Mastitis is a major disease that affects the profitability of dairy farms. Peroxisome proliferator-activated receptor gamma (PPARγ) may improve the response to mastitis and regulate differentiation of adipocyte. A putative PPAR agonist, 2,4-thiazolidinedione (TZD), modulates metabolism and inflammation. The objective of this study was to determine the effects of TZD during induced subclinical mastitis on the milk fatty acid profile and lipid-soluble vitamins in dairy goats. The experiment included 24 Saanen lactating dairy goats receiving low-energy diet without vitamin supplementation. Six goats in each group received a daily L.V. injection of either 8 mg/kg BW of TZD or saline. A week later, goats were challenged with intramammary infusion (IMI) of Streptococcus uberis (MTZD or MCTR) or saline (CTZD or CTRL). Milk samples were obtained on d −8, 1, 4, 7, and 12 relative to IMI and were analyzed for retinol, α-tocopherol and fatty acid profile. Data were analyzed using the Proc Mixed of SAS with significance declared at P ≤ 0.05. CTZD had greater retinol concentration compared with CTRL on d 1 (658.7 vs 376.0 ± 147.5 µg/mL), and MTZD had lower retinol concentration over time. On d 4 after IMI, MCTR had greater α-tocopherol concentration than CTRL (1.44 vs 0.69 ± 0.39 µg/mL) and tended to be greater than MTZD. The MTZD had lower α-tocopherol over time. The TZD effect on fatty acid profile was detected on d 12; CTZD group was greater than CTRL in C18:0 (7.63 vs 5.68 ± 0.79%), C18:1 cis (25.9 vs 21.4 ± 1.8%), C18:3n-3 (1.5 vs 1.2 ± 0.1%), and C20:5 (0.07 vs 0.04 ± 0.01%). In addition, during subclinical mastitis, MTZD had greater α-linolenic acid on d 12 (1.4 vs 1.2 ± 0.1%) and C22:6 on d 4 (0.05 vs 0.01 ± 0.01%) compared with that for CTRL group. Overall, during sub-clinical mastitis, MTZD had lower energy diet, and no vitamin supplementation, TZD increased the presence of several dietary long-chain fatty acids with anti-inflammatory features and retinol in milk. This suggests that TZD affects milk fat and may possibly improve anti-inflammatory responses of the mammary gland.

Key Words: thiazolidinedione, mastitis, dairy goat

Effects of 2,4-thiazolidinedione on milk fatty acid profile and vitamins in dairy goats with subclinical mastitis. C.-Y. Tsai1*, F. Rosa1, M. Bionaz2, and P. Rezamand1, 1University of Idaho, Moscow, ID, 2Oregon State University, Corvallis, OR.

Systemic inflammation and sub-optimal feed intake are common in dairy cows in the transition to lactation, and both conditions are associated with greater risk for removal from the herd and less productivity. No compelling mechanistic link has tied postpartum inflammation to suppression of feed intake. Recent findings in rodents demonstrated that an acute phase protein, α-1-acid glycoprotein (AGP), could provide this link by acting as a leptin receptor agonist. To determine the feed intake dose response of sheep to central AGP administration, nonlactating, non-pregnant, adult (≥1 yr of age) mixed breed black face ewes (n = 4) weighing 79.0 ± 5.0 (SD) kg were ovarioctomized and surgically implanted with a cannula into a lateral ventricle of the brain. Ewes were kept indoors in individual pens with an environment consisting of a 12-h light/dark photoperiod and approximately 22–24°C. Ewes were fed a diet calculated to meet 100% of daily maintenance requirements and had ad libitum water. Ewes received 1 of 4 treatments [0 (control), 12 (low), 60 (medium), or 300 (high) µg/kg BW AGP (AGP from bovine plasma; Sigma Aldrich Co. Saint Louis, MO)] administered in 500 µL of sterile, nonpyrogenic, isotonic, 0.9% sodium chloride into the lateral ventricle. Sheep were allowed ad libitum access to feed and intake was determined at −72, −48, −24, 0, 2, 4, 6, 8, 12, 24, 36, and 48 h relative to treatment. The study was repeated until all sheep received all treatments with a 10-d washout period between treatments. Data were analyzed using procedures for repeated measures with JMP software (version 10.0.0; SAS Inst. Inc., Cary, NC) and tested for effects of replication, treatment, time, and treatment × time interaction. There was an effect of time (P < 0.0001) and no effect of treatment (P = 0.31), replication (P = 0.45) or treatment × time interaction (P = 0.84) on feed intake. These results indicate central AGP administration may not affect feed intake in...

T18 Precalving body condition score affects leukocytes count following pegbovigrastim treatment in Simmental cows around calving, V. Lopreiato*, D. Britti, and V. M. Morittu, Interdepartmental Services Centre of Veterinary for Human and Animal Health, Department of Health Science, Magna Gracia University, Catanzaro, Italy.

Treatment with granulocyte colony stimulating factor (G-CSF) has been shown to increase neutrophil count and function in transition cows. In this study we tested the hypothesis that cows with high or low body condition score (BCS) may have different response in peripheral blood leukocyte populations count after the treatment with pegbovigrastim (recombinant bovine G-CSF). Twenty-six Simmental cows were randomly allocated to one of 2 treatment groups, homogeneous for parity: pegbovigrastim (PEG; 14 cows) or saline control (CTR; 12 cows) injections. Within each treatment group, cows were divided in 2 subgroups according to a 5-point scale recalving BCS: BCS ≤3.5 (LowBCS; 7 PEG and 6 CTR cows) and BCS ≥3.75 (HighBCS; 7 PEG and 6 CTR cows). Cows received s.c. injections approximately 7 d before (1st) and within 24 h from calving (2nd). Blood samples collected at −7, 0, 1, and 3 d relative to calving (time) were used to determine the complete blood count using an Advia 2120 Hematology Analyzer (Siemens Healthcare Diagnostics inc., Deerfield, IL). The data were analyzed using a MIXED model procedure of SAS (Ver. 9.3) with fixed effects of treatment, BCS, time, and their interactions, and cow was the random effect. Overall, PEG-treated cows resulted in significantly higher neutrophil, basophil, and monocyte counts. These differences were also observed during time from calving onwards. LowBCS cows resulted in a tendency for higher neutrophil, basophil, and lymphocytes count compared with HighBCS cows. Furthermore, a BCS x treatment interaction was observed for neutrophil due to significantly higher count in PEG-LowBCS compared with PEG-HighBCS, while no differences were detected in CTR cows. These results shed light on the pegbovigrastim response in cows with different BCS. Simmental cows with BCS 3.5 or lower before calving experienced a greater responsiveness to pegbovigrastim treatment. However, further studies are required for the understanding mechanism of G-CSF response associated with the degree of adiposity around parturition.

Key Words: thiazolidinedione, mastitis, dairy goat

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sheep or concentrations of AGP reached during systemic inflammation, that may affect feed intake, were not achieved in our model.

**Key Words:** appetite, inflammation, sheep

**T21**  The effects of central administration of a leptin receptor antagonist on endotoxin-induced hypophagia and fever in sheep. B. K. Whitlock*1, B. A. Gregg1, P. A. Parker1, M. K. Waller1, M. Garcia2, B. J. Bradford2, and J. A. Daniel3, 1College of Veterinary Medicine, University of Tennessee, Knoxville, TN, 2Department of Animal Sciences and Industry, Kansas State University, Manhattan, KS, 3Department of Animal Science, Berry College, Mount Berry, GA.

Inflammation is often modeled with endotoxin (LPS from *E. coli*). Intracerebroventricular (ICV) infusion of appetite-stimulatory neuropeptides, many of which act “downstream” of leptin, and fasting inhibit LPS-induced reduction in feed intake and changes in body temperature. The objective of this study was to test the effects of a leptin receptor antagonist on LPS-induced hypophagia and fever in sheep. Adult black face ewes [n = 16; 81.2 ± 23.1 kg] were ovariectomized and fitted with a cannula for ICV infusion. Ewes were kept in individual pens with a 12-h light/dark photoperiod and ~22°C. Ewes had ad libitum access to a diet calculated to meet their requirements. Ewes received 1 of 2 treatments [0 (saline) or 500 (OLA; ovine super-active leptin antagonist)] µg of OLA] administered via ICV infusion 30 min before receiving 1 of 2 peripheral treatments [0 (saline) or 0.4 (LPS; from *E. coli* O55:B5) µg/kg BW LPS] administered via the jugular vein. Feed intake and rectal temperature was determined at ~72, ~48, ~24, 0, 2, 4, 6, 8, 12, 24, 36, and 48 h relative to peripheral treatments. Data were analyzed using repeated measures procedures with JMP software and tested for effects of LPS, OLA, and time, and all their interactions. As expected, LPS decreased feed intake at 2 and 4 h, but increased at 8 h compared with saline (LPS × time, P < 0.05). For ewes receiving LPS, OLA decreased feed intake at 2 h but increased at 12 h compared with saline (LPS × OLA × time, P = 0.07). Rectal temperatures were affected by LPS and OLA in a time-dependent fashion. LPS increased rectal temperatures at 2, 4, and 6 h (LPS × time, P < 0.0001) and OLA increased it at 6, 8, and 12 h (OLA × time, P < 0.0001), both compared with saline. We found no evidence that OLA moderated the hypophagic and febrile effects of LPS (OLA × LPS, P > 0.10). In contrast, OLA administration can increase rectal temperature in sheep.

