

Animal Health I

M28 Molecular basis of virulence in *Staphylococcus aureus* ovine mastitis. C. Le Maréchal^{1,2}, N. Seyffert^{1,4}, J. Jardin^{1,2}, D. Hernandez⁵, G. Jan^{1,2}, V. Azevedo⁴, P. François⁵, J. Schrenzel⁵, S. Even^{1,2}, N. Berkova^{1,2}, R. Thiéry³, J. R. Fitzgerald⁶, S. Lortal^{*1,2}, and Y. Le Loir^{1,2}, ¹INRA STLO, Rennes, France, ²AGROCAMPUS OUEST STLO, Rennes, France, ³ANSES, Sophia-Antipolis, France, ⁴ICB/UFGM, Belo Horizonte, MG, Brazil, ⁵University of Geneva Hospitals (HUG), Geneva, Switzerland, ⁶University of Edinburgh, Edinburgh, Scotland, United Kingdom.

Staphylococcus aureus is one of the main pathogens involved in ruminant mastitis worldwide. The severity of staphylococcal infection is highly variable, ranging from subclinical to gangrenous mastitis and is dependent on host as well as bacterial factors. This work represents an in-depth characterization of *S. aureus* mastitis isolates to identify bacterial factors involved in severity of mastitis infection. We employed genomic, transcriptomic and proteomic approaches to comprehensively compare 2 clonally related *S. aureus* strains that were responsible for severe (strain O11) and milder (strain O46) mastitis in ewes, respectively. Variation in the content of mobile genetic elements, iron acquisition and metabolism, transcriptional regulation and exoprotein production was observed. In particular, O11 produced relatively high levels of exoproteins, including toxins and proteases known to be important in virulence. A characteristic we observed in other *S. aureus* strains isolated from clinical mastitis cases. Our data are consistent with a dose-dependent role of some staphylococcal factors in the hypervirulence of strains isolated from severe mastitis. Mobile genetic elements, transcriptional regulators, exoproteins and iron acquisition pathways constitute good targets for further research to define the underlying mechanisms of mastitis severity.

Key words: *Staphylococcus aureus*, mastitis, omic approaches

M29 Serological proteome analysis of *Staphylococcus aureus* strains isolated from gangrenous and subclinical ewe mastitis reveals core and accessory seroproteomes. C. Le Maréchal^{1,2}, J. Jardin^{1,2}, G. Jan^{1,2}, S. Even^{1,2}, D. Hernandez⁴, P. François⁴, J. Schrenzel⁴, D. Demon⁵, E. Meyer⁵, N. Berkova^{1,2}, R. Thiéry³, E. Vautour³, S. Lortal^{*1,2}, and Y. Le Loir^{1,2}, ¹INRA STLO, Rennes, France, ²AGROCAMPUS OUEST STLO, Rennes, France, ³ANSES, Sophia-Antipolis, France, ⁴University of Geneva Hospitals (HUG), Geneva, Switzerland, ⁵Ghent University, Faculty of Veterinary Medicine, Merelbeke, Belgium.

Staphylococcus aureus is a major cause of mastitis in ruminants. In ewe mastitis, symptoms range from subclinical to gangrenous mastitis. *S. aureus* factors or host-factors contributing to the different outcomes are not completely elucidated. In this study, experimental mastitis was induced on primiparous ewes using 2 *S. aureus* strains, isolated from gangrenous (strain O11) or subclinical (strain O46) mastitis. Strains induced drastically distinct clinical symptoms when tested in ewe and mice experimental mastitis. Notably, they reproduced mild (O46) or severe (O11) mastitis in ewes. Ewe sera were used to identify staphylococcal immunoreactive proteins commonly or differentially produced during infections of variable severity and to define core and accessory seroproteomes. Such SERological Proteome Analysis (SERPA) allowed the identification of 89 immunoreactive proteins, of which only 52 (58.4%) were previously identified as immunogenic proteins in other staphylococcal infections. Among the 89 proteins identified, 74 appear to constitute the core seroproteome. Among the 15 remain-

ing proteins defining the accessory seroproteome, 12 were specific for strain O11, 3 were specific for O46. Distribution of one protein specific for each mastitis severity was investigated in 10 other strains isolated from subclinical or clinical mastitis. We report here for the first time the identification of staphylococcal immunogenic proteins common or specific to *S. aureus* strains responsible for mild or severe mastitis. These findings open avenues in *S. aureus* mastitis studies as some of these proteins, expressed in vivo, are likely to account for the success of *S. aureus* as a pathogen of the ruminant mammary gland.

