M64  Effect of CalfAce on performance and health of Holstein dairy calves. M. Cooney*1, D. Cooke2, and R. James3, 1phdR&D, Fort Atkinson WI, 2R&D Life Sciences, Menomonie, WI, 3Virginia Tech, Blacksburg, VA.

The objective of this study was to evaluate performance effects of CalfAce, a registered trademark of R&D LifeSciences LLC, compared with the antibiotic Neo-Terramycin, NT Concentrate, a registered trademark of Phibro Animal Health Corporation, and a non-treated control. Fifty-four female Holstein calves fed 0.4 to 0.9 kg of whole milk solids/day depending on age were assigned at random to 1 of 3 treatments upon birth, balanced by dam parity (n = 18). The experimental diets added to milk consisted of (1) CalfAce at 12mL/hd/d, administered 2×/d at 6mL/feeding for 21 d; (2) NT Concentrate at 46g/hd/d, administered 2×/d at 23g/feeding for 14 d; and (3) untreated control. Individual milk consumption along with grain consumption over 21 d was recorded. Serum total protein was measured 24 h post colostrum administration. Body weights were recorded at birth and the end of the experiment (d 21) to determine average daily gain. Treatment and weather conditions were recorded daily throughout the study. Data analyzed using the MIXED and FREQ procedures of SAS from calves that completed the entire duration of the study. Overall, supplementation with CalfAce led to a statistically greater number of days with 0.5 or less fecal score observed compared with control and NT Concentrate and a significantly lower number of days of treatment administration compared with control. A trend toward significance was seen for average 21-d fecal score and a significantly lower duration of the study. Overall, supplementation with CalfAce led to a reduction in mortality compared with cows with LS of 3 (BAI of 278). These results suggest that monitoring a combination of behavioral metrics, such as lying time and BAI, could be used to consistently identify lame cows within herds.

Key Words: lameness, behavior, dairy cattle

M65  Effect of lameness on behavioral activity in transition dairy cows. J. M. Piñeiro*1, T. B. Menichetti1, A. A. Barragan1, W. P. Weiss2, S. Bas1, and G. M. Schuenemann1, 1Department of Veterinary Preventive Medicine, The Ohio State University, Columbus, OH, 2Department of Animal Sciences, The Ohio State University, Wooster, OH.

The objective of this study was to assess the effect of lameness on behavioral activity in transition dairy cows. A behavioral activity index (BAI) was computed (Titler et al., 2015 J. Dairy Sci. 98:5304–5312) for every animal taking into account the number of steps (no./d), standing time (min/d), lying time (min/d), and lying bouts (LB, no./d). A total of 387 Holstein dairy cows (110 primiparous and 277 multiparous) in 3 commercial dairy herds were enrolled at each farm, and electronic data loggers (IceQube, IceRobotics, Edinburgh, UK) were fitted to the hind leg of individual animals to assess their behavioral activity. Pre-partum heifers and cows were enrolled into pre-partum pens 21 d before the expected calving date. All heifers and cows were housed in similar pre-partum free-stall barns and moved into a contiguous individual maternity pen for parturition. Animals were scored for lameness using a 3-point scoring system (LS; 1 = normal walk, 2 = moderately lame, and 3 = severely lame) at 7 d before calving and at 14 DIM. The BAI was computed for the first 7 DIM to assess differences among LS in primiparous and multiparous cows. Data were analyzed using MIXED procedure of SAS. Primiparous cows (P < 0.05) had greater BAI compared with multiparous cows, and as cows mature (multiparous), they become less active around the transition period. Regardless of parity, postpartum cows with LS of 3 spent more time lying (742 min/d) than cows with LS of 1 (654 min/d; P < 0.05). Postpartum cows with LS of 1 had a greater BAI (380; P < 0.05) compared with cows with LS of 3 (BAI of 278). These results suggest that monitoring a combination of behavioral metrics, such as lying time and BAI, could be used to consistently identify lame cows within herds.

Key Words: calf, health, antibiotic alternatives

M66  Pre- and postweaning performance and health of dairy calves fed milk replacers supplemented with various additives. D. Ziegler*1, H. Chester-Jones1, A. Geiger2, J. Olson2, B. Ziegler1, and D. Shimek3, 1University of Minnesota, Waseca, MN, 2Milk Products Inc., Chilton, WI, 3Hubbard Feeds Inc., Mankato, MN.

One hundred and nine (2 to 5 d old) individually fed Holstein heifer calves (39.2 ± 0.65 kg) from 3 commercial dairies were randomly assigned to 1 of 4 milk replacer (MR) treatments to evaluate pre- (d 1–42) and post weaning (d 43–56) calf performance and health when supplemented with various additives. The study was conducted between March and June 2016. Treatments included (1) all-milk protein, non-medicated MR 24% CP: 20% Fat fed at 0.34 kg in 2.38 L of water 2× daily from d 1 to d 35 and 1× daily from d 36 to d 42 (CON); (2) CON supplemented with neomycin sulfate and tetracycline (NT) at a rate of 22 mg/kg of body weight for 14 d (MRNT); (3) CON supplemented with 6 g of dried colostrum powder providing 3 g of IgG per feeding for 14 d (MRCP); and (4) CON supplemented with an additive blend of animal plasma, Bio-Mos, microalgae meal (All-G Rich, Schizochytrium limacinum), essential oils (Apex) and multiple direct fed microbial strains including Lactobacillus and Bacillus from d 1–42 (MRAB). Calf starter (18% CP as fed) and water were fed free choice d 1–56. There were no differences in pre weaning gain (d 1–42; P > 0.05) averaging 0.57 kg/d. Post-weaning gains (d 43–56) did not differ and averaged 0.90 kg/d. Overall gain was similar (P > 0.05) and averaged 0.62, 0.68, 0.57 kg/d. Post-weaning gains (d 43–56) did not differ and averaged 0.90 kg/d. Overall gain was similar (P > 0.05) and averaged 0.62, 0.68, 0.63 and 0.66 kg/day for CON, MRNT, MRCP, and MRAB, respectively. There was no difference in hip height gain, which averaged 11.4 cm for all treatments. There was no difference in MR solids intake, which averaged 27.7 kg for 42 d. Calf starter intake from d 1-56 was similar (P > 0.05) for all treatments, averaging 37.1, 40.9, 35.6, and 40.9 kg for CON, MRNT, MRCP, and MRAB, respectively. There were no differences in daily fecal scores, scoring days, or treatment costs. Under conditions of this study, calves fed milk replacers with alternative additives for health and growth can perform similarly to calves fed NT.

Key Words: calf performance, milk replacer, supplemented additive

M67  Effects of non-digestible saccharides on passive immunoglobulin G transfer and serum immunoglobulin G concentration in newborn calves fed colostrum replacer. A. Hunan*1, T. Sato2, and M. Hanada2, 1United Graduate School of Agricultural Sciences, Iwate University, Morioka, Iwate, Japan, 2Obihiro University of Agriculture and Veterinary Medicine, Obihiro, Hokkaido, Japan.

It has been reported that non-digestible saccharides such as difructose anhydride III (DFA III), fructooligosaccharides (FOS), and maltitol (MAL) enhanced the intestinal calcium absorption by acting on intestinal absorption.

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epithelium tight junctions. We have already shown that DFA III promoted apparent efficiency of absorption (AEA) of immunoglobulin G (IgG) and serum IgG concentration in newborn calves (Htun et al., J. Dairy Sci. 99:5701–5706), but effects of FOS and MAL on AEA and serum IgG concentration have not been investigated yet. This experiment was done to investigate the effects of FOS and MAL supplementation on AEA and serum IgG concentration in newborn calves. Eighteen newborn Holstein male calves were randomly assigned to receive no supplement (Control group, n = 6), or 18 g of FOS supplement (FOS group, n = 6), or 18 g of MAL supplement (MAL group, n = 6) in each feeding. All calves were fed 2 packages of colostrum replacer providing 120 g of IgG at 1 and 10 h after birth. After colostrum replacer feeding, 250 g/2 L of milk replacer was fed at 24 h, 36 h, and then twice daily for 7 d after birth. Blood samplings were done before feeding at 0 h, 10 h, 24 h, 36 h, 4 d and 7 d of age for IgG analysis. One-way ANOVA followed by LSD multiple comparisons tests were used to compare individual parameters among the groups. Serum IgG concentration sharply increased from 0 h of age and reached a peak level at 24 h of age in all groups. Mean serum IgG concentration at 24 h of age in the MAL group (26.3 g/L) was higher than those in the control (20.0 g/L) and the FOS (19.1 g/L) groups (P < 0.05). Mean AEA at 24 h of age in the MAL group (42.3%) was higher than those in the control (31.4%) and the FOS (30.3%) groups (P < 0.05). In conclusion, MAL could improve both AEA and serum IgG concentration in newborn calves by feeding it with the colostrum replacer, but the effects of non-digestible saccharides on passive immune transfer in newborn calves differ with their types.

Key Words: non-digestible saccharide, immunoglobulin G, newborn calf.

M68  Pre- and postweaning performance and health of dairy calves fed milk replacers supplemented with different strains of direct-fed microbials. H. Chester-Jones1, D. Ziegler1, E. Davis2, J. O’Neill1, S. Hayes1, 1University of Minnesota, Waseca, MN, 2Agro Bio Sciences, Wauwatosa, WI, 3Day I Technology, Winona, MN.

