
Morbidity rate is still high in modern dairy calf operations. Nutritional strategies based on n-3 FA to positively modulate the immune system have barely been studied in dairy calves. The aim was to assess the effect of a based-fish oil product versus canola oil (control) on blood lactate concentration, rectal temperature (RT), nasal (NS) and fecal score (FS), BW and starter intake (SI) in Holstein calves. The study was conducted at the Dairy Research Center UGA, Tifton Campus. Between September and November 2019, 30 calves were randomly assigned by sex at birth to 2 groups. Calves were fed a milk replacer (26% CP, 20% fat, 12.5% solution), 2 L in a.m. and 2 L in p.m. during wk 1. Then, 3 L in a.m. and 3 L in p.m. between wk 2 and 7, and 3 L in a.m. during wk 8. Starter and water were offered from d 3 until weaning. A group received 30 mL of canola oil (CAN) and the other received 60 g of a fish oil-based product providing 30 g of fish oil (FO), daily, at the a.m. feeding until weaning. Products were added to the milk solution in the feeding bucket. At 7, 14, 21, 28, 35, 49 and 56 d of age a blood sample, RT, BW, and SI were taken. FS and NS were obtained daily. Lactate was measured in blood through a handheld device (Lactate Meter, Nova Biomedical, Waltham, MA). Lactate, RT BW, and SI were analyzed by ANOVA for repeated measures (PROC MIXED). FS and NS were analyzed by PROC NPAR1WAY, SAS. There was a tendency for lactate to be lower in the FO than the CAN at d 7 (P = 0.09) and 28 (P = 0.06). Neither BW nor RT, and SI were different between groups (P > 0.05). There was a tendency for the overall FS (P = 0.1) and NS (P = 0.053) to be higher in the CAN than the FO throughout the trial (Table 1). We concluded that FO improved slightly health parameters of dairy calves.

**Key Words:** oxidative stress, inflammation, neonate

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**T17** Colostrum supplementation with omega-3 fatty acids does not alter calf outcome on a commercial farm. J. Opgenorth*, L. M. Sordillo, and M. J. VandeHaar, Michigan State University, East Lansing, MI.

Our objective was to supplement colostrum with omega-3 fatty acids (n-3 FA) to provide anti-inflammatory mediators that may improve the immune response of neonatal calves. We hypothesized a colostrum supplement containing 60 mL of a 1:1 ratio fish:flaxseed oil with or without 200 mg α-tocopherol might provide an advantageous start to early life by enhancing health and growth. Calves were blocked by birth order and randomly assigned to 1 of 3 treatments: no supplement added to colostrum (CON); 60 mL 1:1 fish:flaxseed oil blend (FF); 60 mL 1:1 fish:flaxseed oil blend with 200 mg α-tocopherol (FFE). In total, 180 heifer calves (n = 60 per treatment) were enrolled on a commercial farm. Health was scored 3 times per week until weaning. Weight, wither height, and heart girth were measured after birth, 3 wk, and 8 wk of age to assess pre-weaning growth. A subgroup of 54 calves (18 blocks or 18 calves per treatment) was sampled 2 d (±8 h) after birth to evaluate oxidant status, serum total protein, and inflammatory gene and cytokine protein expression in blood after an in vitro LPS challenge as indicators of health and immunity. At 9 wk, calves were transported 18 h to another farm, and medical records were kept as an indicator of disease incidence up to 13 wk of age. Calf mortality was 1.8 percent which is below industry average, and exceptional health was observed throughout the study. Health scores and growth were similar regardless of treatment. Serum total protein indicated successful passive transfer in all calves, and oxidant status index was not affected by treatments on d 2 of age. Concentrations of tumor necrosis factor α (TNF-α) increased with LPS stimulation, but this increase was not altered by treatment. Likewise, leukocyte gene expression of TNF-α, interleukins 8 and 10, and cyclooxygenase-2 increased upon LPS stimulation, but the fold change did not differ with treatment. In conclusion, 60 mL 1:1 ratio fish:flaxseed oil colostrum supplement did not enhance pre-weaning calf performance. Supplementing n-3 FA in a one-time meal may not provide the anti-inflammatory benefits observed with continuous feeding.