Key words: *Staphylococcus aureus*, mastitis, seroproteome

M30 Changes of plasma fatty acid and metabolites during the transition period in dairy cows with or without subclinical mastitis after calving. Y. Yang^{1,2}, J. Wang^{*1}, S. Li¹, D. Bu¹, T. Yuan¹, L. Zhou¹, and P. Sun¹, ¹State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China, ²Institute of Animal Science and Veterinary Medicine, Anhui Academy of Agricultural Sciences, Hefei, China.

The transition period is especially critical and present considerable physiological challenges to homeostasis that may contribute to the onset of most health disorders, and the biggest challenge is mastitis. To explore specific blood metabolic markers as risk factors for the development of mastitis during early lactation. Thirty-two Holstein primiparous cows were selected and separated into healthy cows (n = 18) and subclinical mastitic cows (n = 14) in 7–21 DIM according to the veterinary treatment records and milk somatic cell counts with 500,000 cells/mL. Blood samples were collected from the tail vein of the cows at 21, 14 and 7 d prepartum, and 1, 4, 7, 14 and 21 d postpartum. Distribution of fatty acids in plasma and metabolic parameters (glucose, blood urea nitrogen, total bilirubin, cholesterol and β -hydroxybutyrate, as well as aspartate aminotransferase) of serum are observed and presented identical profile in the transition cows that were healthy and developed subclinical mastitis. Plasma 18:2 *cis*-9,*cis*-12 was the main fatty acid and its weight percentage increased significantly during early lactation compared with values before calving and during the first week after calving, while stearic acid values gradually decreased from 21 d before parturition through early lactation. Oleic acid increased around the calving and then gradually decreased, 18:3 significantly decreased after calving and then gradually increased. Glucose, blood urea nitrogen, total bilirubin, cholesterol, high density lipoprotein and β -hydroxybutyrate, as well as aspartate aminotransferase activity of serum metabolites around the time of calving in cows were abruptly altered. During the gestation period and calving, no difference was observed in fatty acids and metabolic parameters in the transition cows with or without subclinical mastitis after calving. However, the multiplication product of aspartate aminotransferase at 21 and 14 d before calving from the subclinical mastitic cows was significantly higher than healthy cows and may have value as a potential marker for risk of mastitis during early lactation.

Key words: metabolites, fatty acid, cow

M31 iTRAQ quantitative analysis of changes of serum protein from the cows in the periparturient period. S. S. Li, J. Q. Wang*, H. Y. Wei, Y. X. Yang, D. P. Bu, T. J. Yuan, and P. Sun, State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China.

Serum potentially carries an archive of important histological information whose determination could serve important source of immune-related biomarkers. The objective of this study was to elucidate the molecular mechanisms of immune system suppressed in the periparturient cows. In this study, blood samples were collected at 21 d before expected calving and 1 d after calving from healthy Chinese Holstein heifers (n = 8) considered free of mastitis, milk fever and endometriosis based on the somatic cell count and clinical diagnosis. Developmental changes were examined using an integrated proteomic approaches consisting of minor abundance protein enrichment by ProteoMiner, protein label by isobaric tags for relative and absolute quantification (iTRAQ), protein identification by liquid chromatography coupled with tandem mass spectrometry (LC-MS/MS). In total, 78 serum proteins were identified and 19 proteins showed to be differentially expressed at 1 d after calving compared with 21 d before calving. In particular, 4 proteins including conglutinin, apolipoprotein A-II, deoxyhemoglobin and ECM1 protein were downregulated 11.24-, 2.27-, 2.17- and 1.68-fold at 1d postpartum, respectively, while 15 proteins were up-regulated, such as haptoglobin and lipopolysaccharide binding protein. Western blotting validated the relative increases of haptoglobin, which was in agreement with the LC-MS/MS data. These results may provide valuable information to elucidate immune system response at the protein level during the transition period.

Key words: periparturient, dairy cow, isobaric tags for relative and absolute quantification

M32 Prevalence, transmission and impact of bovine leukosis in Michigan dairies. T. M. Byrem^{*1}, J. T. Houseman¹, R. J. Erskine², P. C. Bartlett², C. Render², C. Febvay², D. H. Norman³, and J. R. Wright³, ¹Antel BioSystems Inc., Lansing, MI, ²Michigan State University, College of Veterinary Medicine, East Lansing, ³Animal Improvement Programs Laboratory, ARS, USDA, Beltsville, MD.