One hundred and thirty-five (2 to 5 d old) individually fed Holstein heifer calves (38.8 ± 0.62 kg) from 3 commercial dairies were randomly assigned to 1 of 5 milk treatments to evaluate pre- (d 1–42) and post weaning (d 43–56) calf performance and health when fed milk replacers supplemented with a direct-fed microbial (DFM) or neomycin sulfate and oxytetracycline (NT). The study was conducted between June and September 2016. Treatments included 1) all-milk protein, non-medicated milk replacer (MR) 20% CP; 20% Fat fed at 0.28 kg in 2 L of water 2× daily from d 1 to d 35 and 1× 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 for 14 d, (MRNT); 3) MR as in CON supplemented with 5 g of DFM containing Bacillus subtilis strain 747 (1 × 10^9 cfu) per feeding for 42 d, (MRDFM); 4) MR as CON supplemented with 5 g of DFM containing B. subtilis strains 747+1781 (1 × 10^9 cfu) per feeding for 42 d, (MRDFM2); 5) MR as CON supplemented with 5 g DFM as in MRDFM2 plus Lactobacillus plantarum (5 × 10^8 cfu) per feeding for 42 d, (MRDFM3). Calf starter (18% CP as fed) and water were fed free choice from d 1 to 56. There were no differences in pre- or postweaning average daily gains (ADG) averaging 0.42 kg/d and 0.88 kg/d respectively. Overall 56 d ADG tended to be greater (P = 0.06) for calves fed MRNT and MRDFM, 0.57 kg/d vs. those fed CON, 0.52 kg/d and MRDFM3, 0.50 kg/d with MRDFM2, 0.54 kg/d being intermediate. Calf starter and MR intake were similar (P > 0.05) across treatments averaging 35.9 and 20.8 kg total intake, respectively. There were no differences in daily fecal scores, scouring days or treatment costs. Under conditions of this study, calves fed milk replacers with MRDFM can perform as well as calves fed MRNT.*

Key Words: calf performance, milk replacer, direct-fed microbial

M69  Effects of Protemace on the performance and small intestinal health of Jersey calves challenged with Salmonella enterica serotype Typhimurium at 7 day of life. Y. Liang*, R. Hudson, and M. Ballou, Department of Animal and Food Sciences, Texas Tech University, Lubbock, TX.

The objective of this study was to determine the effects of Protemace on the performance and health of Jersey calves challenged with Salmonella enterica serotype Typhimurium. Jersey bull calves within 1 d of birth were blocked by total serum protein and initial BW and randomly assigned to treatments in a 2 × 2 factorial arrangement with Protemace (PM) and Salmonella enterica (ST) as the main effects (n = 8). Calves challenged with PM had a mean IgG concentration of 5.5 × 10^8 cfu in the AM milk replacer in d 7. Calves supplemented with PM had more IgG added directly to the bottle before each feeding. All calves were fed 300 g of a 22% CP and 20% fat milk replacer twice daily. Calves had ad libitum access to a starter. Blood samples and body weight measurements were taken at d 0, 7, 10, 14, and 21. All calves were harvested on d 21, and duodenum and ileum samples collected for histomorphological measurements. Data were analyzed as a repeated measures with the fixed effects of PM, ST, time, and all possible interactions; block was included as an additional random effect. There was no treatment × time difference on ADG (P = 0.802); however, ST calves tended to decrease ADG (P = 0.054). No treatment × time difference was observed in rectal temperature (P = 0.883), but ST calves had greater rectal temperature than unchallenged calves at d 9 to 12 post challenge (P < 0.001). There was no treatment × time or treatment differences in fecal dry matter percentage either before or post challenge (P ≥ 0.261). There was no treatment × time difference in plasma haptoglobin concentration (P = 0.736); however, calves supplemented with PM had decreased concentrations (P = 0.016). The ST calves had a tendency (P = 0.082) for reduced villi:crypt in the duodenum, but PM calves had greater villi:crypt in the duodenum (P = 0.040). Additionally, the ST calves had a tendency (P = 0.072) for reduced villi:crypt in the ileum; however, there was no effect due to PM (P = 0.154). These data indicate that Protemace reduced some inflammation indices of Jersey calves challenged with Salmonella enterica on d 7 of life.

Key Words: calf, health, nutrition

M70  Risk factors for retained placenta and metritis in grazing dairy herds. R. R. Daros1, M. J. Höltzel1, S. J. LeBlanc1, J. A. Braun2, A. J. Thompson1, and M. A. G. von Keyserlingk1, 1Animal Welfare Program, Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC, Canada, 2Laboratório de Etiologia Aplicada e Bem-Estar Animal, Departamento de Zootecnia e Desenvolvimento Rural, Universidade Federal de Santa Catarina, Florianópolis, SC, Brazil, 3Population Medicine, Ontario Veterinary College, University of Guelph, Guelph, ON, Canada.

Retained placenta (RP) and metritis are known to decrease the reproductive performance of dairy cows. There is evidence that the prevalence of RP and metritis is high in pasture-based systems. Thus, the aims of this study were to determine the risk factors for RP and metritis for cows managed on pasture. We visited 53 rotational grazing dairy farms in southern Brazil between February and September 2015. Cows between
M71 The determination of concentrations of tocopherol isoforms in whole tissues and mitochondria via high-performance liquid chromatography after short-term supplementation in dairy cows. Y. Qu*, T. H. Elasasser², S. Kahle², M. Garcia³, C. M. Scholte¹, E. E. Connor³, G. F. Schroeder⁵, and K. M. Moyes¹, ¹Department of Animal and Avian Science, University of Maryland, College Park, MD, ²Agricultural Research Service, Animal Biosciences and Biotechnology Laboratory, USDA, Beltsville, MD, ³Agricultural Research Service, Animal Genomics and Improvement Laboratory, USDA, Beltsville, MD, ⁴Department of Animal Sciences and Industry, Kansas State University, Manhattan, KS, ⁵Cargill Animal Nutrition, Elk River, MN.

Mitochondria are cell organelles vulnerable to stress and may be damaged either by reactive oxygen or nitrogen species during the stress response. The antioxidant tocopherol may be useful in protecting mitochondrial health. The objective of our study was to determine the pattern of change in the concentrations of 4 isoforms of tocopherol (α-, β-, γ-, and δ-tocopherol) in whole tissue and mitochondrial fraction from bovine liver and mammary gland after short-term feeding of a vegetable-derived oil (Tmix) particularly enriched with γ- and δ-tocopherol (9% bovine liver and mammary gland after short-term feeding of a vegetable-β-, γ-, and δ-tocopherol) in whole tissue and mitochondrial fraction from bovine liver perhaps due to a higher affinity of tocopherol transport and binding proteins for α-tocopherol when compared with the γ-tocopherol. Regardless of tocopherol isoform or sample source (i.e., whole tissue vs. mitochondria), the liver accumulated higher total tocopherol concentration when compared with the mammary gland (8.2 vs. 2.7 µg/g, respectively). Limited concentrations of β- and δ-isofom were detected in whole tissues and mitochondria. In conclusion, the liver had higher tocopherol (α- and γ-isofoms) concentrations than the mammary gland suggesting that the liver may be preferred over the mammary gland for tocopherol accumulation. The α-isofom accumulated at higher concentrations than the γ-isofom in liver perhaps due to a higher affinity of tocopherol transport and binding proteins for α-tocopherol when compared with the γ-isofom.

Key Words: mitochondria, tocopherol, bioaccumulation

M72 Exploring lameness across a lactation through the eyes of a fatty pad. C. Stambuk*, H. Huson, and R. Bicalho, Cornell University, Ithaca, NY.

Lameness is a major animal welfare and economic issue for the dairy industry and is a challenge to overcome due to its multifaceted causes. Digital cushion thickness (DCT) is a strong predictor of lameness and is phenotypically associated with incidence of claw horn disruption lesions. The digital cushion is a complex structure composed of adipose and loose connective tissue located between the distal phalanx and the sole. It is important in dampening compression of the corium tissue beneath the cushion. The objective of this study was to characterize the change in DCT within the animal across lactation. Body condition score (BCS), visual locomotion score (VLS), DCT, and presence or absence of lesions were collected at 4 sample events: <40 d prepartum, 1 to 30 d in milk (DIM), 90 to 120 DIM, and >255 DIM for 124 commercial Holstein cows. Cow height was measured at the beginning and end of the study. Cows underwent digital sonographic examination for the measurement of DCT evaluated at the typical sole ulcer site for the right front and hind foot. Factors such as parity number and stage in lactation were obtained from the farm’s dairy management software (DairyCOMP 305). The prevalence of lameness (VLS ≥3) and lesions was greater in parity greater than 1 animals than parity equal to 1 animals. To evaluate the associations with DCT, a mixed linear model was built using MIXED procedure in SAS software. Compared with tall cows, DCT was significantly different by height; thinner for short cows and thicker for average cows. Those that are lame (VLS ≥3) and of average BCS group have significantly thicker digital cushions than those that are lame and of fat BCS group. Among fat BCS group animals, lame cows had significantly thinner digital cushions than cows that were not lame. Those with a lesion at 90 to 120 DIM had the thinnest digital cushion. The hind medial claw was the thinnest claw compared with the other claws. The average DCT of the measured claws at each sample event for parity greater than 1 appears to follow the BCS curve. The results indicate there is not a specific threshold of DCT where a dairy cow becomes lame or incurs a lesion.

