($P < 0.1$) to differ at 118 and 134 d of age and differed ($P < 0.05$) from 146 to 218 d. At 125 d of age, concentration of LH was greater in the HIGH (1.83 ± 0.05 ng/ml) than CONT (1.50 ± 0.07 ng/ml) treatment and was lesser ($P < 0.01$) at 181 (1.07 ± 0.04 vs. 1.43 ± 0.08, respectively) and at 210 (1.00 ± 0.03 vs. 1.34 ± 0.06, respectively) days of age (trt x age, $P < 0.01$). Number of LH pulses did not differ between treatments at 69, 97, 156 and 181 d of age but was greater ($P < 0.01$) in the HIGH than CONT treatment at 125 d (8.33 ± 0.95 vs. 3.00 ± 0.44, respectively) and tended ($P = 0.07$) to be greater at 210 d of age (trt x age, $P < 0.01$). The amplitude of LH pulses was greater ($P < 0.05$) in the CONT than HIGH treatment at 125, 181 and 210 d of age and a tended ($P < 0.1$) to be greater at 97 and 156 d of age. These data suggest that a high energy diet initiated at 2 mo of age induces a rapid activation of the gonadotropic axis in Holstein bulls expressed as increased frequency of LH pulses of a lesser amplitude which results in a greater mean concentration of LH. This alteration in LH secretion may accelerate maturation of the reproductive axis in bulls.

Key words: reproductive axis, LH, male calves

777 Effects of volatile fatty acid infusions on angiopoietin-like protein 4 concentration in plasma and ruminal papillae of cattle. S. H. Li*, B. J. Bradford, and L. K. Mamedova, *Kansas State University, Manhattan.*

Angiopoietin-like protein 4 (ANGPTL4), a plasma regulator of energy and lipid metabolism, may be influenced by microbial populations. Microbes could influence ANGPTL4 production via changes in volatile fatty acid (VFA) production. The objective of this study was to evaluate the effects of VFA on plasma and papillae ANGPTL4 concentrations. Six ruminally cannulated lactating Holstein cows were randomly assigned to treatment sequence in replicated 3x3 Latin squares and fed a standard lactation diet ad libitum. Cows were initially infused with 10 mol/d acetate, propionate, or butyrate for 2d, provided as bolus infusions every 4 h. However, during period (P) 1, both DMI and calculated ME intake were decreased by infusions ($P < 0.001$) relative to pre-treatment. Therefore, in P2 and P3, infusion rates were decreased to 5 mol/d. Blood and ruminal fluid samples were collected immediately before and after infusions. Ruminal papillae samples were collected after infusions and ruminal pH data were collected every 5 min during treatment with an indwelling pH probe. Five d were allowed between treatment periods. Period 1 results were analyzed independently from P2 and P3 data using mixed model analysis. There were no treatment effects on DMI, ME intake, or ruminal pH at either infusion rate ($P > 0.12$). Plasma ANGPTL4 concentration was determined by ELISA, which revealed no treatment effects at either infusion rate ($P > 0.14$). Papillae ANGPTL4 concentration was determined by Western blot, and no effects of treatment were observed at either infusion rate ($P > 0.51$). Furthermore, no correlations were observed between ANGPTL4 and ruminal VFA concentration. However, papillae ANGPTL4 was positively correlated with both ruminal pH ($P = 0.02$) and ME intake ($P = 0.03$). Conversely, plasma ANGPTL4 had an inverse relationship with ruminal pH ($P < 0.01$), with regression estimates ranging from 5.6 to 1.9 ng/mL as mean ruminal pH increased from 6.0 to 6.2. Consistent with previous findings, ruminal ANGPTL4 abundance is positively associated with ruminal pH, but is not associated with plasma ANGPTL4 concentrations.

Key words: ANGPTL4, cattle, volatile fatty acids

778 Incorporation of essential and non-essential fatty acid into distinct lipid classes in cultured bovine and porcine small intestine and muscle explants. C. Caldari-Torres* and B. A. Corl, *Virginia Polytechnic Institute and State University, Blacksburg.*