**Key Words:** inflammation, appetite, fever


Ruminants are less susceptible to mycotoxins than monogastrics. However, a long-term intake of a diet contaminated with fumonisins (FUM) can lead to reduced feed intake and a loss in milk production. In this study we investigated the effect of fumonisin B1 and B2 (FB1, FB2) on rumen fermentation parameters using batch fermentations. Pyrex bottles (n = 15) were inoculated with 100 mL of a mixture containing 50% rumen fluid from bulls, 30% water and 20% synthetic saliva. Culture material of *Fusarium verticilloides* was added to 7 reactor bottles to achieve an end concentration of 7.2 mg/L FB1 and 2.8 mg/L FB2 (FUM treatment). Eight reactor bottles remained untreated (negative control). All reactors were incubated for 24 h at 39°C. Samples of the fermentation broth were taken at 0 h, after 1 h and 24 h of fermentation to determine the concentrations of volatile fatty acids (VFA) and the total bacterial counts by flow cytometry. The pH value was measured directly in the reactors. Statistical analysis was performed using SPSS 19.0. Lactate concentrations were significantly higher in reactors with FUM than in reactors without FUM treatment after 24 h of incubation. In the FUM treated reactors, propionate concentrations were significantly lower after 1 h of incubation and concomitantly, the acetate/propionate ratio was significantly higher. Total bacterial counts were significantly lower in the FUM treated reactors compared with the negative control after 1 h of incubation. The pH value was not significantly different between the treatments. While FB1 concentrations did not change during the incubation (average concentration = 5.3 mg/L), FB2 was significantly decreased after 24 h of fermentation (0 h: 1.7 mg/L; 24 h: 1.1 mg/L). In conclusion, the addition of FUM-containing culture material partially affected parameters of rumen fermentation in vitro. The toxicologically most relevant fumonisin FB1 was not degraded by the rumen microbiota.

**Key Words:** fumonisin, rumen fluid, in vitro


Bovine rumen is inhabited by diverse microbiota that plays important roles in feed digestion, nutrient uptake and energy metabolism. Rumen microbiota is essential to animal production and is affected by animal feeds and dietary additives. Dietary polyphenols can modulate the diversity and function of rumen microbes and improve animal health and productivity. Cowpea based feeds have health and production benefits for ruminants but the effect of cowpea polyphenols on bovine rumen microbiome is yet to be elucidated. The objective of this study was to evaluate the effect of cowpea polyphenols on bovine rumen microbial composition and population. Rumen fluid collected from Holstein-Friesian heifers (n = 3) was treated with cowpea phenolic extract (CPE) for 48 h. Genomic DNA was isolated from the rumen of CPE-treated and control groups and high-throughput sequencing of 16s rRNA gene on an Illumina HiSeq platform was performed. Sequence data were aligned, assembled, and analyzed using MSR: Metagenomics Version: 1.0.0, MSR Version: 2.4.60.8. CPE treatment resulted in variation in rumen microbial communities and composition (P < 0.05) at all taxonomic levels. The phyla *Firmicutes* (40.9%), *Proteobacteria* (30.5%) and *Bacteroidetes* (15.7%) were the dominant bacterial communities in the rumen. CPE treatment enhanced the abundance of many taxa belonging to *Bacteroidetes, Firmicutes* and *Tenericutes* phyla, while methanogenic archaea were reduced. Cellulolytic and fibrolytic bacterial communities were altered by CPE. Overall, treatment with CPE affected the rumen microbial population and diversity. In addition to the impact of cowpea on animal health and production, these results show that cowpea polyphenols modulate the rumen microbiome in cow.

**Key Words:** bovine rumen, cowpea polyphenols, microbiome

**T24**  Relationship between in vitro ceftiofur minimum inhibitory concentration and quarter somatic cell count response after the occurrence of clinical mastitis caused by *Klebsiella spp*. M. J. Fuenzalida*1 and P. L. Ruegg2, 1University of Wisconsin, Madison, Wisconsin, 2Michigan State University, East Lansing, MI.

The objective was to describe in vitro ceftiofur minimum inhibitory concentration (MIC) to inhibit growth (INH) of *Klebsiella* spp. (KLE) and its association with quarter somatic cell count (QSCC) during a
28-d follow-up period (FUP). Cases of clinical mastitis (CM) confirmed as gram-negative were randomly assigned to receive 2-d (short), 8-d (extended) intramammary cefiofur or to a non-treated (control) group. Only cases confirmed as KLE were included in this analysis (n = 38). The primary outcome was QSCC collected 7, 14, 21, and 28 d after enrollment. The Wisconsin Veterinary Diagnostic Laboratory (WVDL) performed in vitro antimicrobial susceptibility tests according to the Clinical and Laboratory Standards Institute (CLSI). The WVDL categorized isolates based on the MIC at which cefiofur (tested ranged from 0.5 to 4.0 µg/mL) completely inhibited KLE (≤0.5, 1.0 and ≥ 4.0 µg/mL). Survival analysis was performed using PROC LIFETEST to measure the probability of QSCC reduction (<200,000 cells/mL) during the FUP by MIC categories of INH. Repeated measures analysis was performed to analyze QSCC changes using PROC MIXED. Proportion of MIC categories of INH were not different among treatment groups (P = 0.78). The probability of QSCC reduction over the FUP was not different among MIC categories of INH of KLE (P = 0.49). The log_{10}SCC for quarters that received 8-d (5.8, P < 0.01) therapy was less than QSCC of quarters that received 2-d (6.4) or no therapy (6.6). Time (P = 0.24) and cefiofur MIC (P = 0.48) were not associated with QSCC. However, an interaction between MIC categories, and treatment group with QSCC was observed (P = 0.04). Quarter SCC did not change with time and was associated with cefiofur therapy. The exposure to cefiofur intramammary therapy seemed to modify the QSCC response when compared with the control group depending on the MIC category of INH.

Table 1 (Abstr. T24).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>&lt;0.5 (n = 17)</th>
<th>1.0 (n = 11)</th>
<th>&gt;4.0 (n = 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>6.3</td>
<td>6.7</td>
<td>6.8</td>
</tr>
<tr>
<td>Short</td>
<td>6.2</td>
<td>6.2</td>
<td>6.7</td>
</tr>
<tr>
<td>Extended</td>
<td>6.2</td>
<td>5.6</td>
<td>5.6</td>
</tr>
</tbody>
</table>

abWithin rows, means with different superscripts differ (P < 0.05).

Key Words: Klebsiella, cefiofur, MIC

T25 Effects of postpartum oral calcium supplementation on productive and reproductive outcomes in Jersey cows. A. Valladecabres* and N. Silva-del-Rio, Veterinary Medicine Teaching and Research Center, University of California-Davis, Tulare, CA.

The effects of postpartum prophylactic oral Ca supplementation on the first Dairy Herd Improvement Association (DHIA) test milk yield, first-service conception and days open within 150 d in milk (DIM) were evaluated on 1,095 multiparous Jersey and Jersey × Holstein cows from 2 commercial herds. After calving, cows were systematically assigned to control (no oral Ca supplementation; n = 553) or oral Ca supplementation (CaOS; 50 to 60 g of Ca as boluses; QuadraticMINI Bio-Vet Inc., Barneveld, WI; n = 542) at 0 and 1 DIM. Blood samples for serum Ca determination were collected before 1st treatment administration for a subset of cows (n = 768). Productive outcomes and days open within 150 DIM were analyzed by ANOVA with the MIXED procedure, with herd as a random effect and first service conception was analyzed by logistic regression with the GLIMMIX procedure of SAS. Additional variables considered for inclusion in the final model were previous lactation milk yield and DIM, gestation length, dry and close-up period lengths, body condition and locomotion scores at calving and calving easiness. There was a dry period length × treatment (P = 0.006) and a tendency for a DIM at 1st test × treatment (P = 0.08) interaction for 1st test milk yield. For cows with a dry period length larger than the herd mean (60 and 73 d for Herd 1 and 2, respectively), CaOS produced 1.6 kg of milk more than control cows (P < 0.05) whereas for cows with a dry period length shorter than the herd mean, CaOS produced 0.9 kg of milk less than control cows (P = 0.05). When the 1st DHIA test occurred >15 DIM, CaOS tended to produce 1.1 kg more of milk than control cows. No significant effect of treatment was observed on reproductive outcomes nor interactions with serum Ca were observed in the preliminary analysis. Our results suggest that the response to postpartum oral Ca supplementation may vary according to different peripartum factors and time relative to treatment administration, but further analysis is required to define these interactions.

Key Words: calcium, hypocalcemia, dairy cow

T26 Establishment of an in vitro rumen model with primary rumen epithelial cells. N. Reisinger*, D. Baranski, D. Wendner, V. Nagl, and E. Mayer, Biomim Research Center, Tulln, Austria.