Key Words: digital cushion, lameness, lesion

M73 Uterine microbiome, antibiotic resistance genes and virulence factors of metritic treated cows that cure or failed to cure from metritis. Z. Zhou*, M. S. Gomes, I. F. Canisso, E. F. Garrett, J. S. Stewart, and F. S. Lima, University of Illinois, Champaign-Urbana, IL.

Metritis is major postpartum disease in dairy cows causing reduced milk production, impaired fertility, and substantial economic losses. Although treatment with β-lactam antibiotics is the main therapeutic option for treating cows with metritis, ~35% of cows fail to respond
to treatment. Herein, we used whole-genome shotgun sequencing (WGS) to shed light of uterine microbiome, antimicrobial resistance genes (ARGs), and virulence factors genes (VFGs) profiles of cows that cured or failed to cure of metritis after treatment with ceftiofur or ampicillin. Uterine swabs were collected for each cow at the time of metritis diagnosis (D1) and 5 d later (D6) one day after treatments finished. Half of the cows (12/24) cured after the 5-d treatment (7 from ampicillin and 5 from ceftiofur). Our WGS revealed that over time (from D1 to D6) the mean relative abundance (MRA) of the genera Bacteroides, Prevotella, Alstipites, Fusobacterium, and Tannerella were reduced ($P < 0.01$), whereas Porphyromonas was increased ($P < 0.01$) independent of treatment ($P > 0.05$). For cows responding to treatment for metritis, only Streptococcus MRA was increased when compared with counterparts that did not cure of metritis. Beta-diversity decreased ($P < 0.01$) after treatment independent of treatment type ($P > 0.05$) and cure status ($P > 0.05$). Antibiotic treatment independent of type decreased VFGs abundance ($P < 0.01$), but increased ARGs ($P < 0.01$) abundance. Tetracycline resistance genes dominated the resistome of metritic cows, but β-lactam ARGs such as CMY-2 were not changed by treatment ($P > 0.05$) or time ($P > 0.05$). The ARGs TetT and TetW increased over time ($P < 0.01$) independent of treatment ($P > 0.05$) or cure status ($P > 0.05$). A higher MRA and presence of virulence factors for Streptococcus spp., Mycoplasma pneumoniae, and Vibrio cholerae were identified suggesting these bacteria and VFGs may be linked to metritis pathogenesis. In conclusion, antimicrobial treatment over time (from D1 to D6) independent of type and ability to cure metritis altered uterine microbiome, reduced VFG abundance and increased ARGs abundance.

**Key Words:** microbiome shift, metritis, metagenomics

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**M74 Water intake of transported Holstein dairy calves classified as sick or healthy in the first 21 d.** S. Y. Morrison*, K. N. Brost, P. A. LaPierre, and J. K. Drackley, University of Illinois, Urbana, IL.

A common recommendation is that water should be provided to calves from soon after birth, but few data are available on water intake in the early preruminant phase and how it might be influenced by health status. Our objective was to determine whether water intake differed between calves that were sick or healthy in the first 21 d after arrival. Data for male and female Holstein calves (n = 225) from 3 experiments that recorded daily intakes of milk replacer (MR), free water (FW), and electrolyte solution (EC) were combined. Calves were enrolled within the first week of life. Fecal scores were assigned on a 1 to 4 scale. Calves with a fecal score of > 2 for > 3 d over the first 21 d of each study were classified as sick (S; n = 98) while the remainder were classified as healthy (H; n = 127). Calves were housed in individual hutches bedded with straw and offered water for ad libitum consumption. Data were analyzed using the GLIMMIX procedure of SAS. Initial serum TP on day of arrival was greater for H calves (5.7 vs 5.6 ± 0.09; $P < 0.001$) independent of treatment ($P > 0.05$). As expected, the health status by time interaction was significant ($P < 0.05$) for incidence of scours, with the highest proportion of calves classified as sick in the first 5 d of study and again during d 11 to 15. The health status by time interaction was significant ($P < 0.001$ for FW intake with H calves consuming more than S calves in the first 21 d (2.12 ± 1.87 L/d). Calves classified as S consumed significantly less FW on d 5 compared with H calves (0.82 vs. 2.36 L/d) and numerically less during d 3 and 4, which corresponded to the highest prevalence of scours. The average EC for S calves was greater ($P < 0.001$) than H calves (0.11 vs 0.02 L), with S calves having more EC on d 3, 4, 6, and 9. Water consumed from MR over the first 21 d did not differ ($P = 0.40$), although S calves had greater incidence of MR refusals ($P = 0.03$). Total water consumed from FW, EC, and MR did not differ between health status groups ($P = 0.69$). Our data emphasize the importance of providing FW in the early preweaning period and supplemental fluid from electrolyte solution when FW consumption may be depressed for S calves.

**Key Words:** water, health, dairy calf

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**M75 Economic comparison of ampicillin trihydrate and ceftiofur hydrochloride for treating metritis in dairy cows: A prospective cohort study.** J. A. Snodgrass1, A. Vieira-Neto2, R. S. Bisinotto2, E. S. Ribeiro2, N. Martinez2, K. N. Galvao2, J. E. P. Santos2, and F. S. Lima*. 1University of Illinois, Champaign-Urbana, IL, 2University of Florida, Gainesville, FL, 3University of Guelph, Guelph, ON, Canada, Zoetis, Kalamazoo, MI.

Metritis is one of most prevalent and economic detrimental postpartum health disorders in dairy cows. However, there is lack of controlled prospective cohort studies evaluating its economic impact for dairy cows. The objective of this study was to perform an economic comparison of metritic treated cows using data from a previous prospective controlled cohort study that compared the efficacy of ampicillin trihydrate and ceftiofur hydrochloride. We hypothesized that an economic analysis considering differences in costs of antibiotics, labor, and feed, mean time to pregnancy, and milk production would determine the least costly treatment strategy for metritis. Cows diagnosed with metritis were blocked by parity and within each block allocated randomly to receive either ampicillin (n = 259), or ceftiofur (n = 269). A control group of cows without metritis matching parity and days in milk was also enrolled (n = 268) to be used as a baseline for comparison. Data on cows sold or dead, days open, and milk production (305 d) were used along with drug and commodity prices to create a per case cost of metritis. Mean time to pregnancy was analyzed using PROC PHREG and LIFETEST on SAS 9.4. Percent of dead or sold, feeding cost, milk production, and final cost analysis (with and without the value of feeding withdrawal milk to calves) were performed using PROC GLIMMIX. Cows without metritis had reduced mean time to pregnancy, reduced feeding cost, and increased milk production ($P < 0.01$) than counterpart diagnosed with metritis and these differences were accounted in the final cost analyses. There were no differences among treatments for mean time to pregnancy, percent of sold or dead, and feed costs ($P > 0.05$). Milk production tended to be greater ($P = 0.07$) in cows treated with for ampicillin (9,078 kg) than cows treated with ceftiofur (8,732 kg). The final cost per case for treating metritis was higher ($P < 0.001$) for cows treated with ceftiofur ($387.63$) than for ampicillin, either feeding milk from withdrawal period to calves ($294.83$ or not ($328.70), indicating that ampicillin was the least costly treatment for metritis.

**Key Words:** ampicillin, ceftiofur, metritis

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**M76 Associations of gait score, lying behavior, hygiene, and body condition score between dairy cows with low and high somatic cell counts.** A. Zambelis*, I. Robles, and T. J. DeVries, Dept. of Animal Biosciences, University of Guelph, Guelph, ON, Canada.

The objective of this study was to examine associations of gait score, lying behavior, hygiene, and body condition score (BCS) between cows with low and high SCC. Cows from 14 commercial free-stall dairy herds were enrolled in a cross-sectional study. Enrollment of herds was based on monthly participation in DHI milk testing. Each farm was visited for a total of 3 observation periods (at ~5-wk intervals) on 2 occasions
per period (7 d apart) until 3 DHI milk tests had been completed. Upon immediate receiving of the results of each DHI test, lactating Holstein calves were selected according to SCC. Cows with the highest 10% SCC in the herd (≥200,000 cells/mL) were first selected and matched for parity and DIM to cows with low SCC (≤100,000 cells/mL). Lying behavior was recorded for 6 d after each milk sampling using data loggers. On the visit where data loggers were attached, cows were scored for gait (1 = sound to 5 = lame) and hygiene of udder, lower legs, and upper legs/ankle (1 = clean to 4 = dirty). On the visit where data loggers were removed 7 d later, BCS (1 = thin to 5 = fat) and hygiene were scored. Cows were then classified into each of the scoring categories for hygiene (dirty: ≤ 2, clean: ≥ 3), BCS: (high: ≥ 4, normal: 3–3.5, low: ≤ 2.5), and gait: (sound: ≤ 2, lame: ≥ 3). Association of cows being high (n = 352) and low (n = 362) in SCC with lying behavior, BCS, gait score, and hygiene score were tested in mixed-effect linear and logistic regression models. As compared with normal BCS cows, low BCS cows were found to be at greater odds of having a high SCC (OR = 1.57, 95% CI = 1.00–2.47, P = 0.049). As compared with normal BCS cows, low BCS cows were at a higher odds of having dirty lower legs (OR = 2.64, 95% CI = 1.08–6.46, P = 0.03), spent less time lying down (27.2 ± 12.5 min/d, P = 0.03), and produced more milk (+2.90 ± 0.88 kg/d, P < 0.01). On average, cows with high SCC produced 2.2 ± 0.72 kg/d less milk (P < 0.01) than those with low SCC. These results suggest that cows with low BCS, which were at greater risk of having high SCC, were also the highest producing, had poorest lower leg hygiene, and spent the most time standing.

