

## ADSA-SAD Undergraduate Competition: Original Research

**196 Monitoring the incidence of ketosis in fresh cows using milk composition, urine ketones, and milk ketones.** K. D. Stevens,\* E. L. Stayduhar, M. L. Eastridge, and K. M. Daniels, *The Ohio State University, Columbus.*

Fresh cows have a high risk for ketosis within the first 30 DIM due to low DM intake and the rapid mobilization of fat after parturition. Early detection of ketosis, including subclinical ketosis, can allow for earlier intervention and minimize the loss of milk production. Detection of ketosis is commonly done in the field with measuring ketones in urine or milk, but concentration of fat in milk also may be useful for detection of ketosis. A 700-cow Holstein farm in Ohio was used for collecting samples at 7 and 14 DIM ( $n = 204$  cows). Composite milk samples were collected using a BouMatic (Madison, WI) in-line sampler and right-front (RF) quarter strip samples were collected. Both samples were analyzed for milk components at the farm using a LactiCheck (LIC; Page and Pedersen International Ltd., Hopkinton, MA), with weekly calibration using samples from Eastern Laboratory Services (Medina, OH). Composite milk samples also were sent to DHI Cooperative, Inc. (Columbus, OH) for analysis of milk components. Keto-Test strips (Elanco, Greenfield, IN) were used to measure ketones ( $\beta$ -hydroxybutyrate) in milk stripped from the RF quarter, and urine ketones (acetoacetate) were measured with KetoStix (Bayer Healthcare LLC, Monheim, Germany). The average fat concentration from LIC composite samples was  $5.36 \pm 2.05\%$  and  $5.15 \pm 1.90\%$  from DHI, with the RF strippings having a lower milk fat ( $3.17 \pm 1.88\%$ ). Average milk ketone concentration was  $0.55 \pm 0.98$  mg/dL, and urine ketone concentration was  $4.41 \pm 15.4$  mg/dL; however, the incidence of clinical ketosis was relatively low in the herd (3.4% based on urine ketones  $\geq 40$  mg/dl or 6.9% based on milk ketones  $\geq 2.0$  mg/dL). The correlation coefficient for LIC and DHI composites was 0.70 ( $P < 0.0001$ ), and the correlations between the composites and the RF samples were similar for both methods of analysis (0.30;  $P < 0.0001$ ). The correlation of the RF milk fat percentage and the milk and urine ketones also was similar (0.22;  $P < 0.001$ ). The changes in milk fat concentrations from 7 to 14 DIM were similar for LIC and DHI composites and the RF samples ( $-0.63$ ,  $-0.88$ , and  $-0.77$ , respectively). Monitoring milk fat concentration of individual cows holds promise for the diagnosis of ketosis, and it appears that either composite samples or strippings can be used to establish a baseline from which to identify cows with elevated milk fat concentrations.

**Key Words:** ketosis, urine ketones, milk ketones

**197 Effect of a liquid acid footbath solution containing a cationic surfactant on digital dermatitis in dairy cattle.** T. A. Reiter\*<sup>1</sup>, B. A. Beavers<sup>2</sup>, F. R. Moreira<sup>3</sup>, K. J. McQueery<sup>1</sup>, C. L. Wood<sup>1</sup>, and J. M. Bewley<sup>1</sup>, <sup>1</sup>University of Kentucky, Lexington, <sup>2</sup>Beavers Hoofcare Service LLC, Lebanon, KY, <sup>3</sup>GEA Farm Technologies, Naperville, IL.