The rumen and its function gain more and more importance in cattle industry. Only a limited number of studies are available, using primary rumen epithelial cells isolated from cows (Sun et al., 2017; Stumpf et al., 2009). Establishing a cell based rumen in vitro model provides an important tool to investigate not only the rumen metabolism, but will also help to evaluate the effects of different toxins (e.g., bacterial toxins, mycotoxins) on rumen cells. The aim of the study was to isolate, cultivate, and characterize rumen epithelial cells (REC) isolated from the rumen tissue of dairy cows. Furthermore, it was assessed, if deoxynivalenol (DON) and fumonisin B1 (FB1) affect cell viability of REC. Rumen tissue was obtained from a local abattoir and transported on ice to the laboratory. Epithelial cells were isolated from the tissue by enzymatic dissociation with trypsin. Cell growth was visually checked with a light microscope. In addition, cells were characterized via immunostaining for cytokeratin and tight junction proteins. The water-soluble tetrazolium salt (WST-1) assay was used to assess the effects of 2 mycotoxins on cell viability: DON (0–25 µM) and FB1 (0–25 µM). For statistical evaluation of data, GraphPad Prism software (Version 7) was used. As data were normally distributed, ANOVA was performed with Dunnett’s as post-hoc test. P-values of <0.05 were considered as significant. REC were successfully isolated from the rumen tissue and could be cultivated for up to 8 passages without changes in cell morphology. Cells were positively stained for cytokeratin (epithelial cell marker) and all 3 tested tight junction proteins (claudin-1, occludin and zonula occludens-1). DON significantly decreased cell viability at a concentration of 1 µM (P < 0.05), whereas FB1 significantly decreased cell viability at 12.5 µM (P < 0.05). The establishment of an in vitro model with REC was successful as cells could be cultivated and showed cell type specific characteristics. Furthermore, DON seems to exhibit higher cytotoxicity than FB1, in REC.

Key Words: rumen, epithelial cells, in vitro


Treatment with granulocyte colony-stimulating factor (G-CSF) increases neutrophil counts in periparturient cows. The aim of this experiment was to evaluate the effects of treating Holstein cows with pegbovigrastim on periparturient diseases, milk production, and reproductive performance. Cows were randomly allocated into 1 of 2 treatment groups: untreated control (CTR, n = 423) and pegbovigrastim (PEG, n = 417). At 7 d
T28 Impacts of various milk replacer supplements on the health and performance of high-risk calves. E. M. Davis*, Y. Liang, T. A. Batchelder, and M. A. Ballou, Texas Tech University, Lubbock, TX.

Objectives were to determine the effects of supplementing a blend of probiotics, β-glucan, mannanoligosaccharides, and small-molecular-weight molecules from colostrum on the performance and health of high-risk Holstein calves. One hundred bull calves were acquired from a local calf ranch within 24 h of birth and randomly assigned to 1 of 5 treatments added to the milk replacer: Control (CON), no additive; Immu-Prime (ImmPr), 1.5 g/d ImmPr first 3 d only; (3) Beta glucan (BG), 3 g/d BG; (4) Mannaoligosaccharide + Bacillus subtilis (MOS+Bs), 3 g/d MOS + 4 × 10^9 cfu/d Bacillus subtilis; and PROVIDA (PRO), blend of 2 × 10^9 Lactobacillus casei and Enterococcus faecium + 2 × 10^8 Saccharomyces cerevisiae. Calves were weaned at d 56, comingled, and treatment carry-over effects were evaluated through d 84. Starter intake was measured daily and BW weekly. Peripheral blood samples were collected on d 1, 3, 7, 14, 21, 42, 56, and 84 and analyzed for hematometry and serum analyzed for haptoglobin concentrations. Neutrophil function was assessed through surface L-selectin and phagocytic and oxidative burst activities. Data were analyzed using Proc Mixed. The BG consumed the most starter from d 1 to 28 and both the MOS+Bs and ImmPr consumed more than the CON (P = 0.016). Preweaned ADG was greater for PRO and BG when compared with the CON (P = 0.038), both the MOS+Bs and ImmPr were not different than the other treatments. There was no carry-over effect on ADG (P = 0.879). There was a tendency for BG, MOS+Bs, and PRO to have reduced serum haptoglobin throughout the study (P = 0.075). Total leukocyte, neutrophil, and lymphocyte counts were reduced among MOS+Bs calves (P ≤ 0.003), whereas BG calves tended to have the greatest neutrophil:lymphocyte ratio (0.051). Neutrophil L-selectin was reduced among BG (P = 0.030), whereas PRO was not different than BG or the other treatments. Neutrophil oxidative burst was reduced among BG and PRO when compared with CON and ImmPr (P = 0.011), but MOS+Bs was not different than any treatment. Supplementing BG, MOS+Bs, and PRO all influenced performance and health of high risk calves, but the mechanisms appear to be different.

Key Words: periparturient diseases, dairy cow, pegbovigrastim


Withholding information for multiple therapeutic natural products used in organic production is not available. The objective was to determine whether the administration of a prophylactic intrauterine infusion of an oregano extract and oregano essential oils product (Optimum UterFlush (UF), Van Beek Natural Science, Orange City, IA), in postpartum dairy cows results in detectable levels of the active ingredient carvacrol (4-isopropyl-2-methylphenol) in milk. Five primiparous Holstein cows (DIM = 3.8 ± 0.4 d) were randomly selected from the fresh pen of an organic certified dairy farm. After a clinical inspection to ensure the enrolment of healthy individuals, a baseline composite milk sample was collected from each of the 5 cows. All the study cows were treated with an intrauterine infusion consisting in 3.75 mL of UF diluted in 117 mL of distilled water, applied every other day for 3 applications, as indicated by the manufacturer. Two sampling schemes were used: (1) composite milk samples were collected from all cows at 6, 12, 24 and 48 h after the first treatment administration; (2) composite milk samples were collected from a subgroup of 2 cows at 6, 12, 24 and 48 h after the last treatment. After collection, milk samples were frozen at −20°C and stored until lab analysis. The presence of carvacrol was analyzed using gas chromatograph mass spectrometry (ABC testing, Tustin, CA). Carvacrol was not detected in the baseline samples. In contrast, carvacrol was detected in all the samples collected after treatment application. Means and standard deviations were calculated using PROC MEANS from SAS. The average concentration of carvacrol reached its highest point at 6 h after the first UF infusion (0.217 ± 0.159 ppm) and then decreased to 0.084 ± 0.096 ppm at 12 h, to 0.005 ± 0.006 ppm at 24, and to 0.0006 ± 0.001 ppm at 48 h after the first treatment. Samples following scheme 2 resulted in average carvacrol concentrations of 0.097 ± 0.057 ppm at 6 h, 0.089 ± 0.068 at 12 h, 0.042 ± 0.038 ppm at 24 h, and 0.002 ± 0.002 ppm at 48 h after the last treatment. These results indicate that under the recommended dose of UF, carvacrol can be detected in milk after prophylactic intrauterine infusion.

Key Words: metritis, organic, oregano


Lactating dairy cows require a particular composition of nutritional ingredients depending on their production status. The optimal supply of energy and minerals in diet, one of them potassium, is indispensable for the prevention of disbalances, such as hypokalemia or hypoglycemia. Potassium balance is the result of potassium intake, distribution in the organism, and excretion, and closely interacts with glucose and electrolyte metabolism, in which postpartum veterinary treatments frequently intervene. We present a mechanistic, dynamic model for the prevention of disbalances, such as hypokalemia or hypoglycemia.
potassium balance together with a glucose-insulin model in nonlactating and lactating dairy cows based on ordinary differential equations. Parameter values were obtained from fitting to data of a clinical trial as well as from literature. To verify the mechanistic functioning of the model, we validate the model by comparing simulation outcomes with clinical study findings. Furthermore, we perform numerical experiments and compare them with expected behavior according to mechanistic knowledge. The results give insight into the dynamic behavior of the network and open the way for further open questions and hypotheses to be tested, as hypokalemia development and dynamics of different potassium substitution therapeutic strategies.

Key Words: ODE model, potassium, glucose-insulin

T31 Effect of metritis on endometrium tissue transcriptome during puerperium in Holstein lactating cows. S. Genís†, A. Aris†, M. Kaur†, and R. L. A. Cerri‡, 1Department of Ruminant Production, IRTA, Caldes de Montbui, Spain, 2Applied Animal Biology, UBC, Vancouver, BC, Canada.

The objective of this prospective cohort study was to evaluate the gene expression profile of endometrium in dairy cows regarding metritis incidence and parity. Thirty Holstein cows from a group of 90 cows initially enrolled were randomly selected (22 multiparous (MP) and 8 primiparous (PP)) and endometrium biopsies were collected on d 1, 3, and 6 after calving and clinically monitored for metritis. Rectal temperature was measured twice and fever was defined as a temperature ≥39.5°C. A case of metritis was defined as a cow with a red-brown watery foul-smelling uterine discharge or purulent discharge with more than 50% pus and fever on d 1 to 6 postpartum. Twenty-four cows from 30 were selected to analyze the expression of 66 genes measured on the NanoString nCounter Analysis System. The genes selected were related with adhesion, immune system, steroid and prostaglandin biosynthesis regulation, insulin metabolism and transcription factors, and nutrient transporters. The results indicated a different pattern on genes related to immune function by parity. PTX3, involved in antigen presentation, was increased in healthy MP compared with healthy PP whereas inflammatory cytokine TNFa and complement-related protein SERPING1 were upregulated in MP compared with PP (P ≤ 0.05). As expected, metritis incidence affected gene expression pattern related to immune function with a clear increase in expression of antiviral factor MX2 and myosin MTHH10 gene, involved in macrophages recruitment, in metritic cows compared with healthy cows (P ≤ 0.05). Differences in uterus involution with metritis were reflected by downregulation of IGF1 (P < 0.10), involved in endometrium remodeling, and a compensatory upregulation of its receptor IGFR1 in metritic cows compared with healthy cows (P ≤ 0.05). A greater expression of receptors of prostaglandins and oxytocin (PGR and OXTR), involved in involution processes, were observed in metritic PP compared with healthy PP (P ≤ 0.05). Overall, these results reflect the effect of metritis in involution and immune response along with the parity influence in post-calving status of the animal.