Key Words: mastitis, behavior, body condition


The effect of an accelerated growth feeding protocol (AGFP), based on pasteurized waste milk, was evaluated in Holstein dairy calves under tropical conditions. Sixteen individually housed Holstein calves were used in the study. The control and AGFP groups consisted of 8 Holsteins (4 males and 4 females). The experimental period lasted 7 weeks. The control group was always fed 2 L of milk at 0600 h and 2 L of milk at 1800 h. The AGFP group was fed progressively more milk (divided equivalently in 2 feedings at 0600 h and 1800 h) with 4.0, 4.74, 5.68, 6.62, and 7.56 L from week 1 through 5, respectively. Then at wk 6, milk was increased (divided equivalently in 2 feedings at 0600 h and 1800 h) with 12.5 min/d, P < 0.01). On average, cows with high SCC produced 2.2 ± 0.72 kg/d less milk (P < 0.01) than those with low SCC. These results suggest that cows with low BCS, which were at greater risk of having high SCC, were also the highest producing, had poorest lower leg hygiene, and spent the most time standing.

Key Words: mastitis, behavior, body condition


The primary goal of this project was to evaluate how pre-weaned calf housing, environment and management strategies impact calf health during periods of cold stress. This was an observational study in which calf facilities were evaluated on a single visit conducted between November 29, 2016, and January 4, 2017. Housing included hutches (n = 8), individual pens in a barn (n = 8) and group pens in a barn (n = 11). Facility, calf pen and animal evaluations included: wind speed, temperature, relative humidity, heat stress index, wind chill, bedding type, ammonia concentration, nesting score, calf health scoring, and number of calves/pen. Data were analyzed using SAS 9.3 to determine the impact of housing type, environmental and management variables on calf health score. A total of 27 facilities and 426 pre-weaned calves were evaluated. The mean outdoor temperature was 6.3°C (SD = 5.6; range −5.2 to 19.4). Mean respiratory score was 2.8 (SD = 1.64; range 0 to 9) with 14.5% of calves evaluated scoring >5, indicating they have a respiratory challenge and should be treated. Prevalence of respiratory illness among calves ranged from 0 to 46% on a farm basis (mean = 15.0%), with 8 farms having no respiratory illness, and 6 farms having 30 to 46% of evaluated calves exhibiting signs of respiratory illness. Health score was affected (P < 0.05) by housing, bedding, number of calves per pen, NH₃ concentration, temperature and wind chill (at calf level). Calves housed in hutch had greater (worse) health scores as compared with those in group pens (3.9 vs 2.2, respectively). Calves in individual pens did not differ in health scores from their counterparts (mean health score = 3.3). Risk of health score >5 increased if calves had a body condition score <2 (relative risk = 1.7; 95% CI 1.0, 2.8), if ammonia concentration in the pen was >1 PPM (relative risk = 1.9; 95% CI 1.2, 3.0) and if calves/pen was >5 (relative risk = 1.6; 95% CI 1.0, 2.6). Data collected from this study suggests that respiratory illness continues to be a challenge. However, factors that increased the risk of respiratory illness can be addressed by changes in management practices.

Key Words: calves, respiratory, housing

M79 Effects of the addition of electrolyzed water to a footbath solution on digital dermatitis incidence. H. K. Himmelmann*, B. W. Jones, and J. M. Bewley, University of Kentucky, Lexington, KY.

Digital dermatitis (DD) can cause lameness and pain in dairy cows. The objective of this 11-wk study, conducted at the University of Kentucky Coldstream Dairy Research Farm, was to test the effects of electrolyzed water, in a copper sulfate solution on DD. A split, plastic footbath was used to deliver 2 footbath solutions. The control solution, assigned to the right hooves of the cows, contained 79.5 L of water with 1.75 kg of copper sulfate, and 325 mL of acidifier. The treatment solution, assigned to the left hooves of the cow, contained 79.5 L of water with 1.75 kg of copper sulfate, and 325 mL of acidifier. The treatment solution, assigned to the right hooves of the cows, contained the same solution as the control side with the addition of 7.5 L of electrolyzed water. The footbath solutions were made Monday thru Friday before morning milkings. Cows walked through the footbath while exiting the milking parlor once a day. The solutions were dumped after the completion of morning milkings. Holstein cows (n = 77) DD were scored biweekly in the milking parlor to determine active or inactive DD. Rear hooves were hosed off to remove debris before being evaluated. A headlamp was worn to provide clarity of hooves while scoring. The FREQ Procedure of SAS (SAS Institute Inc., Cary, NC) was used for a chi-squared analysis and a McNemar’s test was used to compare the number of hooves with active DD (scores
of M1 and M2) to the number of hooves with non-active DD (scores of M3 and M4). No significant differences in DD between the control and treatment groups existed ($P > 0.05$); however, over the course of the study, both footbath solutions improved DD overall (Table 1; $P < 0.01$). These results suggest that the addition of electrolyzed water in a footbath solution had no negative effect on DD.

### Table 1 (abstract M79).

<table>
<thead>
<tr>
<th>Occurrence</th>
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</tr>
</thead>
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<tr>
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<td>64</td>
</tr>
<tr>
<td>No lesion at baseline and no lesion at end</td>
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<td>12</td>
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<tr>
<td>Lesion at baseline and lesion at end</td>
<td>2</td>
<td>1</td>
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</tbody>
</table>

**Key Words:** digital dermatitis, footbath, copper sulfate

### M80 Management practices and prevalence of bovine respiratory disease in pre-weaned dairy calves in California. B. M. Karle*, G. Maier, W. J. Love, D. R. Williams, J. W. Stackhouse, R. J. Anderson, A. L. Van Eenennaam, T. W. Lehenbauer, and S. S. Aly. University of California Cooperative Extension, Orland, CA, University of California, Davis, CA, UC Davis Veterinary Medicine Teaching and Research Center, Tulare, CA, Department of Animal Science, University of California, Davis, CA, University of California Cooperative Extension, Eureka, CA, California Department of Food and Agriculture, Animal Health Branch, Sacramento, CA, Department of Population Health and Reproduction, School of Veterinary Medicine, University of California, Davis, CA.

The objective of this cross-sectional study was to estimate the prevalence of bovine respiratory disease (BRD) in California pre-weaned dairy calves and identify management practices that may be associated with BRD and their variations across the state. A convenience sample of 104 dairies in the 3 distinct dairy regions of CA were surveyed. Regions evaluated were Northern (NCA, San Francisco area and north, mean herd size 678, n = 33), Central (CCA, San Joaquin, Stanislaus, Merced counties, mean herd size 1,569, n = 36), and Greater Southern region (SCA, Fresno County and south, mean herd size 2,878, n = 35). A questionnaire on calf management practices and demographic information was administered via in-person interviews at each dairy and a random sample of pre-weaned calves evaluated using the CA BRD scoring system on the same day. Prevalence of BRD varied between the 3 dairy regions (NCA, 9.3% ± 0.89; CCA, 4.4% ± 0.70; SCA, 7.4% ± 0.92; $P = 0.005$). Calf breed was not associated with BRD prevalence at the statewide level (Holsteins 7.3% ± 0.82, Jerseys 5.4% ± 0.69, other and cross breeds 5.7% ± 2.68; $P = 0.4$). Differences in prevalence were observed between breeds across the regions with a higher prevalence in NCA for Jerseys (15.0% ± 1.83 NCA, 2.8% ± 1.01 CCA, 3.4% ± 0.96 SCA; $P < 0.001$) and in SCA for Holsteins (8.0% ± 1.1 in SCA, 4.7% ± 0.84 in CCA; $P = 0.045$) but not compared with NCA (5.9% ± 0.12; $P = 1.00$). Prevalence of BRD varied greatly across the state, likely contributing to the variation in BRD prevalence seen in the 3 regional evaluations.

**Key Words:** bovine respiratory disease, calf, pre-weaned

### M81 Effect of calving stress on feed intake of dairy cows soon after calving. M. R. Reshalaithan, K. Matsuki, T. Sato, and M. Hanada. United Graduate School of Agricultural Science, Iwate University, Morioka, Iwate, Japan, and Obihiro University of Agriculture and Veterinary Medicine, Obihiro, Hokkaido, Japan.