Dairy producers use many different footbath solutions for control of digital dermatitis (DD); however, many of these compounds have adverse effects on cows, handlers, or the environment. The objective of this research, consisting of 3 studies, was to examine the effects of a liquid acid footbath solution containing a cationic surfactant (PediCuRx Prevent A (PED), GEA Farm Technologies, Naperville, IL) on digital dermatitis size (DDS) and pain (DDP). For each study, treatment cows were exposed to a 2% PED solution 3X per wk. The same observer

evaluated DDS and DDP scores using 0 to 3 scales with 0 assigned to hooves with no DD. For DDS, scores were assigned as follows: 0 = no DD; 1 =  $< 20$  mm DD; 2 =  $\sim 20$  mm DD; and 3 =  $> 20$  mm DD. The pain caused by wart presence was determined by the cow's reaction to either water or finger pressure on the hoof. For DDP, scores were assigned as follows: 0 = no pain; 1 = minimal pain; 2 = moderate pain; and 3 = severe pain. Study 1 included 53 cows in a commercial dairy that were exposed to PED in a footbath for 4 mo. Study 2 included 250 cows in 2 commercial dairy farms in a 4-mo experiment comparing PED to a 10% copper sulfate (CS) solution. Study 3 was conducted at the University of Kentucky Coldstream Dairy with 53 cows assigned for 4 mo to either a PED treatment or a 5% CS control. The MIXED procedure of SAS® (Cary, NC) was used to assess factors affecting DDS and DDP. In study 1, mean responses for DDS and DDP were higher ( $P < 0.05$ ) before starting the study (0.37 and 0.39 for DDS and DDP, respectively) than for the 3 test months after the study started (December: 0.12 and 0.10; January: 0.09 and 0.08; February: 0.00 and 0.00 for DDS and DDP, respectively). In study 2, mean responses for DDS and DDP were not different ( $P < 0.05$ ) during PED periods and CS periods (PED: 0.42 and 0.40; CS: 0.40 and 0.39 for DDS and DDP, respectively). In study 3, mean responses for DDS and DDP were not different ( $P < 0.05$ ) between treatments (PED: 0.28 and 0.28; CS: 0.21 and 0.25 for DDS and DDP, respectively). Control of DD was similar for PED and CS footbath solutions.

**Key Words:** digital dermatitis, footbath

**198 Establishment of antibiotic resistance genes in the gut of pre-weaned dairy calves.** L. Woloohojian,\* E. Hurley, P. Ray, B. Willing, H. Littier, A. Pruden, and K. Knowlton, *Virginia Tech, Blacksburg.*

Antibiotic resistance genes (ARG) are caused by mutations found on specific genes that enable bacteria to survive exposure to antibiotics. ARG are readily transferred horizontally and longitudinally. While ARG have been found in the gut and feces of pre-weaned calves little data are available on the succession of ARG in the early weeks. The objective was to observe the establishment of ARG in fecal bacteria of dairy calves from birth to weaning. Six heifer calves were fed a medicated milk replacer (28% CP, 20% fat, containing neomycin sulfate and oxytetracycline hydrochloride each fed at 10 mg/calf/d) and free choice water and calf starter (22% CP) until weaning at d 42. Fecal grab samples were collected using sterile gloves on d 1, 3, 5, 7, 14, 21, 28, 35 and 42 of age. Colostrum, drinking water, milk replacer, and grain samples were collected to assess possible sources of inoculation with ARG-carrying bacteria. All samples were immediately frozen ( $-20^\circ\text{C}$ ) until DNA extraction. Quantitative polymerase chain reaction was performed to quantify 16S rRNA genes and *tetW* and *sul1* ARG encoding resistance to tetracyclines and sulfonamides, respectively. Changes in absolute and relative abundance of the ARG over time were analyzed using PROC GLIMMIX procedure in SAS. Both genes were present in the feces of 1-d old calves and the abundance of 16S rRNA (log gene copies/g wet feces) did not change during the 42 d of the study. Similarly, relative abundance of *tetW* and *sul1* (gene copies/16S rRNA) remained constant over the study period. This study provides new insight into the colonization of calf gut flora with ARGs in the early weeks.