Key Words: endometrium, metritis, NanoString

T32 Stabilized rice bran addition in milk of non-weaned organic Holstein calves. A. Velasquez†, D. Manriquez‡, S. Paudyal†, H. Hyungchul†, R. Callan‡, E. Ryan‡, and P. Pinedo†, 1Department of Animal Sciences, College of Agricultural Sciences, Colorado State University, Fort Collins, CO, 2Department of Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, CO, 3Department of Environmental and Radiological Health Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, CO.

The objective was to evaluate the effect of stabilized rice bran (SRB) addition into milk on health and performance of non-weaned dairy calves. Holstein heifer calves (n = 90) were enrolled at 6 ± 1 d old and monitored for 28 d, from July to August 2017. A paired comparison design with 2 treatment groups was considered. Calves were randomly assigned into a control (n = 45) or a treatment group (n = 45) receiving SRB. The treatment group received a daily dose of SRB corresponding to 10% of the daily calories (120 g). Calves were offered milk 3 times a day, in 2.8 L bottles. The SRB dose was divided in 2 feedings (0500 and 1900 h) to allow for adequate suspension in milk. Calf starter was offered in increasing amounts from d 4 of life. A health evaluation was conducted at enrollment and the initial health status was subsequently included as a covariate in the statistical models. Body weight was measured in the first and last day of the study. Additionally, a daily health evaluation was performed to assess health status and disease severity through diarrhea, dehydration, attitude, and milk intake scores. Milk intake was individually recorded after AM and PM feeding. Health status was categorized as not sick, slightly affected, moderately sick, and severely sick. Data were analyzed using repeated measures for binary responses, time to event analyses, and repeated measures ANOVA. Overall, average daily weight gain was not affected by treatment. The total number of calf-days classified as healthy or sick were not different between treatment groups. Similarly, the number of calf-days categorized as slightly affected, moderately sick, or very sick did not differ between treatment groups. The survival analyses indicated no differences in time to first moderate case of disease by treatment group and by health status at enrollment. Time to recovery from a moderate disease status showed a tendency for a shorter recovery time (P = 0.052) for healthy control calves. Our results indicated that the addition of SRB in milk did not have an effect in the performance and health of non-weaned dairy calves.

Key Words: neonatal diarrhea, stabilized rice bran, dairy calves

T33 Evaluation of the incidence of health events compatible with recumbency at dry-off in Denmark. H. L. Hyttel†, K. Krogh‡, and A. de Prado-Taranilla§, 1Danish Cattle Association, SEGES, Skejby, Denmark, 2Ceva Sante Animale, Libourne, France.

The transition from gestation to lactation is marked by significant physiological changes for the individual cow in such a way that disease incidence is the highest in early lactation. Similarly, the transition from lactating to dry state is a critical period for the cow. Cows need to adapt to changes in diet, pen, pen mates and the milk synthesis must be stopped during this period. Most of the research at this period has focused on udder health issues and not on other diseases that cows may experience. The objective of this retrospective study was to evaluate the incidence of health events (HE) compatible with recumbency (REC) at dry-off (DO) in Danish dairy cows using descriptive statistics. Data provided by the Danish Cattle Association (DCA) from lactating cows with registered DO dates for 2 years were used for analysis of incidence of REC at DO. DCA maintains a central database for dairy farmers which contains data on HE. To evaluate the incidence of REC in the period ± 7 d to registered DO dates, 2 different proxies were included in the analysis: (A) records of the following clinical disease codes compatible with recumbency: atypical milk fever, abomasal dilatation/displacement/ulcer/disorder, ketosis, fatty liver or milk fever (REC-1); and (B) records of the use of products containing calcium intended for Intravenous use to treat diseases compatible with recumbency (REC-2). The average number of events reported compatible with recumbency were 1.56‰ and the average of number of treatments compatible with recumbency
were 0.93%. Disease events at dry off are rarely reported but occur with varying incidence. We conclude that health events compatible with recumbency (REC) happen between 7 d before and 7 d after DO in Danish dairy herds in the period of 2015 and 2016. There was no variation between the years 2015 and 2016. More research is needed to evaluate the risks cows may encounter in the transition from lactation to dry period that can lead to health events.

### Table 1 (Abstr. T33).

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of events per 1000 cows dried off</th>
<th>No. of DO dates/laactations</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>1.55</td>
<td>269,162</td>
</tr>
<tr>
<td>2016</td>
<td>1.57</td>
<td>282,424</td>
</tr>
</tbody>
</table>

**Key Words:** dry off, recumbency, paresis

### T34 Udder health, milk production, and longevity parameters across three OmniGen-AF feeding trials. S. C. Nickerson, 1, F. M. Kautz, 1, L. O. Ely, 2, A. D. Rowson, 2, D. J. McLean, 2, and J. D. Chapman, 1 University of Georgia, Athens, GA, 2Phibro Animal Health Corporation, Teaneck, NJ.

Effects of feeding OmniGen-AF (OG) to bred heifers and cows in 3 separate trials in a university dairy herd was summarized. In trial 1, 15 heifers receiving OG beginning at 6 months of age through day of calving; 18 animals served as controls. In trial 2, 35 heifers receiving OG beginning 60 d prior to calving; 28 animals served as controls. In trial 3, 11 late lactation cows receiving OG beginning 60 d prior to calving, 30 d post calving; 11 animals served as controls. OG was fed at 9g/100 kg BW/d. Prior to and/or during each trial, quarter milk samples were collected for microbiological analyses and SCC to monitor mastitis status. Mastitis treatments were recorded, and DHIA records monitored for milk production and cow longevity. Data were analyzed as Control vs. Treatment using ANOVA and means separation with Least Squared Means (PROC GLM, SAS 9.4, 2017). Results demonstrated that for heifers in trials 1 and 2, controls exhibited a greater number of clinical mastitis quarters than OG heifers during the precalving period (12 vs. 9). Likewise, after calving through dry-off for all trials, controls exhibited a greater number of clinical mastitis quarters than OG animals (7 vs. 0). Across all trials, 11 quarters from controls were treated for mastitis, whereas no OG animals were treated. Twelve control quarters became chronically infected, while only 2 OG quarters became chronic. At dry-off, the number of mastitis cases present in control and OG animals were 7 and 2. Numbers of quarters from control and OG animals diagnosed with new IMI between calving and dry-off were 4 and 0. DHIA overall lactation SCC were 3.04 and 2.48 for control and OG animals (P<0.10), and lactation SCC were 209,000/ml and 121,000/ml for control and OG animals (P<0.14). The 305-d ME for milk yield were 11,020 and 11,286 kg for control and OG animals. The 305-d ME for fat was numerically higher for control than OG animals (415 vs. 409 kg), and protein was numerically lower (317 vs. 324 kg). Cull rates were 10.52% for controls and 5.88% for OG animals. OG is effective in maintaining udder health and lowering SCC in dairy cattle when fed at least 2 months prior to calving.

**Key Words:** challenge model, gut health, intestinal barrier function

### T35 Induction of leaky gut through feed restriction or abomasal infusion of resistant starch in healthy post-peak lactating cows. P. Piantoni, 1, M. A. Abeyta, 2, G. F. Schroeder, 1, H. A. Ramirez-Ramirez, 2, H. A. Tucker, 1, and L. H. Baumgard, 1. 1Cargill Animal Nutrition Innovation Campus, Elk River, MN, 2Iowa State University, Ames, IA, 3Novus International, St. Charles, MO.

Leaky gut (decreased intestinal barrier function) decreases milk yield and DMI, and might be related to metabolic disease in dairy cows. Six cannulated Holstein cows (36.3±1 kg/d milk; 212±97 DIM; 691±70 kg BW) were used in a replicated 3×3 Latin square design experiment with 21-d periods (d 1–16 wash-out and d 17–21 challenge) to develop a model to induce leaky gut via feed restriction or altered hind gut fermentation. Treatments during the challenge were ad libitum feeding (CTR), 50% feed restriction (FR), and 500 g/d DM resistant starch (RS; abomasally infused once a day before feeding). Blood samples were collected 4 h after feeding on d 13 and 14 to create a baseline for responses measured, and on d 17, 19, and 21 of each period. Cecal samples were collected 4 and 8 h post-feeding on d 14 and 21. Data were analyzed using the GLIMMIX procedure of SAS with fixed effects of treatment, challenge day (repeated measures) and their interaction, and random effects of square, period, and cow. Baseline values were used as covariates. During the challenge period, FR decreased DMI by 48% and ECM yield overtime (25.4 vs. 28.0 kg/d) compared with CTR and RS (both P<0.05). Overall, FR increased plasma NEFA compared with CTR and RS (160 vs. 82.4 mMg/L; P<0.05). In addition, FR increased plasma total proteins (7.57 vs. 7.36 g/dL), albumin (3.69 vs. 3.43 g/dL), and γ-glutamyltransferase (37.9 vs. 31.8 U/L) at d 19, and decreased alkaline phosphatase (41.4 vs. 49.1 U/L) at d 21 compared with CTR (all P<0.05). Responses to the RS treatment were intermediate between CTR and FR for the last parameters measured. Treatments did not affect plasma concentrations of lipopolysaccharide binding protein, endotoxin, serum amyloid A, interleukin 1-β, and serum coloration (all P>0.20). Treatments did not affect fecal pH 4 h post-feeding. However, RS decreased fecal pH 8 h post-feeding compared with CTR and FR (6.21 vs. 6.80; P<0.05). Lack of responses on inflammatory biomarkers measured in this experiment suggests the models tested did not affect intestinal barrier function, and therefore, a more intense challenge may be needed to induce leaky gut in healthy post-peak cows. Further, evaluating these insults earlier in lactation is of scientific and practical interest.