Several studies reported that dry matter intake (DMI) after calving was lower and the degree of calving difficulty was higher in primiparous cows compared with multiparous cows. These results suggest that primiparous cows might experience more stress around calving than multiparous cows. This study was done to compare calving stress around calving between primiparous and multiparous cows and to investigate the effect of the stress on DMI in dairy cows soon after calving. Fifteen primiparous and 15 multiparous Holstein cows were used. The cows were offered a total mixed ration (TMR) restrictedly (80% of energy requirements) and hay ad-libitum before calving and were offered another TMR and hay ad-libitum after calving. DMI was measured from 1 to 6 d after calving. Blood was taken at −33, 0.5, 3 and 7 d after calving to measure metabolites. Urine was collected at −11, −8, −4, 0.25, 4, 8 and 13 d after calving to measure cortisol concentration. BW was measured once a week and milk yield was measured every day after calving. One-way ANOVA followed by LSD multiple comparisons tests were used to compare individual parameters among the groups. Average DMI for 6 d after calving was lower in primiparous cows (88 g/BW0.75/d) than in multiparous cows (112 g/BW0.75/d, $P < 0.01$). Highest urinary cortisol was observed at 0.25 d after calving in both cows and there was no significant difference between primiparous and multiparous cows ($P > 0.10$). However, urinary cortisol was higher in primiparous cows than in multiparous cows at 4 d after calving ($P < 0.01$). Pearson correlations were performed to investigate the relationship between the parameters. Average DMI for 6 d after calving was negatively related to the urinary cortisol at 4 d after calving ($P < 0.01$) and positively related to average milk yield for 6 d after calving ($P < 0.01$) and serum Ca at 3 d after calving ($P < 0.01$). To identify the effect of these 3 factors on the DMI, a multiple regression analysis was performed and a significant multiple regression equation was obtained ($r^2 = 0.67$, $P < 0.01$). The standardized partial regression coefficients of the equation were −0.43 for the urinary cortisol, 0.52 for the milk yield and 0.44 for the serum Ca.

**Key Words:** cortisol, intake, transition dairy cow

### M82 Transgenerational effects of postpartum inflammatory diseases in dairy cows. M. R. Carvalho*, F. Pehagaracino, J. E. Santos, T. J. DeVries1, B. McBride1, and E. S. Ribeiro1.

Inflammatory diseases postpartum have long-lasting effects on reproduction of dairy cows and increase substantially the likelihood of pregnancy losses. The objective of this study was to investigate whether the lasting effects of inflammatory diseases extends into postnatal life in pregnancies that survive until term. Incidence of diseases (metritis, mastitis, lameness, respiratory and digestive problems) in 5,085 cows from a single herd in FL was recorded from calving until first breeding postpartum. Cows that became pregnant after first breeding were followed until calving. Born female calves were then followed up to 305
M83 Colostrum mineral concentrations and their association with calcemic status at calving in Jersey cows. J. Chiozza-Logroño*, A. Valldecabres1, A. Lago3, and N. Silva-del-Río1, 1Veterinary Medicine Teaching and Research Center, University of California Davis, Tulare, CA, 2Cátedra de Higiene, Epidemiología y Salud Pública, Facultad de Ciencias Veterinarias, Universidad Nacional de La Plata (FCV–UNLP), La Plata, Argentina, 3DairyExperts Inc., Tulare, CA.

The aim of the present study was to evaluate the association of postpartum calcemic status and colostrum concentration of Ca, P, Mg, K, Na, Fe, Zn and Cu on 131 multiparous Jersey cows. Colostrum samples were harvested at 9 h 36 min (±3 h 36 min) after calving and analyzed for mineral concentration by inductively coupled plasma–optical emission spectrometry. Final colostrum weight was recorded at milking. Blood samples for serum Ca analyses were collected from the coccyeal vessels within 6 h after calving. Based on serum Ca concentration, cows were classified as hypocalcemic (SHC; Ca ≤8.5 mg/dL; n = 103) and normocalcemic (NC; Ca >8.5 mg/dL; n = 28). Descriptive statistics, including first (Q1), second (Q2) and third (Q3) quartiles of colostrum mineral concentrations based on calcemic status at calving are shown in Table 1. Associations among calcemic status and colostrum weight, Na and Mg were also studied. Using the MIXED procedure of SAS including the CORR procedure of SAS was used to evaluate the association among SCa1, SCa2, CCac and CCag. To study explanatory variables of SCa2 a linear regression model with repeated measurements was fitted using the MIXED procedure of SAS including CCac, milking time, and colostrum weight. There was not an association between SCa1 and SCa2 (r = −0.32; P = 0.06), CCac1 (r = 0.09; P = 0.45), or CCag1 (r = 0.02; P = 0.85). At second milking, we observed a decrease in SCa2 as CCac increased. No effect of colostrum weight was detected on SCa2. Our results indicate that postpartum calcemic status might be affected by concentration of Ca in colostrum.

Key Words: hypocalcemia, colostrum, Jersey cow

Table 1 (abstract M83). Quartile distribution (Q1 = 25th percentile, Q2 = 50th percentile, Q3 = 75th percentile) of colostrum mineral concentrations (mg/kg) at first milking

<table>
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<tr>
<th></th>
<th>Ca</th>
<th>P</th>
<th>Mg</th>
<th>K</th>
<th>Na</th>
<th>Fe</th>
<th>Zn</th>
<th>Cu</th>
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</thead>
<tbody>
<tr>
<td>SHC</td>
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<td></td>
<td></td>
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<tr>
<td>Q1</td>
<td>2.000</td>
<td>1,100</td>
<td>280</td>
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<tr>
<td>Q2</td>
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<td>1,428</td>
<td>759</td>
<td>0.64</td>
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<tr>
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<td>1,600</td>
<td>380</td>
<td>1,677</td>
<td>980</td>
<td>0.79</td>
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<td></td>
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<td></td>
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<tr>
<td>Q1</td>
<td>1.600</td>
<td>730</td>
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<td>1,276</td>
<td>0.87</td>
<td>22</td>
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</tr>
</tbody>
</table>
High-producing dairy herds where there is a predominant utilization of high-concentrate low-fiber diets can impair the buffering capacity of the rumen in dairy cows, and lead to a subacute ruminal acidosis (SARA). SARA is characterized by ruminal pH < 5.6 for extended hours. Decreased milk yield and milk efficiency, rumen epithelial damage, and laminitis are among several consequences of SARA. This study aimed to investigate the physiological adaptations during induced SARA in lactating Holstein cows. Eighteen cannulated cows were classified based on a retrospective analysis of pH after SARA induction, cows were grouped as non-SARA (n = 12) or SARA (n = 6) if ruminal pH was <5.6 for ~4 h regardless of treatment. SARA induction at d 5 (challenge) of trial was performed by giving a wheat/barley pellet at 10% of previous day DMI. Blood samples were collected on d 2, 5, 6, 7, and 8 of trial, and on d 5 at 0, 3, 6, and 12 h relative to the challenge. Data were analyzed using the PROC MIXED procedure of SAS, where group, hour, and day were fixed effects, while cow nested within group was the random effect. An interaction of Group × day (P = 0.01) was observed for haptoglobin with SARA group having greater concentration (0.23 vs 1.16 g/L) of this blood inflammatory biomarker on d 8 after challenge. Blood concentrations of creatinine and myeloperoxidase (P ≤ 0.04) were also greater in the cows subjected to challenge. Similarly, an interaction of Group × hour (P = 0.04) was observed for blood creatinine where cows challenged had greater concentration 6 h after induction. Concentrations of BHB were greater (P < 0.01) during hours after SARA induction in SARA group. Overall, our results suggest that the metabolic and inflammatory profile in blood were more affected in cows induced to SARA regardless of treatment.

Key Words: SARA, immunometabolic profile, lactating cow

M86 Liquid chromatography-mass spectrometry metabolomic serum signatures indicate global and disease-specific challenges in protein and fatty acid metabolism precede retained placenta in dairy cows. F. Zandkarimi, C. Maier, and G. Bobe*, Oregon State University, Corvallis, OR.

Retained placenta (RP), a condition that fetal membranes failed to expel within 24 h of calving, is one of the most prevalent and costly diseases in dairy cows. Our objective was to discover molecular biomarkers and pathways, which can aid in screening, prediction and/or early diagnosis of RP. Using a nested case-control design, we collected 21, 14, 7 before and directly after calving, 7 d before calving and directly after calving serum samples in healthy dairy cows that subsequently did (RP; n = 8) or did not (Control; n = 9) develop RP. After ethanol extraction, samples were injected onto an Acquity amide column (Waters Corporation) coupled to the SYNAPT G2 mass spectrometer. Feature annotations and structural elucidation were assigned using an in-house library and online databases (METLIN, HMDB, LIPIDMAPS), and matching MS/MS and MS² data. Data analysis was conducted in PROC MIXED of SAS version 9.4. Fixed effects were collection time, group, and their interaction. Repeated measures within cows were modeled using a first-order heterogeneous variance-covariance matrix. Group differences were most pronounced 7 d before calving and showed significant differences in 44 of 81 annotated metabolites; 9 carnitines, 23 amino acids and their metabolites, 3 conjugated bile acids, 2 carbohydrates, and 3 phospholipid precursors were all higher in RP-vs. Control cows. Complete group separation was achieved by 1 [methyl ethanolamine phosphate (MEP)], 3 (free carnitine, choline, MEP), 9 (free carnitine, Car C4:0, -C16:0, -C18:0, MEP, trimethyl-lysine, histidine, phenylalanine, taurine), and 1 metabolite (choline) at 21, 14, 7, and 0 d before calving, respectively (all higher in RP vs. Control cows). The best early RP indicator was MEP (signal intensities were 2.3-fold, 2.7-fold, 5.4-fold, and 2.3-fold higher in RP- vs. Control cows at 21, 14, 7, before and directly after calving, respectively. In conclusion, LC-MS metabolomic serum signatures indicate that global challenges in protein, phospholipid, and fatty acid metabolism precede RP in transition dairy cows.