**Key Words:** antibiotic resistance gene, feces, dairy calf

**199 Effects of supplementing propionibacteria in lactation dairy diets on ruminal fermentation in continuous cultures.** K. A. Dolecheck<sup>\*1</sup>, J. M. Vera<sup>1</sup>, A. J. Young<sup>1</sup>, A. H. Smith<sup>2</sup>, V. Fellner<sup>3</sup>, and J.-S. Eun<sup>1</sup>, <sup>1</sup>*Department of Animal, Dairy, and Veterinary Sciences, Utah State University, Logan,* <sup>2</sup>*Danisco USA Inc., Waukesha, WI,* <sup>3</sup>*Department of Animal Science, North Carolina State University, Raleigh.*

The aim of the present study was to assess characteristics of in vitro ruminal fermentation when mixed cultures were offered lactation dairy diets supplemented with the direct-fed microorganism, *Propionibacterium* P63 in continuous cultures. The design of the experiment was a 2 × 2 factorial with 4 replications. Diets based on corn silage and alfalfa hay as the forage sources were formulated; high forage (HF) or low forage (LF) diet with a forage-to-concentrate ratio of 60:40 or 40:60 (DM basis), respectively, was combined without or with P63 to form 4 treatments: HF without P63, HF with P63, LF without P63, and LF with P63. Approximately 700 mL of the strained ruminal fluid obtained from 2 lactating dairy cows was inoculated into each of 4 fermentors with a continuous dual-flow system. The cultures were allowed 6 d of adaptation to the treatments followed by 3 d of sampling and data collection. Feed totaling 40.0 g of DM was added to each fermentor daily in equal portions delivered at 0700 and 1900 h. The P63 treatments received  $7 \times 10^8$  cfu of P63/fermentor/feeding. Data were analyzed with a model that included the effects of level of forage in the diet (high vs. low forage), P63 (without vs. with P63), and the interaction between level of forage and P63. Supplementing P63 decreased culture pH ( $P = 0.05$ ) in the LF diet, but not in the HF diet. Feeding the LF diet increased total VFA concentration compared with the HF diet ( $P = 0.01$ ), and supplementing P63 increased total VFA concentration regardless of level of forage in the diet ( $P < 0.01$ ). Molar concentrations and proportions of acetate and propionate did not differ in response to supplementing P63 in the HF and the LF diet. However, molar concentration and proportion of butyrate increased due to P63 supplementation ( $P < 0.05$ ) only in the LF diet, resulting in interactions between level of forage and P63 supplementation ( $P < 0.08$ ). Overall results in this in vitro study indicate that P63 supplementation enhanced ruminal fermentation by increasing VFA production, but its effects on continuous culture fermentation differed between the HF and the LF diet.

**Key Words:** propionibacteria, ruminal fermentation, continuous cultures

**200 Effect of calf starter form and milk source on growth and intake of dairy calves.** S. A. McCullough,<sup>\*</sup> T. S. Dennis, and T. D. Nennich, *Purdue University, West Lafayette, IN.*

A combination of texturized calf starter and milk replacer are commonly used feeds for dairy calves, but alternative feeds may offer improved growth and development. The objective of this study was to determine the effects of different forms of calf starter and sources of milk on growth, dry matter intake, and feed efficiency of dairy calves on a commercial dairy. In this randomized complete block design with a 2 × 2 factorial arrangement of treatments, 120 Holstein heifers (BW =  $39.6 \pm 5.4$  kg) were blocked in groups of 4 by hutch type and birth date. Heifers were assigned to either pasteurized whole milk (WM) or milk replacer (MR) and either texturized (T) or pelleted (P) starter. The MR fed was 24% CP and 18% fat. Samples of WM were collected at each feeding and analyzed for total solids, protein and fat. Calves were allowed ad libitum access to starter and received 3.8 L/d of milk for 14 d, 6.7 L/d from d 15 to 21, and 7.6 L/d from d 22 to 56. Calves were weaned on d 63. Calves were weighed at birth and measured every 2 wk for BW, hip and withers height, body length, and heart girth circumference (HGC) for 10 wk. Feed and refusal samples were collected weekly and starter intake was measured every 2 wk. Data were analyzed as repeated measures using the Proc Mixed procedure of SAS. Heifers