**Key Words:** challenge model, gut health, intestinal barrier function

### T36 Associations between the general condition and the selling price of culled dairy cows sold at 3 Ontario auction markets in a defined time period. A. Moorman, 1,2, M. A. Godkin, 1, J. Rau, 3, and D. B. Haley, 1, 2. 1Department of Population Medicine, University of Guelph, Guelph, ON, Canada, 2Campbell Centre for the Study of Animal Welfare, University of Guelph, Guelph, ON, Canada, 3Ontario Ministry of Agriculture, Food and Rural Affairs, Elora, ON, Canada.

The purpose of this study was to determine the general condition of culled dairy cows sold at auction markets in Ontario, Canada, and how this related to the sale price of the cow. Culled dairy cows were visually observed and evaluated during weekly sales at licensed Ontario livestock auction markets. Data were collected on 4460 dairy cows sold at 3 Ontario auction markets over 16 weeks. Observers recorded the general condition of dairy cows entering the sales ring, by recording each cow’s hock injury score, body condition score (BCS), gait score, and tail score in accordance with the Dairy Farmers of Canada 2017 proAction Animal Care standards. Observers also recorded each cow’s sale-ring bodyweight (in pounds), breed, and the sale price paid ($/pound). Results were then later converted to metric units. Standardized
data collection sheets were used to record observations and data were directly entered into an excel spreadsheet. The spreadsheet data were then imported into statistical analysis software (SAS) the frequency of each variable, and its relation to price paid, was assessed. Results showed that 27.2% of the culled cows scored a medium to severe hock injury, 40.7% had a BCS ≤ 2, 72.7% had an abnormal gait, and 12.5% had docked tails. Culled cows with a BCS ≤ 2 sold for $0.20 less per kg compared with those with a BCS > 2, which equated to an average loss of $117 per cow (P < 0.001). Cows with an abnormal gait sold for $0.04 less per kg compared with culled cows with a normal gait, which equated to an overall average loss of $32.45 per cow (P < 0.001). The main issues identified with culled cows in this study were the high prevalence of suboptimal body condition and lameness, which translated into a reduced sale price for the cow compared with cows with good body condition and a normal gait.

Key Words: culled cow, cattle transport, auction market

T37  Milk yield relative to supplement intake and rumination time differs by health status for fresh cows milked with automated systems. M. T. M. King*1, K. J. Sparkman1, S. J. LeBlanc2, and T. J. DeVries1, 1Department of Animal Biosciences, University of Guelph, Guelph, ON, Canada, 2Department of Population Medicine, University of Guelph, Guelph, ON, Canada.

The objective of this study was to determine associations of subclinical ketosis (SCK) and blood β-hydroxybutyrate (BHB) with milk yield, supplemental feed consumption, and rumination time of cows in herds using automated milking systems (AMS). We also examined ratios of milk yield relative to supplement intake and rumination time. We monitored 605 cows from 9 AMS herds, testing blood BHB concentrations 1 ×/wk for the first 3 wk of lactation. Milk yield, supplement intake, and rumination data were collected from the AMS computer on each farm for the first 28 DIM for each cow. For analyses, only multiparous cows from 8 herds were included (n = 172 total) and were matched, within farm, to include an equal number of cows in each of 4 health status groups (n = 43 per group): SCK− (BHB ≥ 1.2 mmol/L at ≥1 of 3 tests, with no other disorder in the first 30 DIM), SCK+ (BHB ≥1.2 mmol/L at ≥1 of 3 tests, with another health disorder), HLT− (BHB always <1.2 mmol/L, with no other disorder), or HLT+ (BHB always <1.2 mmol/L, with a health disorder). Multivariable mixed-effect linear regression models were used to make comparisons by health status. Linear and logistic regressions were used to analyze associations of BHB concentrations and risk of SCK, respectively. Milk yield (P < 0.001) and rumination time (P < 0.001) varied by health status (HLT+: 32.8 kg/d, 477 min/d; SCK+: 35.1 kg/d, 431 min/d; SCK−: 39.5 kg/d, 484 min/d; HLT−: 37.2 kg/d, 500 min/d), but there was no difference in supplement intake by health status group (averaging 4.2 kg/d). As a result, milk yield relative to supplement intake (P < 0.001) and rumination time (P < 0.001) differed by health status, and both were associated with BHB and risk of SCK (P < 0.05). Cows in SCK− had the highest milk yield and ratio of milk yield:supplement intake, but SCK+ cows had the lowest rumination time and the highest milk yield:rumination ratio. These results highlight the differences in milk production (per day and relative to supplement consumption or rumination time) associated with blood BHB and health status, and the potential to modify supplementation in AMS to reduce negative energy balance.

Key Words: gut health, sequencing, scouring

T38  Young calves that will suffer at least one episode of diarrhea in the first 30 days of life have a different fecal microbiome than those that will not incur diarrhea. F. Correa1, F. Fábregas2, V. Aragón3, and Á. Bach123, 1IRTA, Centre de Recerca en Sanitat Animal (CReSA, IRTA-UAB), Barcelona, Spain, 2Department of Ruminant Production, IRTA, Barcelona, Spain, 3ICREA, Barcelona, Spain.

Diarrhea is the most common affliction of young calves during the first weeks of life. Reasons for diarrhea are multifactorial, but we hypothesized that the composition of the microbiota inhabiting the gastrointestinal tract may act as a protective barrier or as a facilitator for colonization of the intestine by pathogenic bacteria or viruses. For a period of 2 mo, all healthy calves that entered a commercial contract heifer operation were enrolled in a sampling scheme consisting of collecting fecal samples from the rectum at arrival and at 30 d of life. Calves were checked daily by a veterinarian. After completing all samplings, calves were classified as HEALTHY if it did not have diarrhea, or as DIA if they experienced at least one case of diarrhea. Calves from DIA and HEALTHY categories were randomly selected and their fecal samples processed to recover DNA. Then, the 16sRNA gene was sequenced (Illumina MiSeq 2X250) individually using barcoded primers. One animal from DIA and 3 from HEALTHY were excluded from sequencing due to poor DNA recovery. Thus, data presented herein correspond to 18 (7 HEALTHY and 11 DIA) Holstein female calves (44.2 ± 2.9 kg of initial BW). The Quantitative Insights Into Microbial Ecology software package was used to define operational taxonomic units (OTUs) and compare the community structures and taxonomical profiles of calves. The diversity within samples (α) and between groups (β) were estimated, and a discriminant analysis of OTUs at the genus level was performed between HEALTHY and DIA calves at arrival. First cases of diarrhea occurred at 19.3 ± 8.6 d of age. Alpha diversity increased with age (P < 0.05), but at arrival, calves in the HEALTHY category had greater (P < 0.05) α diversity than DIA calves at arrival. Based on the discriminant analysis, HEALTHY calves, in general, had greater abundance of Collinsella, Lactobacillus, Lachnospiraceae, Subdoligranulum, and Megagphaera, and lower abundance of Anaerostipes, Fecalibacterium, and Ruminococcus than DIA calves. Management and nutritional practices that promote this microbiome pattern before 10 d of life may represent a potential alternative to minimize diarrhea.

Key Words: robotic milking, energy balance, subclinical ketosis

T39  On-farm selection of adult fecal microbiome for transplantation into neonatal dairy calves as an enhancer for growth and development. F. Rosi*, E. Trevisi2, and J. S. Osorio1, 1Dairy and Food Science Department, South Dakota State University, Brookings, SD, US, 2Department of Animal Sciences, Food and Nutrition, Università Cattolica del Sacro Cuore, Piacenza, Italy.

The objective of this study was to evaluate the effects of early life fecal microbial transplantation (FMT) from adult healthy donors into neonatal dairy calves on growth and health performance as well as effects on inflammation and metabolism. The selection of the adult donor was based on health and production records at the Dairy Research and Training Facility (DRTF) at South Dakota State University as well as fecal samples testing negative for Mycobacterium paratuberculosis, Salmonella, and Cryptosporidium. The final selected donor from the DRTF farm was a fifth lactation Holstein dairy cow, among the highest milk yield (~11,090 kg/lactation) of the herd, no treatment records for any disease or metabolic disorder, and negative for all pathogens mentioned above. Sixteen healthy newborn Holstein calves (n = 8/trt) housed in individual hutches were used in a randomized complete block design from birth to 7 wk of age. Calves were fed 2.8 L/d of antibiotic-free milk replacer 2 × /d during wk 1 to 5, 1 × /d in wk 6, and weaned at d 42.
Antibiotic-free starter pellets and water were fed ad libitum. Treatments were a baseline nutritional program (CON) or calves subjected to 1×/d inoculations with 25 g of fecal donor material (FMT) mixed in the milk replacer from 8 to 12 d of age. Individual intakes of milk and pellets were measured daily. Fecal and respiratory scores were recorded daily. Body weight (BW) and withers height (WH) were recorded weekly. Blood samples were collected weekly for metabolic and inflammatory profiling during the experiment. Data were analyzed using the MIXED procedure of SAS. There was a trend (P = 0.09) for greater BW (50.8 vs 52.7 kg ± 0.7) in FMT calves. Similarly, there was a trend for greater WH (P = 0.13) in FMT (82.6 vs 83.8 kg ± 0.49) calves. Starter intake was not affected (P = 0.86). Fecal scores were not affected (P = 0.25) by FMT inoculation. Although mild improvements were observed in BW and WH by FMT inoculation, these are suggestive that neonatal dairy calves may benefit from this approach to enhance gut health and immunity, which might be explained by biomarkers profiling in blood.