Key Words: early disease indicator, metabolomics, retained placenta

M87 Polyphenolic extract from cowpea (Vigna unguiculata) modulates galectin 3 and 9 expression in bovine peripheral blood. S. Adjei-Fremah*, E. Asiamah, K. Ekwenmalor, and M. Worku, North Carolina A&T State University, Greensboro, NC.

Galectins are animal lectins that bind glycoconjugates containing β-galactose proteins. Galectin (gal)-3 and gal-9 expressions have been associated with innate and adaptive immunity, and inflammation response. Plant-derived polyphenols found in feed have a beneficial effect on animal health. The objective of the study was to determine the effect of polyphenol extract from cowpea (CPE) on gal-3 and gal-9 mRNA levels and protein expression in bovine peripheral blood. Blood collected from Holstein cows (n = 10) was treated with 10 μg of CPE, controls were treated with either 100 ng/mL of lipopolysaccharide (LPS), or left untreated. Total RNA was extracted after treatment; reverse transcribed to cDNA and real-time PCR was performed using specific primers for bovine gal-3 and gal-9. Real-time PCR data analysis was performed with the housekeeping gene GAPDH and fold change (FC) in gene expression was calculated using the 2^−ΔΔCT method. Plasma concentration of gal-3 and gal-9 was measured using a commercial ELISA. One-way ANOVA was performed on gal_3 and gal_9 concentration data, a P-value of < 0.05 was considered significant. Results from the RT-PCR showed increased mRNA levels of gal_3 (FC = 48.90) and Gal_9 (FC = 147.41) after LPS treatment relative to the untreated controls. In the CPE-treated samples, the relative gene expression of gal-3 and gal-9 were 1.72 and 2.07 respectively. Also, the concentrations of gal-3 and 9 in plasma increased in LPS-treated samples but decreased in the CPE-treated group relative to the untreated control. The results from this study showed that polyphenols from cowpea modulate gal-3 and gal-9 mRNA and protein expression in bovine blood. Hence, the use of polyphenols extract from cowpea enriched feed supplements may have immunomodulatory properties for animal health, and aid in the design of galectin-based strategies to counteract LPS induced inflammation and morbidities.

Key Words: cowpea, galectin, polyphenol

M88 A statewide survey of colostrum management practices on organic dairy farms in Ohio. L. da Costa*1 and K. Bohland2, 1Department of Preventive Medicine, The Ohio State University, Columbus, OH, 2The Ohio State University, Columbus, OH.

Newborn calf survival is an important indicator of farm success. In order for calves to fully develop, ingestion of high quality colostrum is essential during the first hours of life. Proper intake of quality colostrum can determine the future health and milking performance of the calf. The aim of this study was to survey Ohio organic dairy farms regarding practices related to administration and management of colostrum. The survey was done by phone interviews based on questions of a questionnaire previ-
Nitrergic and natriuretic peptides are endogenous vasodilators that protect against pulmonary hypertension progression. We compared nitric oxide synthase (NOS) and natriuretic peptides (NPs) expression levels in Holstein heifers with brisket disease and healthy controls located at Lhasa for one year. Physiological parameters, blood pressure and blood gas status were measured. Plasma samples were analyzed for brain NP, C-type NP, adrenomedullin, endothelial NO (eNOS), inducible NOS (iNOS), total NOS (TNOS) and NOx levels (n = 10/group). We performed histological analyses to detect remodelling of small pulmonary arteries. RT-PCR and Western blots were used to determine lung eNOS and endothelin-1 (ET-1) expression. Respiratory rates, oxygen saturation and blood velocity were significant higher in healthy controls. However, heart rates were higher in heifers with brisket disease. Peripheral arterial pressures were significantly higher in healthy controls than those in cattle with brisket disease. In healthy cattle, plasma NPs, eNOS, iNOS, TNOS and NOx levels were elevated relative to those in cattle with brisket disease. Moreover, eNOS mRNA and protein were highly expressed in healthy control lungs (P < 0.01, P < 0.01, respectively). Immunostaining revealed that eNOS was highly expressed in the intima of pulmonary arteries. In addition, ET-1 mRNA and protein levels were reduced in healthy cattle compared with those of cattle with brisket disease (P < 0.05, P < 0.01, respectively). Cattle with brisket disease displayed small pulmonary arterial thickening, proliferation of smooth muscle cells and low eNOS expression in the intima. In conclusion, it is possible that highly expressed NO and NPs dilate vasculature, maintain blood flow and pressure and attenuate vascular remodeling to protect against pulmonary hypertension progression.

Key Words: Holstein heifer, pulmonary hypertension, nitric oxide


Objectives were to determine effects of an injectable formulation of calcitriol on Ca concentration, risk of subclinical hypocalemia, and health in dairy cows. Cows were blocked by lactation number (1 vs. >2) and calving sequence, and within each block, randomly assigned to receive, within 6 h of calving, subcutaneously vehicle only (Control, n = 450), 200 μg of calcitriol (Cal200, n = 450), or 300 μg (Cal300, n = 450). Blood samples were collected before treatment administration, and on d 1, 2, 3, and 5. Samples were analyzed for blood ionized Ca, and total plasma Ca and Mg. Vaginal discharge (VD) was evaluated at 4, 6, and 8 DIM, and cows with VD reddish/brownish foul smell were diagnosed with metritis. Morbidity was evaluated until 60 DIM, and responses measured included metritis, mastitis, displaced abomasum, digestive and respiratory disorders. At 35 DIM, VD was scored for diagnosis of purulent vaginal discharge (PVD, VD ≥ 2, mucopurulent discharge). Cyclicality was evaluated by presence of a corpus luteum (>20mm) in at least one of 2 ovarian ultrasound scans performed at 35 and 49 DIM. Data were analyzed using PROC MIXED and PROC GLIMMIX of SAS. Cows receiving calcitriol resulted in greater concentration of blood ionized Ca and plasma total Ca during the first 5 and 3 DIM, respectively, whereas concentration of plasma Mg were reduced during the first 3 DIM (Table 1). Treatment with calcitriol did not affect the incidence of metritis, puerperal metritis, morbidity by 60 DIM, PVD, and cyclicity (Table 1). Calcitriol treatment was effective

Key Words: survey, colostrum, organic


This study aimed to determine hair cortisol concentrations (HCC) in various sampling sites on the body of lactating Holstein cows and heifers. Forty-seven multiparous lactating Holstein cows (DIM = 110 ± 47, BW = 623 ± 75 kg) and 23 Holstein heifers (10–12 mo of age, BW = 258 ± 20 kg) were used in this experiment. To obtain serum, blood was collected by jugular venipuncture in vacutainer tubes at 12:00 h at BW = 623 ± 75 kg and 23 Holstein heifers (10–12 mo of age, BW = 258 ± 20 kg) were used in this experiment. To obtain serum, blood was collected by jugular venipuncture in vacutainer tubes at 12:00 h. Only 10% of producers offer colostrum to their calves between 6 to 12 h and 2.6% between 12 to 24 h after birth. Half of responders let calves drink colostrum ad libitum. Almost 25% of producers fed 4 L (or 4 quarts; liters and quart were used interchangeably) following a 12% offering 3 L and 12% offering 2 L. Calves were weaned at an age older than 8 weeks of age in 44% of responding herds, at 8 weeks in 46% and between 6 to 7 weeks of age in 10%. Of 43 responders only 2 farms tested colostrum quality routinely and one farm tested it weekly. The remaining 40 farms (93%) never tested it. Testing was performed routinely in those farms with more than 101 cows. Based on the results it is possible to note that testing colostrum quality is not a routine practice used by small organic producers in Ohio. Furthering education and training practices could be very impactful to improve management practices regarding colostrum.

Key Words: survey, colostrum, organic

M90 Upregulation of nitric oxide synthases and natriuretic peptides in healthy controls compared with pulmonary arterial hypertensive Holstein heifers exposed to chronic hypobaric hypoxia. S. Wang1, Y. Wang2, S. Li1, D. Han2, Q. Shi2, and S. Ji3, 1College of Animal Science and Technology, China Agricultural University, Beijing, China, 2College of Veterinary Medicine, China Agricultural University, Beijing, China, 3Clinical Laboratory of General Hospital of Tibet Military Command, Lhasa, China.