**Key Words:** oxidative stress, inflammation, neonate

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**Table 1 (Abstr. T16).**

<table>
<thead>
<tr>
<th>Day</th>
<th>Lactate (mmol/L)</th>
<th>RT (°C)</th>
<th>BW (kg)</th>
<th>SI (g)</th>
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<tbody>
<tr>
<td></td>
<td>CAN</td>
<td>FO</td>
<td>CAN</td>
<td>FO</td>
</tr>
<tr>
<td>1</td>
<td>1.76</td>
<td>1.31</td>
<td>38.8</td>
<td>38.7</td>
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<tr>
<td>7</td>
<td>1.49</td>
<td>1.27</td>
<td>38.8</td>
<td>38.8</td>
</tr>
<tr>
<td>14</td>
<td>1.10</td>
<td>0.98</td>
<td>40.6</td>
<td>41.3</td>
</tr>
<tr>
<td>21</td>
<td>1.55</td>
<td>1.06</td>
<td>38.7</td>
<td>38.9</td>
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<tr>
<td>35</td>
<td>1.06</td>
<td>1.31</td>
<td>38.7</td>
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</table>
on the health and performance of the animals was performed based on 2 cohorts [satisfactory immunity (n = 36); and not satisfactory immunity (n = 17)] divided by the TP evaluation. The incidences between the cohorts were compared using the chi-squared test. The relative risk was calculated by the number of exposed sick animals incidence divided by the incidence of disease in unexposed animals, with a 95% confidence interval, using the Epi program. The growth performance was compared between cohorts using the ANOVA method. Seventeen animals had FPIT, while 36 had TP concentration higher or equal of 5.5g/dL in the first 24 and 48 h of life, which can be associated with adjusted immunity transfer. All animals with FPIT were diagnosed with diarrhea and 76.5% of them had respiratory diseases. However, 27 calves without FPIT were diagnosed with diarrhea and 17 with respiratory disorders, resulting in an incidence of 75% and 47.2%, respectively. The FPIT increased the relative risk for developing diarrhea by 33%, while for respiratory diseases the increased was of 62%. The growth performance was not affected by the FPIT. In view of the above, we conclude that FPIT can be a predisposing factor for diarrheal and respiratory diseases in neonatal dairy calves.

Key Words: diarrhea, respiratory diseases, neonates

T19 Antimicrobial use and decision making with respect to treatment of respiratory disease in Canadian dairy calves. T. Uyama*, 1 D. Kelton1, S. LeBlanc1, D. Léger2, S. Dufour3, J. Roy3, H. Barkema4, E. de Jong4, K. McCubbin4, M. Fonseca5, L. Heider1, and D. Renaud1, 1Department of Population Medicine, University of Guelph, Guelph, ON, Canada, 2Centre for Food-borne, Environmental & Zoonotic Infections Diseases, Public Health Agency of Canada, Guelph, ON, Canada, 3Faculté de médecine vétérinaire, Université de Montréal, St-Hyacinthe, QC, Canada, 4Department of Production Animal Health, Faculty of Veterinary Medicine, University of Calgary, Calgary, AB, Canada, 5Department of Health Management, Atlantic Veterinary College, University of Prince Edward Island, Charlottetown, PEI, Canada.

Antimicrobial resistance in livestock is a growing concern due to possible transmission to humans. Thus, it is important to understand antimicrobial use in farm animals. Dairy calves receive antimicrobials for the treatment of respiratory diseases, but it is unclear under what circumstances antimicrobials are used. The objective of this study is to investigate antimicrobial use and case-specific information used in treating respiratory diseases in Canadian dairy calves. A total of 105 dairy farmers (Ontario: 31; Alberta: 28; British Columbia: 26; Nova Scotia: 20) were selected purposively and completed a questionnaire in person about calf health. First, farmers were asked, “Do you use antimicrobials to treat respiratory diseases in calves”? Second, only those who used antimicrobials to treat respiratory diseases were asked, “What case-specific information do you use to select a respiratory disease case for antimicrobial treatment”? Respondents were instructed to select all that apply from a list of 4 symptoms (elevated breathing/respiratory rate, spontaneous/induced coughing, fever, presence of nasal/eye discharge) or otherwise specified. The average herd size was 162 milking cows (range 36–560). Among 105 farmers, 98% used antimicrobials to treat respiratory diseases. Among those who used antimicrobials for respiratory diseases, 80% used “elevated breathing/respiratory rate,” 67% used “spontaneous/induced coughing,” 61% used “fever,” 48% used “presence of nasal/eye discharge,” and 33% used other characteristics as indicators to treat respiratory diseases with antimicrobials. Among 34 farmers who specified other characteristics than symptoms given, 38% used “lethargy” and 35% used “lack of appetite” as an indicator for treatment. Among 91 farmers who were asked whether they had a written treatment protocol for respiratory diseases in calves, 35% reported that they have the protocol and 97% of them were discussed with veterinarians. Treatment decisions could be refined with inclusion of additional simple criteria to identify calves that require antimicrobials for their health or welfare.