Key Words: calves, growth, microbiota

T40 Evaluation of the potential enrichment of RNA from immune cells during isolation of fecal RNA from neonatal dairy calves. F. Rosás and J. S. Osorio, Dairy and Food Science Department, South Dakota State University, Brookings, SD.

The fecal RNA is a novel approach to study the biological adaptations of the gastrointestinal tract (GI) of neonatal dairy calves through gene expression analysis. Our objectives in this study was to determine the potential enrichment of RNA from immune cells during isolation of fecal RNA from dairy calves, by a comparative transcriptomic profiling of genes specific for polymorphonuclear leukocytes (PMNL) and macrophages (MPO) and GI tract epithelial cells (FABP2) and cytokeratin 8 (KRT8). Fecal and blood samples were simultaneously taken from 8 neonatal Holstein calves with less than 3 wk old. The total RNA was isolated from 200 mg of feces, using a Trizol based method along with the RNeasy Plus Mini Kit (Qiagen), following the manufacturer’s instructions with some modifications. The overall RNA quantity for all fecal samples was 378.8 ± 192.3 ng/μL and purity (260/280 ratio) was 2.0 ± 0.1 determined via Nanodrop. Using the same RNA isolation method, PMNL was isolated from 100 mL of total blood, and the overall RNA quantity for all PMNL samples was 55.6 ± 32.7 ng/μL, and the purity was 1.9 ± 0.1. The standard curve was composite from all samples including cDNA from fecal and PMNL. The internal control genes used in this experiment were GOLGA5, OSBP2, SMUG1, B2M, ACTB, GAPDH, and RPS9. Normalized gene expression data were log-transformed before statistical analysis using the Proc Mixed of SAS (SAS 9.4). The mRNA expression of KRT8 was greater (P < 0.01) in fecal RNA than in PMNL, and a trend (P = 0.08) was observed for greater expression of FABP2 in fecal RNA than PMNL. In contrast to KRT8 and FABP2, the mRNA expression of MPO was not detectable on fecal RNA, and this was reflected in a lack of amplification over the standard 40 cycles of the RT-qPCR. However, the MPO was amplified on PMNL samples. Our results indicate that RNA isolated from fecal samples contain a low amount of immune cells such as PMNL and further confirms that the signal observed in genes related to inflammation in fecal samples. However, these results need to be validated between normal and diarrhea samples.

Key Words: fecal RNA, immune cell, inflammation

T41 Pre- and post-weaning performance and health of dairy calves fed milk replacers supplemented with egg antibodies, direct-fed microbials, neomycin sulfate and oxytetracycline. D. M. Ziegler*, H. Chester-Jones¹, B. E. Ziegler², A. K. Manthey³, and J. L. Olson³. ¹University of Minnesota, Waseca, MN, ²Hubbard Feeds Inc., Mankato, MN, ³Milk Products, Chilton, WI.

One hundred seven (2 to 5 d old) individually fed Holstein heifer calves (38.5 ± 0.67 kg) from 3 commercial dairies were randomly assigned to 1 of 4 milk replacer treatments (MR) supplemented with egg antibodies (EA), direct-fed microbials (DFM), or neomycin sulfate and oxytetracycline (NT) to evaluate pre- (d 1–42) and post weaning (d 43–56) calf performance and health. The study was conducted between May and August 2017. Treatments included (1) all-milk protein, non-medicated MR 20% CP:20% Fat fed at 0.28 kg in 2 L of water 2× daily from d 1 to d 35 and 1x daily from d 36 to weaning at d 42, (CON); (2) MR as in CON supplemented with NT at a rate of 22 mg/kg BW/d for 14 d, (MRNT); (3) MR as in CON supplemented with a blend of egg antibodies and DFM containing multiple strains of Lactobacillus organisms and lactic acid producing bacteria at a rate of 40 g/d for 14 d then 20 g/d for 14 d, (MREA); (4) MR as in CON supplemented with an additive blend of serum and plasma proteins, Bio-Mos, essential oils, and multiple DFM strains at a rate of 40 g/d for 14 d then 20 g/d for 14 d, (MRAB). Calf starter (18% CP as fed) and water were offered free choice from d 1 to 56. Data were analyzed using the PROC mixed procedures of SAS and repeated measures analyses applied where appropriate. There were no differences in pre- (d 1–42), post weaning (d 43–56), and overall (d 1–56) gains averaging 0.49, 1.06, and 0.63 kg/d respectively (P > 0.05). Pre- (d 1–42), and post weaning (d 43–56), calf starter intake was similar across treatments averaging 13.1 and 28.1 kg total intake, respectively. There were no differences in health costs, gain/feeding, or hip height gain across treatments (P > 0.05). The number of days fecal scores were 3 ≥ (d 1–42, 1 = normal, 4 = very loose, watery) were similar across treatments, averaging 1.61, 1.82, 1.27, and 1.99 d respectively (P > 0.05). Under conditions of this study, feeding calves a MR blended with EA and DFM, NT or other additives did not affect growth compared with calves fed a non-medicated MR.

Key Words: calf performance, milk replacer, egg antibody

T42 Pre- and post-weaning performance and health of dairy calves fed milk replacers supplemented with an organic direct-fed microbial or neomycin sulfate and oxytetracycline. D. M. Ziegler*, H. Chester-Jones¹, T. Marubashì², and R. Shimizu². ¹University of Minnesota, Waseca, MN, ²Calpis America Inc., Peachtree City, GA.

One hundred six (2 to 5 d old) individually fed Holstein heifer calves (39.0 ± 0.63 kg) from 3 commercial dairies were randomly assigned to 1 of 4 milk replacer treatments (MR) supplemented with an organic direct-fed microbial (DFM), neomycin sulfate and oxytetracycline (NT) or combination of (DFM and NT) to evaluate pre- (d 1–42) and post weaning (d 43–56) calf performance and health. The study was conducted between March and June 2017. Treatments included (1) all-milk-protein, non-medicated MR 20% CP:20% fat fed at 0.28 kg in 2 L of water 2x daily from d 1 to d 35 and 1x daily from d 36 to weaning at d 42, (CON); (2) MR as in CON supplemented with NT at a rate of 22 mg/kg BW/d for 14 d, (MRNT); (3) MR as in CON supplemented with 4 g daily of a DFM containing Bacillus subtilis strain C-3102 (1.2 × 10⁹ cfu/g. d 1–42 ; MRDFM); (4) MR as in MRNT supplemented with DFM as in MRDFM, (MRNTDFM); Calf starter (18% CP as fed) and water were offered free choice from d 1 to 56. Data were analyzed using the mixed procedures of SAS and repeated measures applied where appropriate. There were no differences in pre- (d 1–42), post-weaning (d 43–56), or overall (d 1–56) gains averaging 0.54, 1.00, 0.65 kg/d respectively (P > 0.05). Pre- (d 1–42) and post-weaning (d 43–56)
A cross-sectional study was conducted to describe and typify calf health and production management among dairy herds from Trenque Lauquen County, Argentina. A comprehensive survey about calf health care and nutrition management was carried out in 46 randomly selected dairy herds with 60 to 400 cows, 66% of the county dairy herd population belonging to that segment. The questionnaire was divided into topics and subjected to correlation analysis to reduce collinear variables. A multiple correspondence method was used to select the most discriminant management factors, and those factors were used in a hierarchical cluster analysis to typify the herds. The overall survey response rate was 83%. The most discriminant factors were pre-fresh management, colostrum and health management, record keeping, workers profile, and producers’ management and performance perceptions. We identified 2 clusters (C1 = 22 herds and C2 = 24 herds) including both individual and collective rearing systems with differences regarding several aspects. Farms in C1 were better managed in comparison with those included in C2. Most of C1 producers vaccinated cows at dry-off and had a pre-fresh pen, administered colostrum artificially, disinfected calves navels and fed them more than 4 L of milk daily, and hired calf managers with higher education level. The dairy farm clusters found and described in this study would contribute to a better understanding of the calf management variation between herds focusing on the strengths and weaknesses of each cluster, and it would also contribute as a research input for extension programs on calf management.

Key Words: calf health, cluster, calf management

T45 Effects of a fully acidified dietary cation-anion difference diet fed at 2 different concentrations of dietary calcium inclusion prepartum on uterine health of Holstein cows after parturition. K. T. Ryan*1, K. M. Glosson1, X. Zhang2, S. S. Bascom3, A. D. Rowson3, and F. C. Cardoso1, 1Department of Animal Sciences, University of Illinois, Urbana, IL, 2Institute of Animal Nutrition, Key Laboratory of Low Carbon Culture and Safety Production in Cattle in Sichuan, Sichuan Agricultural University, Chendu, Sichuan, China, 3Phibro Animal Health Corp., Teaneck, NJ.