Objectives were to determine effects of an injectable formulation of calcitriol on Ca concentration, risk of subclinical hypocalemia, and health in dairy cows. Cows were blocked by lactation number (1 vs. >2) and calving sequence, and within each block, randomly assigned to receive, within 6 h of calving, subcutaneously vehicle only (Control, n = 450), 200 μg of calcitriol (Cal200, n = 450), or 300 μg (Cal300, n = 450). Blood samples were collected before treatment administration, and on d 1, 2, 3, and 5. Samples were analyzed for blood ionized Ca, and total plasma Ca and Mg. Vaginal discharge (VD) was evaluated at 4, 6, and 8 DIM, and cows with VD reddish/brownish foul smell were diagnosed with metritis. Morbidity was evaluated until 60 DIM, and responses measured included metritis, mastitis, displaced abomasum, digestive and respiratory disorders. At 35 DIM, VD was scored for diagnosis of purulent vaginal discharge (PVD, VD ≥ 2, mucopurulent discharge). Cyclicality was evaluated by presence of a corpus luteum (>20mm) in at least one of 2 ovarian ultrasound scans performed at 35 and 49 DIM. Data were analyzed using PROC MIXED and PROC GLIMMIX of SAS. Cows receiving calcitriol resulted in greater concentration of blood ionized Ca and plasma total Ca during the first 5 and 3 DIM, respectively, whereas concentration of plasma Mg were reduced during the first 3 DIM (Table 1). Treatment with calcitriol did not affect the incidence of metritis, puerperal metritis, morbidity by 60 DIM, PVD, and cyclicity (Table 1). Calcitriol treatment was effective

Key Words: hair cortisol, Holstein cows and heifers, various body sites
Table 1 (abstract M91).

<table>
<thead>
<tr>
<th>Parameter</th>
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<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ionized Ca, mM</td>
<td>Control</td>
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<td>Cal300</td>
</tr>
<tr>
<td></td>
<td>1.12</td>
<td>1.22</td>
<td>1.27</td>
</tr>
<tr>
<td>Total Ca, mM</td>
<td>2.31</td>
<td>2.65</td>
<td>2.70</td>
</tr>
<tr>
<td>Total Mg, mM</td>
<td>0.65</td>
<td>0.54</td>
<td>0.52</td>
</tr>
<tr>
<td>Metritis, %</td>
<td>37.5</td>
<td>38.1</td>
<td>34.1</td>
</tr>
<tr>
<td>Puerperal metritis, %</td>
<td>9.9</td>
<td>8.3</td>
<td>9.6</td>
</tr>
<tr>
<td>Morbidity by 60 DIM, %</td>
<td>60.2</td>
<td>62.6</td>
<td>63.4</td>
</tr>
<tr>
<td>Purulent vaginal discharge, %</td>
<td>26.7</td>
<td>32.8</td>
<td>30.2</td>
</tr>
<tr>
<td>Cyclicity, %</td>
<td>68.3</td>
<td>74.7</td>
<td>73.5</td>
</tr>
</tbody>
</table>


Our objectives were to determine (1) the effect of a single dose of an oral Ca bolus after parturition on blood Ca concentration, and (2) the effect of this supplemental Ca approach on milk production and culling. For our first objective, cows from 1 commercial dairy were enrolled within 19 h after parturition (mean ± SD = 8.3 ± 5.3 h) and randomized within parity group (1st, 2nd, and 3rd or greater) to control [CON (n = 25); no placebo] or bolus treatment [BOL (n = 25); 3 oral Ca boluses administered at once supplying 54 to 64 g of Ca (Quadrical, Bivet, Barneveld, WI)]. Blood samples were collected before group assignment and at 1, 2, 4, 8, 12, and 24 h thereafter. Plasma Ca concentration was analyzed by mixed effects repeated measures ANOVA. Cows in the control and treatment groups were comparable at the time of enrollment. Blood samples were collected at 1, 2, 4, 8, 12, and 24 h after bolus administration for all cows. Administration of a single oral Ca bolus did not affect plasma Ca concentration in the 24 h after bolus administration (CON = 2.00 ± 0.03 vs. BOL = 1.96 ± 0.03 mmol/L, P = 0.36). No preliminary associations between treatment and first test milk yield (BOL = 38.1 ± 0.2 vs. BOL = 38.1 ± 0.2 kg/d, P = 0.88) or culling within 30 d in milk [CON = 4.1% (80/1,976) vs. BOL = 4.9% (96/1,976), P = 0.22] were observed. Administration of a single dose of an oral Ca bolus after parturition did not increase blood Ca concentration, and preliminary results indicate no association between treatment and early lactation milk production or culling.

Key Words: hypocalcemia, oral calcium, transition cow
The objective was to evaluate the association of serum Ca concentration and calcemic status with P, Mg, K, Na, Fe, Zn and Cu concentrations at calving on 768 multiparous Jersey cows from 2 commercial dairies. Blood samples for serum Ca, P, Mg, K, Na, Fe, Zn and Cu analyses were collected from the coccygeal vessels 3 h 14 min (±2 h 04 min) after calving. Serum samples were analyzed by Inductively Coupled Plasma – Optical Emission Spectrometry method (ICP-OES). Based on serum Ca concentration cows were classified as subclinical hypocalcemic (SCH; n = 250). Associations among variables and with calcemic status were analyzed using spearman rank correlations and mixed models, respectively (CORR and MIXED procedures of SAS). Descriptive statistics, including first (Q1), second (Q2) and third (Q3) quartiles, of serum mineral concentrations at calving are shown in the Table 1. Serum Ca concentration was correlated negatively with Mg and positively with P, Na and Zn (P < 0.001; | r | > 0.1). Cows with SCH had higher serum Mg concentration than NC cows (2.53 vs. 2.42 mg/dL; P = 0.01), Na (137.4 vs. 142.3 mEq/L; P < 0.001) but lower P (3.84 vs. 4.77 mg/dL; P < 0.001), K (4.58 vs. 4.73 mEq/L; P = 0.01), Na (137.4 vs. 142.3 mEq/L; P < 0.001), Fe (1.00 vs. 1.11 ppm; P = 0.001), Zn (0.59 vs.0.69; P < 0.001) and Cu (0.80 vs. 0.86 ppm; P < 0.001). Our results suggest that the negative effects of postpartum subclinical hypocalemia on dairy performance may be in some measure mediated by variations in other serum minerals.

Key Words: serum calcium, serum minerals, hypocalcemia

**Table 1 (abstract M94).** Quartile distribution (Q1 = 25th percentile, Q2 = 50th percentile, Q3 = 75th percentile) of serum mineral concentrations at calving

<table>
<thead>
<tr>
<th></th>
<th>Ca (mg/dL)</th>
<th>P (mg/dL)</th>
<th>Mg (mg/dL)</th>
<th>K (mEq/L)</th>
<th>Na (mEq/L)</th>
<th>Fe (ppm)</th>
<th>Zn (ppm)</th>
<th>Cu (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>7.4</td>
<td>3.1</td>
<td>2.2</td>
<td>4.2</td>
<td>133</td>
<td>0.72</td>
<td>0.49</td>
<td>0.66</td>
</tr>
<tr>
<td>Q2</td>
<td>7.9</td>
<td>3.8</td>
<td>2.4</td>
<td>4.5</td>
<td>137</td>
<td>0.94</td>
<td>0.60</td>
<td>0.76</td>
</tr>
<tr>
<td>Q3</td>
<td>8.2</td>
<td>4.6</td>
<td>2.7</td>
<td>4.8</td>
<td>141</td>
<td>1.20</td>
<td>0.72</td>
<td>0.88</td>
</tr>
<tr>
<td>NC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>8.8</td>
<td>4.0</td>
<td>2.2</td>
<td>4.4</td>
<td>139</td>
<td>0.79</td>
<td>0.60</td>
<td>0.71</td>
</tr>
<tr>
<td>Q2</td>
<td>8.9</td>
<td>4.8</td>
<td>2.4</td>
<td>4.6</td>
<td>142</td>
<td>1.00</td>
<td>0.69</td>
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<tr>
<td>Q3</td>
<td>9.2</td>
<td>5.6</td>
<td>2.5</td>
<td>4.9</td>
<td>145</td>
<td>1.30</td>
<td>0.80</td>
<td>0.95</td>
</tr>
</tbody>
</table>

Tulare, CA. 2Unité Mixte de Recherche sur les Herbivores, INRA, VetAgro Sup, Saint-Genes-Champanelle, France.

The objective was to evaluate the association of semen Ca concentration and spermatogenic parameters in male New Zealand White rabbits. A total of 24 male rabbits was used in the experiment. The rabbits were kept under standard laboratory conditions for 2 weeks before the experiment for adaptation. After adaptation, rabbits were divided into 4 groups of 6; positive controls (tap water), and 3 different doses of punicalagin in tap water (1, 2 and 10 mg/kg punicalagin). All treatments were administered by daily oral gavages and 3 different doses of punicalagin. The present study evaluated the potential subacute toxic effects of oral punicalagin in male New Zealand White rabbits. Taking into account that punicalagin is a very powerful anti-oxidant and very abundant in pomegranates and pomegranate juice, the present study evaluated the potential subacute toxic effects of oral punicalagin in male New Zealand White rabbits. A total of 24 male rabbits was used in the experiment. The rabbits were kept under standard laboratory conditions for 2 weeks before the experiment for adaptation. After adaptation, rabbits were divided into 4 groups of 6; positive controls (tap water), and 3 different doses of punicalagin in tap water (1, 2 and 10 mg/kg punicalagin). All treatments were administered by daily oral gavages for 9 weeks. Once a week, body weights and feed intakes of the rabbits were evaluated and the oral doses were adjusted accordingly. On d 63 of the experiment, blood from the ear artery was collected and used for hematological and biochemical parameters. After blood collection, rabbits were sacrificed and internal organ weights were recorded. No significant differences were apparent in treated rabbits in any of the hematological (such as hemoglobin, hematocrit, red blood cells, mean corpuscular hemoglobin, mean corpuscular volume, mean corpuscular hemoglobin concentrations, total white blood cells, lymphocytes, monocytes, granulocytes, platelets, mean platelet volume) or biochemical (serum glucose, cholesterol, triglyceride, urea, creatine, alkaline phosphatase, aspartate aminotransferase, and alanine aminotransferase) parameters (P > 0.1). Body weight changes and feed intakes were similar among the treatments with no significant adverse effects throughout the study. Moreover, no alterations on organ weights were observed among the groups (P > 0.1). Thus, our subacute 63-d study suggested the lack of

**Key Words:** sperm parameters, bisphenol A (BPA), reproduction

**M97** Safety evaluation of punicalagin in male New Zealand White rabbits. H. Karabulut* and M. S. Gulay, Mehmert Akif Ersoy University, Burdur, Turkey.