Key Words: dairy calf, treatment protocol, case-specific information

T20 The systemic inflammatory response to intramuscular endotoxin challenge in dairy heifers. T. M. Sullivan*1, A. Sharma1, K. Lamers1, A. Canovas1, B. Mallard2, and N. A. Karrow1, 1Ontario Agricultural College, Department of Animal Biosciences, Guelph, ON, Canada, 2Ontario Veterinary College, Department of Pathobiology, Guelph, ON, Canada, 3University of Guelph, Guelph, ON, Canada.

Dairy cattle routinely face a variety of stressors. Specifically, climate change has resulted in more frequent heat stress events that increase the incidence of bacterial infections by inducing conditions like leaky gut syndrome, whereby the integrity of the intestinal epithelium is compromised allowing for luminal bacteria and bacterial lipopolysaccharide (LPS) to infiltrate the host’s bloodstream resulting in systemic stimulation of the innate immune system. LPS is a well-characterized and biologically relevant molecule that may alter the immune system. The current study investigated the systemic inflammatory response in dairy heifers under two different environmental conditions: (1) without heat stress (Control, CL); and (2) with heat stress (Heat Stress, HT). The systemic inflammatory response was studied using blood samples collected bi-weekly from the day of calving to one week after calving and bi-weekly from the calving to two weeks after calving (d 0, 14, 28, 42, and 56). Serum samples were analyzed in the laboratory. Student test was used to compare the difference between sample groups. This study found that the humoral immunity of pregnant heifers decreased as they approach parturition, reaching the lowest level around the day of calving. Heifers under HT have lower immunity score compared with CL heifers on the day of calving (P = 0.03). Newborn calves show similar immunity test scores as dams on d 0, due to passive immunity transfer through colostrum feeding. No statistically significant difference was found from calves born from HT dams versus calves born from CL dams. Regardless of the treatment, there was a gradual decline of humoral immunity in neonatal calves from d 0,

Key Words: sustainability, stress, resilience

T21 Using a rapid blood test to study the impact of heat stress on the immune status of first-time pregnant heifers and their calves. Q. T. Huo*, I. Toledo2, B. Davidson2, G. Dahl2, and J. Laporta2, 1University of Central Florida, Orlando, FL, 2University of Florida, Gainesville, FL.

This study was to evaluate the impact of late-gestation environmental heat stress on the immune status of first-time pregnant Holstein heifers during the peri-parturition period and their newborn calves using a rapid blood immunity test. The test uses gold nanoparticles that act as a pseudo pathogen to probe the immune activity in blood samples. Upon mixing the nanoparticle with a blood serum, proteins from the humoral immune system including antibodies and complement proteins react with the nanoparticles, leading to an aggregate formation that is detected using dynamic light scattering. The test score is positively correlated to the humoral immune activity in the blood. Pregnant heifers were assigned randomly to 1 of 2 treatments: heat stress (shade, HT; n = 16) or cooling (shade, fans, and soakers, CL; n = 15) for the final 60 d of pregnancy (d 60). Weekly blood samples were collected from heifers (from d 60 to one week after calving) and bi-weekly from their calves (n = 13 per treatment) after colostrum feeding (d 0, 14, 28, 42 and 56). Serum samples were analyzed in the laboratory. Student test was used to analyze the difference between sample groups. This study found that the humoral immunity of pregnant heifers decreased as they approach parturition, reaching the lowest level around the day of calving. Heifers under HT have lower immunity score compared with CL heifers on the day of calving (P = 0.03). Newborn calves show similar immunity test scores as dams on d 0, due to passive immunity transfer through colostrum feeding. No statistically significant difference was found from calves born from HT dams versus calves born from CL dams. Regardless of the treatment, there was a gradual decline of humoral immunity in neonatal calves from d 0,
reaching the lowest level between d 14 and d 21. Afterward, the immunity test score of the calves increase gradually likely due to the development of calf’s own immune system. In summary, this study finds that heat stress negatively impacts the immune status of late-pregnant heifers at the day of calving, but the impact on their newborn calves is not significant.