Feed management during the transition period can play an important role in the cow’s reproductive tract recovery and function following parturition. The objective of this study was to determine the effects of feeding a fully acidified dietary cation-anion difference (DCAD) diet prepartum to Holstein cows (n = 76) at 2 different concentrations of dietary calcium (Ca) inclusion on uterine environment postpartum. Multiparous Holstein cows were enrolled at 50d before expected calving and followed until 75 DIM. Treatments began at 28d before expected calving and were CON (n = 23), a positive DCAD diet with low dietary Ca (0.4% DM); LOW (n = 22), a fully acidified DCAD diet (urine pH = 5.7) with low dietary Ca (0.4% DM); HIGH (n = 25), a fully acidified DCAD diet (urine pH = 5.7) with high dietary Ca (2.0% DM). Uterine health was evaluated at 4, 7, 10, 13, 15, 17, and 30 DIM by evaluating vaginal discharge for signs of metritis via Metricheck in 2 ways: a MC score (0–3, where 3 is a discharge containing ≥50% purulent material) and by smell score (0 or 3, where 0 is no smell and 3 is a putrid smell). Swabs of the endometrium were collected at 15 and 30 DIM, and followed until 75 DIM. Treatments began at 28d before expected calving and were CON (n = 23), a positive DCAD diet with low dietary Ca (0.4% DM); LOW (n = 22), a fully acidified DCAD diet (urine pH = 5.7) with low dietary Ca (0.4% DM); HIGH (n = 25), a fully acidified DCAD diet (urine pH = 5.7) with high dietary Ca (2.0% DM). Uterine health was evaluated at 4, 7, 10, 13, 15, 17, and 30 DIM by evaluating vaginal discharge for signs of metritis via Metricheck in 2 ways: a MC score (0–3, where 3 is a discharge containing ≥50% purulent material) and by smell score (0 or 3, where 0 is no smell and 3 is a putrid smell). Swabs of the endometrium were collected at 15 and 30 DIM, streaked onto slides, stained, and scanned using whole image scanning. Polymorphonuclear leukocytes (PMN) were counted and a percentage was calculated from these slides. Data collected were analyzed using PROC MIXED in SAS. Contrasts included CONT1 (CON vs average of LOW and HIGH) and CONT2 (LOW vs HIGH). Cows in CON (1.82 ± 0.11) tended to have a lower (P = 0.06) MC score than the average of cows in LOW and HIGH (2.07 ± 0.12) and cows in LOW tended to have higher MC score than cows in HIGH (1.97 ± 0.08). There were
Effects of fully acidified dietary cation-anion difference diet fed at 2 different concentrations of dietary calcium inclusion prepartum on inflammatory related blood metabolites. K. T. Ryan1, K. M. Glosson1, X. Zhang2, S. S. Bascom2, A. D. Rowson3, and F. C. Cardoso1, 1Department of Animal Sciences, University of Illinois, Urbana, IL, 2Institute of Animal Nutrition, Key Laboratory of Low Carbon Culture and Safety Production in Cattle in Sichuan, Sichuan Agricultural University, Chengdu, Sichuan, China, 3Phibro Animal Health Corp., Teaneck, NJ.

Inflammatory related blood metabolites are key indicators of stress that dairy cows can experience during the transition period. The objective of this study was to determine the effects of feeding a fully acidified dietary cation-anion difference (DCAD) diet prepartum to Holstein cows (n = 76) at 2 different concentrations of dietary Ca on circulating inflammatory related blood metabolites both pre- and postpartum. Multiparous Holstein cows were enrolled 50d before expected calving and followed until 75 DIM. Treatments began 28d before expected calving and were CON (n = 23), a positive DCAD diet with low dietary Ca (0.4% DM); LOW (n = 22), a fully acidified DCAD diet (urine pH = 5.7); HIGH (n = 25), a fully acidified DCAD diet (urine pH = 5.7) with high dietary Ca (2.0% DM). Plasma lipopolysaccharide binding protein (LBP) and plasma serum amyloid A (SAA) were assessed at −30, −21, −7, and 30 d relative to calving using commercially available kits. Data were analyzed using PROC MIXED in SAS (v9.4). Contrasts included CONT1 (CON vs. the average of LOW and HIGH) and CONT2 (LOW vs. HIGH). Prepartum LBP and SAA concentrations increased for all treatments as cows approached calving (P < 0.001 and P < 0.001, respectively). Prepartum concentrations of LBP and SAA were 5.21, 5.01, 8.65 ± 0.47 µg/mL, and 20.28, 31.18, 41.11 ± 0.9 µg/mL for d −30, −21, and −7, respectively. Cows fed LOW had a higher LBP concentration prepartum than cows fed HIGH (7.33 vs. 5.84 ± 0.47 µg/mL, respectively; P = 0.03). Postpartum LBP and SAA concentrations decreased for all treatments over time (P = 0.006 and P = 0.02, respectively). Postpartum concentrations of LBP and SAA were 9.09, 7.76 ± 0.37 µg/mL, and 37.49, 34.57 ± 0.82 µg/mL for d 15, and 30, respectively. In conclusion, cows in HIGH had a lower circulating LBP concentration than cows in LOW prepartum. However, postpartum LBP, and both pre- and postpartum SAA concentrations were not statistically different in both CONT1 and CONT2. Cows in all treatments follow a general increase of LBP and SAA concentrations approaching calving and a decrease of LBP and SAA concentrations postpartum.

Key Words: DCAD, inflammatory, LPS binding protein (LBP)

Investigation of antibiotic alternatives to improve health and growth of veal calves. J. A. Pempek*, E. M. Holder, K. L. Proudfoot, M. Masterson, and G. G. Habing, Department of Veterinary Preventive Medicine, The Ohio State University, Columbus, OH.

Veal calves are inherently susceptible to disease early in life, resulting in frequent antimicrobial use. Recent regulations mandate calves no longer be fed medicinally important antibiotics continuously in milk or milk replacer. Thus, improvements in antimicrobial stewardship necessitate alternative therapies to improve calf health and growth, while reducing the need for antimicrobials that are important to human health. This study investigated the effect of 2 alternative therapies, lactoferrin (an iron-binding protein found in colostrum) and cinnamaldehyde (an essential oil of the cinnamon plant) on growth, disease incidence, and mortality risk in special-fed veal calves. On the day of arrival to the growing facility (3 to 7 d of age), calves (n = 80 per treatment) were randomized to 1 of 3 treatments: 1) control (no supplement), 2) lactoferrin (1 g/d in milk replacer for 7 d), or 3) cinnamaldehyde (1 g/d in milk replacer for 21 d). Body weight was measured on the day of arrival (d 0), 21, and 42 d post-arrival. Health assessments were performed twice weekly through 21 d, and mortality records were obtained through 6 wk post-arrival. A repeated measures ANOVA was used to compare growth between treatment groups, and a poisson regression model (PROC GENMOD, SAS) was used to test differences between groups in the frequency of diarrhea (fecal score ≥2 with and without depression and temperature) and disease through 3 wk post-arrival. Body weight and average daily gain were similar (P > 0.05) between treatments. Neither lactoferrin nor cinnamaldehyde had an effect on diarrhea incidence. However, the risk of navel inflammation was lower for calves that received cinnamaldehyde compared with calves in the control group (RR: 0.68; 95% CI: 0.47–0.99; P = 0.04). Mortality through 6 wk post-arrival was low, with 4, 1, and 0 deaths from control, lactoferrin, and cinnamaldehyde treatment groups, respectively. Additional research is needed to investigate various doses of these antibiotics or their combinations.
of these alternative therapies on calf health and growth, in addition to different routes of administration.

Key Words: calf diarrhea, lactoferrin, cinnamaldehyde

**T49 A multi-site randomized field trial to evaluate the influence of lactoferrin on health of dairy calves with diarrhea.** J. A. Pempek*, L. R. Watkins, C. E. Bruner, and G. G. Habling, Department of Veterinary Preventive Medicine, The Ohio State University, Columbus, OH.

Neonatal calf diarrhea remains the most common cause of mortality and antimicrobial use in dairy calves. Reduced overall antimicrobial use necessitates research on viable alternative therapies for calf diarrhea. Lactoferrin, an iron-binding protein found in colostrum, has been shown to improve growth and reduce mortality in pre-weaned heifer calves. The objective of this study was to investigate the effect of lactoferrin on the health of pre-weaned dairy heifer calves with diarrhea. This randomized controlled field trial was conducted on 5 commercial dairy farms in Ohio. In total, 485 calves (≤ 21 d of age) were enrolled after first diagnosis of diarrhea (fecal score ≥ 3 defined as loose to watery), and randomly assigned to receive an oral dose of lactoferrin (3 g lactoferrin powder dissolved in 30 mL water) or water (control) once daily for 3 consecutive days. The frequency of diarrhea through 35 d post-enrollment did not differ between control and lactoferrin treatment groups, respectively, were diagnosed with severe diarrhea (fecal score = 4). The frequency of diarrhea through 35 d post-enrollment did not differ between control and lactoferrin treatment groups (RR: 1.01, 95% CI: 0.93–1.08; P = 0.87). Further, depression (depression score ≥ 2 defined as moderate to severe depression) was not different for calves supplemented with lactoferrin compared with calves in the control group (RR: 0.85, 95% CI: 0.59–1.22; P = 0.37). This study suggests supplementing lactoferrin to dairy calves with diarrhea does not influence the frequency of diarrhea or depression 5 wk post-diagnosis; however, additional analyses of secondary outcomes and future research may uncover longer-term benefits of supplemental lactoferrin on morbidity and mortality in dairy heifer calves.