Taking into account that punicalagin is a very powerful anti-oxidant and very abundant in pomegranates and pomegranate juice, the present study evaluated the potential subacute toxic effects of oral punicalagin in male New Zealand White rabbits. A total of 24 male rabbits was used in the experiment. The rabbits were kept under standard laboratory conditions for 2 weeks before the experiment for adaptation. After adaptation, rabbits were divided into 4 groups of 6; positive controls (tap water), and 3 different doses of punicalagin. All treatments were administered by daily oral gavages for 9 weeks. Once a week, body weights and feed intakes of the rabbits were evaluated and the oral doses were adjusted accordingly. On d 63 of the experiment, blood from the ear artery was collected and used for hematological and biochemical parameters. After blood collection, rabbits were sacrificed and internal organ weights were taken. No significant differences were apparent in treated rabbits in any of the hematological (such as hemoglobin, hematocrit, red blood cells, mean corpuscular hemoglobin, mean corpuscular volume, mean corpuscular hemoglobin concentrations, total white blood cells, lymphocytes, monocytes, granulocytes, platelets, mean platelet volume) or biochemical (serum glucose, cholesterol, triglyceride, urea, creatine, alkaline phosphatase, aspartate aminotransferase, and alanine aminotransferase) parameters (P > 0.1). Body weight changes and feed intakes were similar among the treatments with no significant adverse effects throughout the study. Moreover, no alterations on organ weights were observed among the groups (P > 0.1). Thus, our subacute 63-d study suggested the lack of

**M95** Withdrawn

**M96** Reproductive toxicity of bisphenol A in male New Zealand White rabbits. H. Karabulut and M. S. Gulay*, Mehmert Akif Ersoy University, Burdur, Turkey.

Environmental chemicals, such as bisphenol A (BPA), can be harmful for male reproduction. Therefore, the aim of the current study was to evaluate the possible effects of different doses of BPA on some reproductive parameters in male New Zealand White rabbits. Rabbits were housed individually and trained for semen collection for 2 weeks before the experiment. After the training period, rabbits were divided into 4 groups of 6 rabbits each and received daily gavages of 0, 10, 20, and 100 mg/kg BPA in corn oil for 9 weeks. Semen was collected once a week from each rabbit and semen samples collected were analyzed separately. Libido was also evaluated during semen collection based on the time of introducing the female to the male rabbits until the male rabbit ejaculated into the artificial vagina. At the end of the experiment, the rabbits were euthanized and wet weights of testes, epididymides and accessory sex glands as a whole was recorded. Initial values (ejaculate volume, ejaculate weight, ejaculate pH, sperm concentration, percent progressive motility, and seminal plasma protein levels) tested at d 1 were similar among the groups. Likewise, there were no differences in ejaculate volume, ejaculate weight, ejaculate pH and seminal plasma protein levels at the end of the experiment. Libido and weights of reproductive organs were not affected by the treatments. However, sperm concentrations and percent progressive motility were significantly declined in BPA treated bucks (P < 0.02). Thus, the current 9-week study suggested that as low as 10 mg/kg BPA per day can impair spermatogenesis and motility in male rabbits.

**Key Words:** sperm parameters, bisphenol A (BPA), reproduction
toxic effects of punicalagin even with 10 mg/kg daily intake in male New Zealand rabbits.

**Key Words:** antioxidant, polyphenol, toxicity

**M98 Subacute bisphenol A toxicity in male New Zealand White rabbits.** H. Karabulut and M. S. Gulay*, Mehmet Akif Ersoy University, Burdur, Turkey.

Because of the possible effects of bisphenol A (BPA) on human and other animals, there are several studies about the possible effects of BPA toxicity. Even so, the current literature lacks studies about the potential effects of BPA on rabbits. Therefore, the objectives of the present study were to document the effects of different doses of bisphenol A (BPA) on hematological and biochemical parameters, liver enzymes, weight gain and feed intake of male New Zealand White rabbits. Prior to the experiment, male rabbits (n = 24) were acclimatized to laboratory conditions for 14 d. After the adaptation, rabbits were divided into 4 groups of 6; positive controls (Group 1, corn oil), and 3 different doses of BPA (10, 20 and 100 mg/kg BPA in corn oil) for 9 weeks. Body weights and feed intakes of the rabbits were evaluated weekly. At the end of the experiment, blood samples from the ear artery were taken for the analyses of hematological and biochemical parameters. PROC GLM procedure was used for statistical evaluations. To compare the individual means of the groups, Dunnett post hoc analysis was performed. The results of the current study indicated no changes in weight gain and feed intake among the treatments. Similarly, the mean values of total white blood cells, lymphocytes, monocytes, granulocytes, platelets, mean platelet volume, mean corpuscular volume and mean corpuscular hemoglobin were within the physiological ranges for rabbits and not affected by BPA treatment at the end of the study. However, hemoglobin, red blood cells and mean corpuscular hemoglobin concentrations were reduced significantly due to 20 and 100 mg/kg BPA exposure (P < 0.05). Among the biochemical parameters, serum glucose, cholesterol, and triglyceride concentrations were not affected by BPA treatments. On the other hand, serum alkaline phosphatase, aspartate aminotransferase, alanine aminotransferase, urea, and creatine levels were significantly elevated in the 20 and 100 mg/kg BPA dose groups (P < 0.05). In conclusion, the current subacute study suggested a non-observed adverse effect level (NOAEL) of 10 mg BPA/kg in male New Zealand White rabbits.

**Key Words:** bisphenol A (BPA), rabbit, subacute toxicity

**M99 Omnigen supplementation during the first 150 days of life decreases the incidence of tick fever in dairy calves.** B. B. Leme*, L. F. Barbosa², I. C. Marabiza³, A. C. Mariano⁴, S. H. Casonato⁴, and J. L. M. Vasconcelos³, ¹Universidade Estadual Paulista Júlio de Mesquita Filho, Botucatu, São Paulo, Brazil, ²Universidade Federal de Lavras, Lavras, Minas Gerais, Brazil, ³Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil, ⁴Fazenda Agrindus S/A, Descalvado, São Paulo, Brazil.

The aim of this study was to evaluate the rate of infection of tick fever (disease caused by agents *Babesia bigemina*, *Babesia bovis*, and *Anaplasma marginale*, which are transmitted by the tick) in dairy calves supplemented or not with Omnigen-AF (OMN, Phibro Animal Health, Teaneck, NJ) before and after weaning. One hundred twenty calves ranked by serum protein (refractometer), evaluated 24–48 h after calving, were distributed to receive OMN (n = 60; 10 g /calf/d up to 60 d, added to milk, and later 20gr/calf/d, added to the concentrate, from 61 to 150 d) or not (CON; n = 60). The calves were kept in individual cages, for 75 d, where they received 6L of milk per day plus ad libitum concentrate. After 75 d, they were introduced into group housing (n = 4), where they received a total mixed ration (TMR). During the experimental period, weekly evaluations were made for blood hematocrit, serum protein, stained smear to detect the presence of *Anaplasma spp.* or *Babesia spp.*, mucosal color and rectal temperature. The treatment for tick fever (TF) and others diseases were recorded daily. Blood samples were collected from the TF treated animals for determination of hematocrit, serum protein, and presence of TF. There was no effect (P > 0.10) of treatment for serum protein parameters, rectal temperatures, and detection of hemoparasites by stained smear. Animals that received OMN in relation to the control group required fewer treatment days for diarrhea and pneumonia (mean of 12.67 vs 15.12 ± 1.1 d, P = 0.1) and for TF (mean of 0.88 vs 1.35 ± 0.13, P = 0.012). OMN group had lower number of animals affected by TF (mean 60% vs 77% ± 6%, P = 0.05), lower number of weeks with hematocrit below normal range (mean of 2.17 vs 3.12 ± 0.32, P = 0.035), lower number of animals that needed to repeat treatment by TF (mean of 0.23 vs 0.37 ± 0.059, P = 0.035), and fewer days of treatment (clinical symptoms) (mean of 0.22 vs 0.4 ± 0.06, P = 0.03). For descriptive statistical analysis it was conducted by the Minitab program (Minitab Inc., State College, PA), generalized linear model, assuming statistical significance for P < 0.05. Omnigen-AF supplementation for dairy calves may minimize infections and clinical symptoms of tick fever.

**Key Words:** calf, Omnigen-AF, health