In foregut fermenters, microbial biohydrogenation leads to saturation of essential fatty acids (EFA) and a loss in their biological function. Despite no literature reporting EFA-deficiency in ruminants, EFA conservation mechanisms in these animals are not well understood. The aim of this study was to examine fatty acid (FA) esterification patterns in ruminant and non-ruminant small intestine (SI) and muscle explants. We performed in vitro culture of bovine and porcine SI and muscle explants with radiolabeled FA to track esterification of EFA and non-EFA into lipid classes. Tissue explants were incubated in media containing radiolabeled non-EFA ([1-^{14}C]16:0 or [1-^{14}C]C18:1), or EFA ([1-^{14}C]C18:2 or [1-^{14}C]C18:3). Porcine SI explants incorporated more non-EFA than EFA (17.9 vs 12.4 ± 2.0 nmol•2 h^{-1}•150 mg $tissue^{-1}$, $P = 0.002$). Bovine muscle explants incorporated more EFA than non-EFA (8.73 vs 6.32 ± 0.86 nmol•2 h^{-1}•150 mg $tissue^{-1}$, $P < 0.001$). Pig muscle explants and cattle SI explants did not exhibit preferential esterification of non-EFA compared with EFA. Cattle SI explants esterified more FA into triglycerides (TG) compared with phospholipids (PL) (3.54 vs 2.42 ± 0.35 nmol•2 h^{-1}•150 mg $tissue^{-1}$, $P = 0.01$). Muscle explants from both species incorporated EFA into PL more readily than non-EFA (Cow: 1.98 vs 1.27 ± 0.39 nmol•2 h^{-1}•150 mg $tissue^{-1}$, $P = 0.02$, Pig: 0.98 vs 0.77 ± 0.13 nmol•2 h^{-1}•150 mg $tissue^{-1}$, $P = 0.004$). An increase in PL/TG ratio was observed when measuring incorporation of EFA compared with non-EFA in bovine muscle explants (1.71 vs 0.61 ± 0.19 nmol•2 h^{-1}•150 mg $tissue^{-1}$, $P < 0.001$). There was no difference in PL/TG ratio in porcine muscle explants or bovine or porcine SI explants when quantifying incorporation of EFA compared with non-EFA. Results suggest that muscle esterification patterns of cattle facilitate greater EFA incorporation into PL, while SI esterification patterns of FA seem to have no preference for EFA in ruminants. Support provided by NSF grant IOS-0920491.

Key words: fatty acid, muscle, small intestine

779 Hepatokine, growth hormone, and PPARα-regulated gene network expression in liver of peripartal cows fed two levels of dietary energy prepartum. J. Khan*[1], D. Graugnard[1], D. H. Keisler[2], B. J. Bradford[3], L. K. Mamedova[3], J. K. Drackley[1], and J. J. Loor[1], *[1]University of Illinois, Urbana, [2]University of Missouri, Columbia, [3]Kansas State University, Manhattan.*

Fibroblast growth factor 21 (FGF21) and angiopoietin-like 4 (ANGPTL4) are hepatokines under control of PPARα. During starvation or fasting, liver FGF21 increases leading to inhibition of STAT5ab and impaired growth hormone (GH) action. We examined the expression of 40 genes associated with the network encompassing FGF21, GH, long-chain fatty (LCFA) oxidation, and PPARα in cows (n = 6/diet) assigned to a control (CON; NEL = 1.34 Mcal/kg DM) or moderate-energy (OVER; NEL = 1.62 Mcal/kg DM) diet during the entire dry period. All cows were fed a common lactation diet (NEL = 1.69 Mcal/kg DM) postcalving. A percutaneous liver biopsy was collected at −14, 7, 14, and 30 d relative to parturition (DIM) for transcript profiling via quantitative PCR. Estimated prepartal energy balance (EBAL) was greater (~159% vs. 102%, $P < 0.05$) in OVER vs. CON, but during the first wk postpartum cows fed OVER prepartum were in more negative EBAL. Prior to calving, CON cows had greater ($P < 0.05$) serum FGF21 which corresponded with greater ($P < 0.05$) liver FGF21 expression. Concentration of FGF21 decreased ($P < 0.05$) gradually postpartum regardless of diet. Along with more severe negative EBAL, cows fed OVER vs. CON prepartum had greater ($P < 0.05$) postpartal serum NEFA, BHBA, and GH, and greater liver triglyceride concentrations. Those data agreed with greater expression of ACOX1, CPT1A, ACADVL, HMGCS2, FGF21, and ANGPTL4 in OVER vs. CON at 7–14 DIM. Serum ANGPTL4 concentration was not affected by diet or time. Despite the gradual increase in serum GH after calving, at 7–14 DIM liver from cows fed OVER prepartum had greater ($P < 0.05$) IGFALS potentially to counteract the temporal decrease in hepatic GHR, STAT5ab, and IGF-1. Our results revealed a link between prepartal energy overfeeding and postpartal negative EBAL leading to greater serum NEFA coupled with transcriptional adaptations in liver. Those encompassed not only LCFA oxidation and GH signaling but also hepatokine production. The apparent lack of relationship between liver mRNA of FGF21 and ANGPTL4 with blood concentrations merits further study.

Key words: transition cow, metabolism, growth factors