Key Words: galecit, somatic cell, bovine

**T50 Two variants of galecit-8 secretion and expression in bovine whole blood.** E. Eluka-Okolohdoh*, E. Asiamah, K. Ekweimalor, B. Mulakala, S. Adjei-Fremah, and M. Worku, North Carolina Agricultural and Technical State University, Greensboro, NC.

Galecitins (Gal) are glycan-binding proteins. Galecit-8 modulates inflammatory cell adhesion, migration, proliferation, and apoptosis. The objective of this study was to determine the transcription and secretion of Gal-8 variants in blood from high (H) and low (L) SCC cows. HSCC was an early indicator of mastitis (SCC > 200,000). Clinically healthy Holstein-Friesian cows from the North Carolina A&T State University Dairy Unit were used for this study (n = 10). Whole blood was collected from the jugular vein of 5 HSCC and 5 LSCC cows based on Dairy herd Index (DHI) records. Plasma was extracted from blood. Total protein concentration for LSCC and HSCC was 5,289 ng/total plasma protein concentration for LSCC and HSCC was 5,289 ng/mL and there was no difference between the 2 groups (P > 0.05). Gal-8 was secreted in plasma. The average concentration of Gal-8 was higher (P = 0.003) in LSCC (2.88 ng/mL) compared with HSCC (1.99 ng/mL) cows. Both variants of LGALS8 were detected in PMNL. LGALS8_1 expression was 3.2 folds higher in LSCC compared with HSCC cows; LGALS8_2 expression was 3.6-fold higher in LSCC compared with HSCC cows. Our results suggest a possible association between SCC levels and Gal-8. Thus, further studies are needed to better understand the role of galecit-8 in dairy cows.

Key Words: galecit, somatic cell, bovine

**T51 Impact of Saccharomyces cerevisiae fermentation product (SCFP) on oxidative status and immune response of transition dairy cattle.** S. E. Sivinski†*, K. E. Olagaray1, L. K. Mamedova1, J. M. McIntosh1, B. A. Saylor1, J. E. Shaffer1, J. A. Sauls1, I. Yoon2, and B. J. Bradford1, 1Kansas State University, Manhattan, KS, 2Diamond V, Cedar Rapids, IA.

Holstein cows (n = 64) were used to evaluate effects of dietary SCFP (NutriTek, Diamond V, Cedar Rapids, IA) on oxidative status and immune response during the transition period. Control (CON; n = 30) or SCFP (n = 34) TMR were fed from −29 ± 5 to 42 d relative to calving (45% NDF, 14% starch prepartum; 32% NDF, 19% starch postpartum). Blood samples were collected during wk −4, −2, 1, 2, and 5 relative to calving. Oxidative status was evaluated in plasma by retinol and tocopherol concentrations, glutathione peroxidase activity (GPx), and Trolox equivalent antioxidant capacity (TEAC). Innate immune response was evaluated by PMA-stimulated oxidative burst capacity (OBC) and glycoprotein content of polymorphonuclear cells (neutrophils; PMN) isolated from blood. Ovolumin was administered with adjuvant on d 7 and 21 postpartum, and adaptive immune response was evaluated by serum anti-ovalbumin IgG content on d 28 and 35. Mixed models were used to assess effects of treatment, time, parity, and all interactions. Treatment did not affect oxidative or immune parameters (all P > 0.05). There were no treatment × wk interactions except for plasma tocopherol concentration, which tended to be greater in SCFP cows during wk 2 (P = 0.06). There was a tendency for a treatment × parity interaction for anti-ovalbumin IgG concentrations, which tended to be greater in SCFP vs. CON primiparous cows (P = 0.08). Relationships among oxidative and immune measures were explored with regression techniques. In general, individual antioxidant measures weakly predicted TEAC (R² ≤ 0.20), but GPx became a stronger predictor during wk 2 (R² = 0.31; P < 0.01). Blood glucose showed weak but positive associations with PMN glycoprotein content postpartum (R² = 0.14; P ≤ 0.001), but not prepartum (R² < 0.01). PMN glycoprotein did not predict OBC at any time point (R² < 0.05; P > 0.10). In this cohort of transition cows with low disease incidence, SCFP generally did not affect oxidative or immune parameters, antioxidant measures weakly predicted TEAC, and PMN function was not related to glycoprotein content.

Key Words: yeast culture, transition, immunity

**T52 Effects of metritis on incidence of postpartum disorders and days in the hospital in Holstein dairy cows.** F. S. Lima†, A. Vieira-Neto2, and J. E. Santos3, 1Department of Veterinary Clinical
Objectives were to compare the incidence of disease and days spent in the hospital for cows diagnosed with metritis treated either with ampicillin trihydrate (AMP) or ceftiofur hydrochloride (CEFT) and matched control herdmates without metritis. Holstein cows with fetid, reddish/brownish watery vaginal discharge were diagnosed with metritis. Cows with metritis were blocked by parity and type of metritis (with or without fever) and assigned randomly to receive 11 mg/kg of AMP (n = 259) or 2.2 mg/kg of CEFT (n = 269) daily for 5 d. A cohort of healthy cows (NOMET, n = 268) with the same days postpartum and parity was selected as controls. Postpartum disorders (displacement of abomasum, fever, mastitis, and pneumonia) were monitored for the first 60 d postpartum. Data were analyzed using GLIMMIX procedure of SAS. Cows with metritis tended to have a higher incidence (P = 0.09) of postpartum disorders than cows without metritis (41.3% vs. 29.5%). Multiparous cows had a higher incidence (P < 0.001) of postpartum disorders than primiparous cows (44.9% vs. 28.9%).

The incidence postpartum disorders was greater (P = 0.01) in AMP (45.6%) cows than in CEFT (37.2%) and NOMET (29.5%) cows. There were no interactions among treatment and parity. Cows with metritis spent more days in the hospital than (P < 0.01) cows without metritis (6.0 vs. 2.7). The number of days in hospital was greater (P < 0.01) in AMP (8.6) cows than in CEFT (3.4) and NOMET (2.7). Cows with metritis spent more days in the hospital (P < 0.01) than primiparous cows (5.8 vs. 4.1). Among the individual disorders, mastitis was increased in AMP (34.0%) when compared with CEFT (24.5%) and NOMET (19.0%). There was no interaction between treatment and parity. Metritis increased the number of days in the hospital and tended to increase postpartum disorder. Cows treated with AMP had more postpartum disorders, cases of mastitis and a greater number of days in the hospital than CEFT cows.

Key Words: metritis, postpartum disorder, mastitis

**T54** Blackberry pomace—A novel feed supplement for transition dairy cows. K. Swanson*, S. Akers, K. Estenson, R. Wilson, M. Keller, and G. Bobe, Oregon State University, Corvallis, OR.

Blackberry pomace (BBP) is a by-product generated from juice processing that contains skins, pulp, and seeds of the original fruit. Currently, BBP is disposed in landfills. As alternative, we propose BBP as a novel antioxidant-rich feed supplement for dairy cows during the transition period. Thus, the objective of this study was to evaluate BBP as antioxidant-rich feed supplement in transition dairy cows. Using a randomized block design, 24 multiparous dairy cows (blocked by breed) were given 0 (Control), 57 (Low BBP), or 114 g/d (High BBP) of dried BBP as a top dressing to their fed total mixed ration (TMR). Supplementation started 28 d before predicted calving date and ended 28 d post calving. Blood and milk samples were collected on d 0, 1, 3, 7, 14, 21, and 28 postpartum. Besides markers of metabolism, inflammation, and antioxidant status, we measured at d 7, 14, 21, and 28 postpartum serum concentrations of estradiol and progesterone as indicators of follicular and luteal activity, respectively. In addition, we recorded reproductive events after calving. Reproductive data were analyzed using PROC MIXED, PROC GLIMMIX, and PROC LIFEREG in SAS version 9.4. Fixed effects were breed (Holstein, Jersey) and supplementation (Control, Low BB, High BBP). For repeated-measures, the variance-covariance matrix was modeled using heterogeneous compound symmetry. High BBP cows showed first heat 12 d earlier (P = 0.02), were first bred 15 d earlier (P = 0.04), and were open for 73 d less (P = 0.002) than Control cows, as more cows tended to be confirmed pregnant from their first breeding (P = 0.06). Moreover, High BB cows resumed earlier follicular activity than Control cows, as Control cows did not reach serum estradiol concentrations similar to those of High BBP cows at d 7 until d 28 (treatment x time effect: P = 0.08). Furthermore, High BBP cows tended to have higher serum progesterone concentrations than Control cows (P = 0.08), as High BBP cows reached serum progesterone concentrations indicative of luteal activity at d 21, one week ahead of Control cows. Our results suggest that supplementation with 112 g/d of BBP may accelerate resumption of ovarian activity and improve reproductive performance of dairy cows.

Key Words: blackberry pomace, reproduction, transition cow