fed WM were 4.3 kg heavier at wk 10 than heifers fed MR ( $P < 0.01$ ). Heifers fed WM also had greater ADG than heifers fed MR (0.76 and 0.70 kg/d, respectively;  $P < 0.01$ ). Additionally, heifers fed WM and T or MR and T had greater ADG than heifers fed MR and P (0.76, 0.72, and 0.68 kg/d, respectively;  $P < 0.01$ ). Dry matter intake of starter did not differ between milk or starter source, resulting in heifers fed WM having improved feed:gain compared with heifers fed MR (0.65 and 0.78 kg/kg, respectively;  $P < 0.05$ ). Heifers fed WM and P were taller at the hip than heifers fed MR and P ( $P < 0.05$ ). Withers height and HGC were greater ( $P < 0.04$ ) and hip height tended ( $P < 0.09$ ) to be greater for heifers fed WM compared with MR. However, skeletal measurements were similar between starter sources. Feeding heifers WM as compared with MR resulted in improved body weight and ADG.

**Key Words:** calf starter, dairy calf, milk

**201 Effect of a mannanoligosaccharide (Bio-Mos) on health and growth of Holstein and Jersey calves.** L. R. Such,<sup>\*</sup> G. D. Hobbgood, B. A. Hopkins, and S. Davidson, *North Carolina State University, Raleigh.*

Forty-two neonatal Holstein ( $n = 24$ ) and Jersey ( $n = 18$ ) calves were used to examine the effects of adding Bio-Mos, a mannanoligosaccharide, to the milk, on health and growth. Calves were assigned at birth to treatments in a completely randomized block design: 1). Seven grams of Bio-Mos or 2). 0 g of Bio-Mos (control) added to the whole milk diet. Calves were fed colostrum after birth and housed in individual calf hutches through 63 d. Starter mix was fed from d 1 through 56. Data that included repeated measures were analyzed using the mixed procedure (PROC MIXED) of SAS, and data that included one value per calf, such as ADG and feed efficiency (FE), were analyzed using the general linear models procedure (PROC GLM) of SAS. There were no differences in body weight, average daily gain, starter DMI, hip height, hip width, wither height or FE between calves fed Bio-Mos and control calves ( $P > 0.05$ ). Preweaned Holstein calves had greater ADG (0.71 kg/d) and starter DMI (0.67 kg/d) than Jersey calves (0.46 kg/d and 0.41 kg/d, respectively), but there were no differences ( $P = 0.26$ ) in FE between the breeds (1.2 kg/kg in Holstein vs. 1.5 kg/kg in Jersey). Feeding 7 g/d Bio-Mos in the milk did not improve growth or health of pre-weaned Holstein and Jersey calves.

**Key Words:** calf, Holstein, Jersey

**202 Predicting early life illness in Holstein heifer calves.** C. A. Bellmund,<sup>\*</sup> K. C. McRoberts, and D. J. R. Cherney, *Cornell University, Ithaca, NY.*

Practical technological tools such as infrared surface temperature and calf feeder intake reports may predict early life health problems in Holstein heifer calves. Early prediction of illnesses including bovine virus diarrhea virus (BVDV) and bovine respiratory disease can allow effective treatment and preventative individual isolation. Calves ( $n = 50$ ) born between April and July 2011 were selected at birth from the dairy herd at Cornell University's Teaching and Research Dairy Unit, and tracked the first 30 d. Non-invasive infrared surface temperatures were recorded daily using a Fluke 561 hand-held infrared thermometer at 3 locations: cheek, ribs, and rump. Hair color was also noted at these locations. Core temperatures were measured weekly using a digital rectal thermometer. Drinking speed and intake rate of milk replacer were recorded using an automatic feeder. Daily air temperature and relative humidity readings were taken at calf housing locations. Calf illness was assessed based on observation of either BVDV or bovine

respiratory disease and coded into multiple parameters including daily calf illness and severity. Nominal logistic model development was undertaken using JMP Pro 9.0.2. Parameters significantly predicting daily illness status included: observation date, core temperature, cheek surface temperature, and intake rate, Coefficient of determination was low (<0.15) for all models and goodness of fit was poor. Hair color recorded at surface temperature locations appeared to be higher for black-haired calves than white-haired calves, especially under sunny, high air temperature conditions. Infrared thermometry, core temperature and intake rate can be used to predict calf illness status; however, efficacy of prediction is poor and its utility as a management tool is minimal. Additional environmental and epidemiological factors not considered in this study are likely contributing more to calf disease status than those recorded. Calves observed in this study will continue to be tracked for age at first calving, milk yield, and lifetime productivity, which could be influenced by early life health status.