**Key Words:** immunity, pregnancy, heat stress

### T22 Microbial composition of fecal transplant inoculum from dairy calf feces. G. S. Slanzon*, L. M. Parrish, S. C. Trombetta, W. M. Sischio, and C. S. McConnel, Department of Veterinary Clinical Sciences, College of Veterinary Medicine, Washington State University, Pullman, WA.

GI disease is the most common illness in pre-weaned dairy calves and can lead to dysbiosis, an imbalance of the microbial composition of the gut. Therefore, restoring the microbial composition of the gut is paramount to overcoming the effects of dysbiosis. Fecal microbial transplant (FMT) therapy offers the potential for restoring the microbiota balance by transferring fecal matter from a healthy donor into a diseased recipient. In this study, consistently healthy calves of different breeds 5–24 d of age with fecal scores ≤ 2 out of 4 were used as fecal donors to create the FMT inoculum. A total of 358 frozen fecal samples from 73 calves were combined to prepare a single FMT slurry. All fecal samples tested negative for *Salmonella* and were processed under aerobic conditions. Samples (~130g each) were combined in a commercial blender with 650 mL of 0.85% saline. Fecal material was sequentially sieved (mesh size 35 and 60) and the slurry was centrifuged (15 min at 6,000 rpm). Supernatant was removed and the gelatinous organic material above the pellet was vacuumed. The slurry was re-suspended in a 1:1.25 saline-10% glycerol solution. Composite feces were allocated into size 00 capsules (Capsuline enteric coated) which were placed within size 0 Capsuline gelatin capsules and frozen at ~80°C before administration. Three samples (1g) of the final FMT product were sequenced for the V3-V4 region of the 16S RNA gene. The average microbial composition of the FMT product samples at the phylum level included 56.9% Actinobacteria, 38.1% Firmicutes, 3.4% Bacteroidetes, and 2.1% Faecalibacterium. At the genus level, the predominant species were *Bifidobacterium*, *Collinsella aerofaciens* (8.5% and *Faecalibacterium prausnitzii* (2.2%). Alpha diversity was quantified by the total number of observed species. The FMT product had an average of 200 observed species with an abundance of microorganisms associated with gut health (*Bifidobacterium, Faecalibacterium*).

**Key Words:** fecal transplant, dairy, calves

### T23 Identification of internal control genes via RNA-seq analysis for data normalization in fecal RNA isolated from dairy calves. F. Rosa and J. S. Osorio*, Dairy and Food Science Department, South Dakota State University, Brookings, SD.

The use of fecal material to isolate RNA and perform gene expression analysis is a novel method that has been recently used in humans, rodents, and neonatal dairy calves. In the past, our group has used several internal control genes (ICGs) to normalize gene expression with the aim to reach a suitable stability across samples. However, the identification of the most suitable ICGs, when using fecal RNA for relative mRNA expression via RT-qPCR is remaining. This study aimed to identify robust ICGs for normalization of RT-qPCR through fecal RNA-seq data. Fecal samples were collected from 6 healthy Jersey calves (5 wk old) and frozen in liquid nitrogen until RNA isolation. Total RNA was extracted from 100mg of feces through bead-beater homogenization with trizol, followed by purification through silica membrane columns. The TruSeq stranded Ribo-zero rRNA reduced library was applied to the fecal RNA samples before sequencing. The libraries were sequenced at 2 × 50 base pair read length (NGS; Illumina, NovaSeq S4) at the University of Minnesota Genomics Center. Processed reads were aligned to the bovine genome using HISAT2. Mapped genes were used as counts per million (CPM) to evaluate their stability across samples. Genes with stable expression across samples and medium RNA abundance (3.5 to 6.5 logCPM) were used to identify potential ICGs. The pairwise comparison method using geNorm software with a combination of expression ratio stability (M; the lower the M value, the higher the stability of expression ratio) and optimal number of ICG calculated by the pairwise variation (V) between the normalization factor obtained using the selected genes were used to evaluate the ICGs. The genes with the most stable expression ratio (M <0.20) among those assessed were *SMS, VPS37A, ACTB*, and GAPDH. The V-value (ideally <0.15) for these selected genes were V = 0.04. The level of variation and stability of these genes were clearly below the thresholds previously reported for reliability. Thus, the geometric average of the ICGs *SMS, VPS37A, ACTB*, and GAPDH is an appropriate method for normalization of fecal RT-qPCR data.