**Key Words:** calf health, illness prediction, bovine virus diarrhea virus

**203 Who's listening? The preferred means of communication for Tennessee dairy producers.** M. E. Conley,\* G. M. Pighetti, and P. D. Krawczel, *University of Tennessee, Knoxville.*

The dairy industry encompasses a wide range of individuals, from those involved with on-farm production to allied professionals in diverse settings, and requires efficient and effective communication to disseminate information. The objective of this study was to investigate how Tennessee dairy producers currently receive information, how they prefer to receive new knowledge, and how they communicate with their employees. To address this objective, 452 written surveys (with an online option) consisting of 28 questions were mailed to dairy farms with a current grade A milk permit as of September 2011. Survey responses were quantified using the FREQ procedure in SAS. Unanswered questions were treated as missing data. There was a 30% response rate, with 130 responses returned by mail and 4 responses online. Tennessee dairy producers primarily use non-electronic forms of communication, indicating they sometimes or often rely on personal experience (97%), veterinarians (97%), and magazines (94%) to acquire new information. The internet was the least utilized with only 56% of respondents using this resource sometimes or often versus 44% that never use it. This trend was continued in their preferred means of acquiring information. Eighty percent of TN dairies had 1–4 employees. Most communicated with their employees by casual discussion (81%) or when they observed a problem (64%), whereas only 14% had formal meetings. For independent learning, 59% provided their employees with magazines, 37% would be willing to send their employees for training (with 13% unsure), and 29% would be willing to host on-farm training (with 10% unsure). The results indicate that producers use and prefer non-electronic forms of communication when acquiring new information, thus electronic mediums are not the most effective way to communicate with the majority of Tennessee producers. Communicating new information within a farm may not be efficient as it relies more on casual discussion and troubleshooting rather than structured meetings and/or trainings. This study will aid in better designing and implementing communication strategies with dairy producers, their employees, and affiliated professionals.

**204 Key Words: producer, communication Incorporation of palmitic and stearic acids into plasma lipid fractions of lactating dairy cows.** S. Schmidt,\* C. L. Preseault, J. E. Rico, M. S. Allen, and A. L. Lock, *Michigan State University, East Lansing.*

Transport of fatty acids (FA) in the bloodstream is complex and involves various plasma lipid fractions including phospholipids (PL), cholesterol

esters (CE), triglycerides (TG), and NEFA. Effects of dietary FA on plasma lipid fractions have not been well characterized in lactating dairy cows. The mammary gland preferentially utilizes FA from plasma TG and NEFA for milk fat synthesis, thus changes in the profile and concentration of these fractions may impact milk fat synthesis. Effects of dietary palmitic and stearic acids on the concentration and profile of plasma lipid fractions were evaluated in an experiment with a crossover arrangement of treatments. Sixteen Holstein cows ( $143 \pm 50$  DIM) were assigned to a treatment sequence; treatments were diets supplemented (2% of diet DM) with palmitic acid (PA; 99% C16:0) or stearic acid (SA; 98% C18:0). Treatment periods were 21 d with plasma samples collected every 15 h between d 17 and d 21 of each period and composited. The statistical model included the random effect of cow and the fixed effects of period, treatment, lipid fraction, and the interaction of treatment and lipid fraction. PA treatment increased MF yield by 6.2% compared with SA treatment ( $P < 0.01$ ). The proportion of total plasma FA in each lipid fraction was not affected by treatment and averaged 50.4, 46.5, 2.3, and 0.83% for PL, CE, TG, and NEFA, respectively (all  $P > 0.14$ ). The PA and SA treatments increased the concentration of C16:0 and C18:0 respectively in TG; for C16:0, values were 29.7 vs. 18.2, and for C18:0 they were 29.5 vs. 36.4 g/100 g FA (PA vs. SA treatment, both  $P < 0.0001$ ). PA treatment also increased C16:0 in NEFA and PL fractions ( $P < 0.0001$ ), but not in CE ( $P = 0.24$ ). Likewise, the SA treatment increased C18:0 in NEFA and PL fractions ( $P < 0.01$ ), but not in CE ( $P = 0.9$ ). The majority of C16:0 and C18:0 were transported in PL with 73.6 vs. 71.4% of total plasma C16:0 (PA vs. SA treatment,  $P = 0.08$ ) and 90.5 vs. 88.3% of total plasma C18:0 (PA vs. SA treatment,  $P = 0.006$ ) within the PL fraction. Results demonstrate that the PA and SA treatments increased the concentration of C16:0 and C18:0, respectively, across plasma TG, PL, and NEFA. Treatment did not however, alter proportions of total FA across lipid fractions. Further work is required to determine if the observed increase in milk fat yield with the PA treatment was due to the increase in C16:0 in TG.