**Key Words:** internal control genes, fecal RNA

### T24 Microbiome and resistome characterization of colostrum from selectively treated dry cows. A. K. Vasquez*, D. V. Nydam¹, C. Foditsch¹, L. Warnick¹, P. Morley², and E. Doster³, Cornell University, Ithaca, NY, ¹Texas A&M, College Station, TX, ²Colorado State University, Fort Collins, CO.

Few studies evaluate the impact of selective dry cow therapy on preservation of milk microbiome or the presence of antimicrobial resistance (AMR) genes at freshening. Objectives were to characterize the microbiome and resistome in colostrum of low somatic cell count (SCC) cows that were treated or not treated with antibiotics at dry-off. Cows eligible for dry-off on 1 NY dairy, with histories of SCC ≤ 200k were enrolled. Cows were randomly assigned to receive intramammary antibiotics and teat sealant (ABXTS) or sealant only (TS) at dry-off. Composite colostrum samples (within 4h of freshening) and quarter milk samples (1–7 DIM) were subjected to culture. DNA extraction was performed on culture negative samples (ABXTS = 43; TS = 33). After DNA from cows of the same treatment group and parity was pooled (26 pools; ABXTS = 12; TS = 14), amplification using V4 universal primers and shotgun sequencing were performed. The resistome was captured using a custom RNA bait library. Reads were aligned to resistance and taxonomic databases. Analysis was performed in R: diversity measures were compared; differences in composition were tested with analysis of similarities (ANOSIM). The most abundant phyla were Firmicutes (70%), Proteobacteria (24%), and Bacteroidetes (3%). Shannon and richness diversity means were not different between TS and ABXTS (P = 0.6, 0.6). Overall microbiome composition was not different at the phylum (ANOSIM R = 0.004, P = 0.4), class (ANOSIM R = 0.04, P = 0.2), or order (ANOSIM R = 0.005, P = 0.4) levels. AMR gene accessions identified 9 classes of AMR in 14 samples (TS = 9, ABXTS = 5). The majority of reads aligned to gene accessions that confer resistance to aminoglycoside (TS = ABXTS each 35% abundance), tetracycline (TS = 22%, ABXTS = 54%), and β-lactam classes (TS = 15%, ABXTS = 12%). Shannon and richness diversity means for AMR class were not different between TS and ABXTS (P = 0.03, 0.06). Resistome composition was not different between groups at the class (ANOSIM R = −0.20, P = 1) or mechanism levels (ANOSIM R = 0.01, P = 0.5). While no differences were found for the microbiome or resistome in this study, a larger sample size, deeper sequencing, and additional methodology may be needed.

### T25 The exfoliated fecal transcriptome (exfoliome) and its resemblance to the intestinal gene expression in dairy calves. F. Rosa¹, N. A. Carpinelli¹, R. Mohan¹, F. C. Avaroma², S. Busato², M. Bionaz², A. Gomez³, and J. S. Osorio¹, ¹Dairy and Food Science Department, South Dakota State University, Brookings, SD, ²Department of Animal and Rangeland Sciences, Oregon State University, Corvallis, OR, ³Department of Veterinary Medicine, Washington State University, Pullman, WA.

The exfoliated fecal transcriptome (exfoliome) and its resemblance to the intestinal gene expression in dairy calves. F. Rosa¹, N. A. Carpinelli¹, R. Mohan¹, F. C. Avaroma², S. Busato², M. Bionaz², A. Gomez³, and J. S. Osorio¹, ¹Dairy and Food Science Department, South Dakota State University, Brookings, SD, ²Department of Animal and Rangeland Sciences, Oregon State University, Corvallis, OR, ³Department of Veterinary Medicine, Washington State University, Pullman, WA.
Out of 14 farms that harvested colostrum in the parlor or hospital, descriptive statistics were performed on colostrum harvest, management, and genes involved in the metabolism of proteins and cell proliferation (i.e., CHST4, B4GALNT3, and FGBP1) were upregulated in the fecal RNA. Further analyses are needed, including the commonalities (overlap) between fetal and jejunal transcriptomes, and enrichment pathway analysis, to confirm that fetal RNA can reflect the intestinal transcriptome.

Key Words: fetal RNA, transcriptome, noninvasive method


The study objective was to describe colostrum management practices on New York (NY) dairy farms. A convenience sample of 18 NY Holstein dairies with average (range) milking herd size of 1,409 (540 to 4,150) cows were enrolled between October 2019 and February 2020. Data about colostrum management were collected using a questionnaire. Descriptive statistics were performed on colostrum harvest, management, and feeding. Colostrum was harvested into buckets in the parlor (n = 12, 66.7%), hospital parlor (n = 2, 11.1%), or maternity pen (n = 4, 22.2%). Out of 14 farms that harvested colostrum in the parlor or hospital parlor, 9 collected 3X/d and 5 collected 2X/d. Out of 4 farms that harvested colostrum in the maternity pen, 3 harvested within 2h of calving and 1 harvested 1X/d. Just over half (n = 10, 55.6%) of farms discarded colostrum for visual abnormality, oversupply, or not meeting farm-specific minimum Brix. Colostrum was pooled (n = 7, 38.9%), heat treated (n = 3, 16.7%), refrigerated (n = 12, 66.7%), filled into bags or containers (n = 14, 77.8%), frozen (n = 8, 44.4%), or fed directly to the dam’s calf (n = 2, 11.1%). Two (11.1%) farms used pre-cooled milking equipment to rapidly cool colostrum during harvest. Colostrum Brix and calf serum total protein was read by a refractometer on 14 (77.7%) and 5 (27.8%) farms, respectively. Average (range) first feeding of colostrum was 3.73 (2.84 to 3.79) L and 3.50 (1.89 to 3.79) L for heifer and bull calves, respectively. Farms fed a second feeding of colostrum for heifer (n = 14, 77.7%) and bull calves (n = 7, 38.9%), with an average (range) volume of 2.00 (1.89 to 2.84) L. The first colostrum was fed via esophageal feeder (n = 12, 66.7%), combination of bottle or esophageal feeder (n = 4, 22.2%), or using a bottle (n = 2, 11.1%). This feeding occurred within 2h (n = 17, 94.4%) or within 12h of life (n = 1, 5.6%). Median colostrum Brix determined from all colostrum harvest on 12 farms over a 9-d period averaged (range) 24.6 (21.5 to 26.4%). These results provide insight into typical colostrum management practices on mid- to large-size NY dairy herds.

Key Words: colostrum, New York, management


The goal of this systematic review (SR) was to evaluate the current literature on coccidiostats, and antimicrobial drugs used for the prevention or treatment of calf diarrhea. A review protocol was developed in accordance with PRISMA-P guidelines. The literature search was performed on October and November 2019 using 5 electronic databases (CAB Abstracts, PubMed, Science Direct, Scopus and Web of Science). Eligible studies were non- and randomized controlled trials in English. Descriptive statistics were performed using Microsoft Excel. A total 2,703 publications were retrieved; 26 manuscripts met the inclusion criteria. The studies were about diarrhea prevention (61.5%) or treatment (38.5%). Most studies were performed between 2000 and 2009 (31.0%); the earliest study included was published in 1960. Most trials were conducted in North America (46.2%). Studies reported financial support from private (48.1%) or public (22.2%) sources. Trial size ranged from 3 to 259 calves/treatment group; only one study included sample size calculations. Calves were of HO (53.8%) breed; enrolment age ranged from 0 to 40 d (7.2 ± 10.7 d). Most studies were performed with naturally infected calves (65.3%). All trials had a control group (negative: 96.2%; positive: 3.8%). A total of 18 different treatments from 29 studies were identified. One (69%) or 2 or more (31%) treatments were evaluated per study; coccidiostats (51.8%) and antimicrobials (48.1%). Routes of administration were PO (80.8%), IM (15.4%) or a combination of PO and IV (3.8%). Treatment efficacy on prevention was assessed based on fecal score (100%), clinical status (80%), and fecal shedding (60%), while cure was evaluated based on fecal score (87.5%), fecal shedding (81.3%), and weight gain (81.3%). Positive effects were reported based on a reduction of incidence (23.1%; prevention studies) or cure (60%; treatment studies) of diarrhea after clinical signs and fecal score evaluations. Based on our SR, standardized methods to evaluate clinical outcomes are needed. Also, future studies should include sample size calculations.