**Key Words:** plasma lipids, palmitic acid, stearic acid

**205 Effect of temperature during drying and mechanical extrusion on soybean meal protein in situ degradability and in vitro digestibility.** B. J. Isenberg\*<sup>1</sup>, A. N. Hristov<sup>1</sup>, D. M. Kniffen<sup>1</sup>, C. Lee<sup>1</sup>, K. S. Heyler<sup>1</sup>, T. W. Cassidy<sup>1</sup>, and R. A. Fabin<sup>2</sup>, <sup>1</sup>*The Pennsylvania State University, University Park,* <sup>2</sup>*Fabin Bros. Farms, Indiana, PA.*

The objective of this study was to investigate the effect of drying and extruding temperature on ruminal degradability and intestinal digestibility of mechanically-extracted soybean meal (M-SBM) crude protein (CP). Whole soybeans were processed at a commercial extrusion facility with the following treatments: drying at 49°C and extruding at 149°C (HD-LE); drying at 49°C and extruding at 160°C (HD-ME); drying at 49°C and extruding at 171°C (HD-HE); drying at 27°C and extruding at 149°C (LDLE); and drying at 27°C and extruding at 160°C (LD-ME). Control was solvent-extracted SBM (S-SBM). Ruminal protein degradability was determined by incubating samples in situ for up to 24 h in the rumen of 3 lactating dairy cows. Following the in situ incubation, a portion of the undegraded meal residues were further processed to estimate intestinal CP digestibility in vitro using incubation in pepsin-hydrochloric acid solution for 48 h. Ruminally degradable (RDP) and undegradable (RUP) protein in samples were estimated based on NRC (2001) and ruminal passage rates calculated from actual intake and body weight of the cows. All M-SBM had higher RUP ( $P < 0.001$ ) content compared with S-SBM (33% RUP), which could be partially explained by the slightly larger geometric mean diameter of the former meals (769 vs. 759  $\mu\text{m}$ ,  $P = 0.01$ ). Increasing the extruder temperature

increased ( $P < 0.001$ ) RUP content of the HD (43, 50, and 55%, for HD-LE, HD-ME, and HD-HE, respectively) or LD (43 vs. 49%, LD-LE and LD-ME, respectively) meals. Drying temperature had no effect on M-SBM RUP. Intestinal digestibility of the undegraded in situ CP was similar among treatments ( $P = 0.24$ ), although digestibility of M-SBM was numerically lower than S-SBM CP (65 vs. 71%, respectively). Lys

content of in vitro residues was similar among treatments. Meal output was decreased by about 13% by increasing extrusion temperature. In the specific conditions of this study, increasing extruder temperature from 149°C to 171°C (300 to 340°F) increased RUP content of M-SBM by 28% but decreased meal output.

**Key Words:** soybean meal, processing, ruminal degradability