Key Words: calf diarrhea, systematic review, antimicrobial

T28 Predicting morbidity and mortality using automated milk feeders: A scoping review. J. L. Morrison*, C. B. Wind-er, J. H. C. Costa, M. A. Steele, and D. L. Renaud, University of Guelph, Guelph, ON, Canada. University of Kentucky, Lexington, KY.

Automated milk feeders (AMF) provide producers with a tool that can be used to more efficiently raise dairy calves. AMF are computerized systems that allow for the easier implementation of a higher plane of nutrition to dairy calves. AMF also have the ability to track individualized data, such as milk consumption, drinking speed, and the number of visits to the feeder, that could be used to predict disease. The objective of this scoping review was to characterize the body of literature investigating the use of AMF data to predict morbidity and mortality in dairy calves during the preweaning stage. This review will list the parameters that have been examined for associations with disease in calves and identify gaps in knowledge. Five databases and relevant conference proceedings were searched. Eligible studies focused on the use of behavioral parameters measured by AMF to predict morbidity or mortality in preweaned dairy calves. Two reviewers independently screened titles and abstracts from 6,679 initially identified records. Of those, 386 studies were included and then assessed...
at the full text level. Ninety-three studies fed calves using an AMF and provided some measure of morbidity and mortality. Of these, 15 examined AMF parameters for associations with morbidity or mortality. The studies were completed in North America (n = 7), Europe (n = 6) or New Zealand (n = 2). The studies varied in sample size ranging from 30 to 1,052 calves with an average of 225 calves. Seven of the studies used a mixture of Holstein or Jersey (or both) heifers and bulls, while the rest used exclusively bulls (n = 4) or heifers (n = 3). The most common parameters assessed for associations with health included drinking speed (L/min) (n = 8), rewarded and unrewarded visits (n = 9), and amount of milk consumed (L/day) (n = 14). Morbidity descriptions (time at risk and case definition) varied between studies. This scoping review revealed a small number of studies examining use of data from an AMF to predict disease in calves, with potential challenges with comparability of outcomes. Further research is needed to determine the efficacy of these parameters in commercial settings.

**Key Words:** dairy calf, computerized feeder, AMF


Cryptosporidium (C. parvum) infection can increase intestinal permeability and diarrhea in neonatal dairy calves. Consumer cultures interest in animal welfare and scrutiny of prophylactic drugs is growing; and thus, a natural program was evaluated on a commercial dairy farm (100 milking Holstein cows). Throughout consecutive births, female calves were pairwise allocated into 2 groups: no program (CTL, n = 15) vs. treated (VHP, n = 16) with a veterinary health product (New-Start - Probiotech International Inc.) at 10 g/calf/d mixed into milk meals for the first month of life. New Start is a proprietary blend consisting of 1.335 ppm Se from a selenized yeast, MOS, Yucca schidigera, Vitis vinifera, and essential oils. At d2 and 30 of age, heart girth method was used to estimate calf live weight (LW) with a measuring tape. At d6, 9, 12, 15 18 and 30 of age, diarrhea scores were performed and fecal samples collected. C. parvum excretion was analyzed using the optical density method from fecal samples. Haptoglobin concentration (HAP, n = 6 per group) was completed at d2 and 14 of age by an ELISA kit. Statistical analysis was performed in SAS using the MIXED procedure with repeated measures with day, treatment (trt) and the interaction as the fixed effects. There was a day x trt interaction (P < 0.001) on LW via heart girth which was due to day (P < 0.001) as trt were not different (P > 0.28) at d0 (CTL: 50.6; VHP: 53.1 1.6kg) or 30 (CTL: 64.3; VHP: 65.1 1.6kg). C. parvum excretion peaked at d9 in both groups; however, VHP (0.60 ± 0.05DO) excretion was less (P < 0.001) than CTL (0.87 ± 0.05DO). Although there was no effect (P > 0.05) of trt, day or the interaction on HAP, when applied to a commonly used reference interval range of 0 to 0.5g/L, CTL (d2: 0.54; d14: 0.48 ± 0.17g/L) HAP approached the upper limit, but VHP did not (d2: 0.23; d14: 0.25 ± 0.17g/L) regardless of day. Diarrhea scores were not impacted (P > 0.05) by day, trt or the interaction, nor did they support the HAP and C. parvum excretion results. Additional research with larger population is warranted to confirm the observations on C. parvum excretion.

**Key Words:** dairy calf, cryptosporidiosis prevention, natural alternatives

**T156 Association among serum IgG concentrations in newborn dairy heifers and fertility, milk yield, and survival to first lactation.** A. Velasquez Munoz, P. Pinedo, C. Shively, N. Urié, and J. Lombard, 1Colorado State University, Fort Collins, CO, 2USDA-APHIS-Veterinary Services, Fort Collins, CO.

The objective was to analyze the associations between serum IgG concentrations in newborn Holstein heifer calves (mean ± SE = 3.7 ± 1.7 d old) and fertility, milk yield, and survival to first and second lactation. A retrospective study was performed with data from calves (n = 193) born in 4 farms in CO over a 12-mo period (June 2014 to June 2015). Calves were enrolled to evaluate pre-weaned heifer health and productivity as part of a national study where serum IgG concentrations, health events, and ADG were analyzed. Calves were categorized by serum IgG concentrations into 4 categories: A = ≥25.0 g/L (n = 79); B = 18.0–24.9 g/L (n = 57); C = 10.0–17.9 g/L (n = 36); and D = <10.0 g/L (n = 21). Data were analyzed using SAS. Season and year of birth were included as covariates in the analyses. Outcome variables included survival to 1st and 2nd calving, age at 1st calving, 305-d milk yield for lactation 1, and days to conception after 1st calving. Binary outcomes (survival) were analyzed by logistic regression, while ANOVA regression was used for continuous outcomes. Models included serum IgG category, season and year of birth as fixed effects and farm as random effect. Overall, 143 (74.1%) calves reached 1st calving (A = 81.0%; B = 70.1%; C = 69.4%; D = 66.6%; P = 0.3) and 105 (54.4%) started a second lactation (A = 64.5%; B = 47.3%; C = 44.4%; D = 52.3%; P = 0.1). No difference was observed in the odds of culling in the 1st lactation by IgG category (P = 0.4). A significant difference in age at 1st calving (mean ± SE) for A (715 ± 8 d) vs. C (760 ± 12 d), and D (695 ± 16) vs C (760 ± 12 d; P = 0.005) was established. Milk yield was not associated with serum IgG category (P = 0.3). Average 305-d milk production (±SE) in 1st lactation was A = 8,750 ± 706 kg; B = 7,626 ± 847 kg; C = 7,345 ± 1,050 kg; and D = 8,517 ± 1,469 kg. Days to conception after 1st calving (±SE) did not differ among IgG categories (A = 113 ± 13 d; B = 152 ± 19 d; C = 131 ± 23 d; D = 169 ± 31 d; P = 0.4). No difference was observed in the odds of culling in the 1st lactation by IgG category (P = 0.4). A significant difference in age at 1st calving (mean ± SE) for A (715 ± 8 d) vs. C (760 ± 12 d), and D (695 ± 16) vs C (760 ± 12 d; P = 0.005) was established. Milk yield was not associated with serum IgG category (P = 0.3). Average 305-d milk production (±SE) in 1st lactation was A = 8,750 ± 706 kg; B = 7,626 ± 847 kg; C = 7,345 ± 1,050 kg; and D = 8,517 ± 1,469 kg. Days to conception after 1st calving (±SE) did not differ among IgG categories (A = 113 ± 13 d; B = 152 ± 19 d; C = 131 ± 23 d; D = 169 ± 31 d; P = 0.6). In conclusion, status of passive immunity, indicated by serum IgG concentrations early in life, affected age at first calving but did not impact fertility, 305-d milk yield, or survival to or through the first lactation.

**Key Words:** heifer, immunity, survival