Bovine leukosis, caused by infection with the bovine leukemia virus (BLV), has been characterized as a benign disease of the immune system. Previous National Animal Health Monitoring Surveys indicate complacency has resulted in high BLV prevalence in US dairies (89%) and cows (40%). Recent evidence that BLV affects immunological responses to both pathogenic challenges and vaccination increases the importance of BLV monitoring and control programs to improve overall health and productivity of dairy cows. A herd profiling index utilizing Dairy Herd Improvement (DHI) milk samples was designed to determine the estimated BLV prevalence (EBP) and its relationship to herd management practices and productivity. Management surveys were conducted in Michigan dairies (113) and on DHI test date, milk samples from a subset of animals ($8 \leq n \leq 10$) in each of 1st, 2nd, 3rd, and ≥ 4 th lactations were tested for antibodies to BLV by ELISA. Correlation between testing all lactating animals and the herd profiling index to determine BLV prevalence in 4 herds was 0.997 ($P < 0.01$). Infection with BLV was detected in 88% of the herds. Average EBP within herd was 29% (0–76%) and within lactation, increased from 20% in 1st lactation cows to 45% in ≥ 4 th lactation cows ($P < 0.05$). Multivariate analysis of management variables identified recent animal purchases, bull breeding, palpations per pregnancy diagnosis in heifers, and straw bedding use for breeding heifers as significant ($P < 0.05$) practices associated with EBP. For every 10% increase in EBP, rolling herd average decreased by 115 ± 60 kg. Individual mature-equivalent lactation records were available for 3899 study animals. Significant effects of leukosis on milk, fat and protein yields were evident within all lactation groups. Across all lactation groups, BLV positive cows had lower milk (–488 kg), fat (–15 kg), and protein

(–16 kg) than negative cows ($P < 0.001$). Infection with BLV reduces cow productivity and is associated with purchasing replacements and breeding practices for heifers. Herd profiling using DHI milk samples is an effective strategy to determine and monitor the prevalence of infection in BLV control programs.

Key words: bovine leukosis, milk ELISA, DHI

M33 Relationship between test-day somatic cell count with test-day milk yields in Iranian Holstein cows. A. Laki, S. Babai, and M. Dehghan-Banadaky*, *Department of Animal Sci., Campus of Agriculture and Natural Resources, University of Tehran, Karaj, Tehran, Iran.*

Mastitis is considered worldwide the most costly production disease in dairy herds. The assessment of the economic worthiness of control plans for mastitis has to be anal supported by reliable evaluations of the economic losses caused by the disease. Decrease in milk production is one of the largest components of the economic losses due to clinical and subclinical mastitis. Previous study showed that there is a negative relationship between somatic cell count and test day milk yield. So, the aim of the current study was to determine relationship between somatic cell count and test day milk yield in Iranian Holstein dairy herds. Ten Tehran large commercial Holstein dairy herds were involved in the investigation from October 2005 to September 2008. All test day milk compositions (n = 36433) analyzed by infrared test method at the Tehran milk quality laboratory. Test day milk yield of individual cows was collected from each dairy herd. Milk composition and yield data analyzed by SAS and procedure Correlation (SAS institute 2003). The result of this research showed that relationship between test day somatic cell count and milk yield is negative (–0.14). Also, average somatic cell count in this study was 401.66×10^3 cell/mL. It can be concluded that a large amount of milk in Iranian dairy herds wasted by subclinical mastitis.

Key words: test-day milk yield, somatic cell count, Holstein cows

M34 Effects of drying the udder using paper versus cloth towels on bacterial contamination of teat ends of lactating dairy cattle. C. N. Baloun*, S. I. Kehoe, and L. E. Baumann, *University of Wisconsin-River Falls, River Falls.*

Milking cows are prepared for milking with a standard routine of cleaning and wiping to remove dirt and bacteria as well as stimulate milk letdown. A typical routine consists of using a sanitizing agent and wiping it off with either a paper towel or cloth towel before attaching the milking unit. There are many reasons why producers would choose to use either paper or cloth towels however there is no previous research evaluating whether one is better than the other in drying teats after sanitation. Therefore, the objective of this experiment was to determine whether paper towels are better than cloth towels at reducing bacterial contamination at the teat end. Eight cows were chosen and sampled over 4 weeks (total number of samples used for analysis ranged from 150 to 190 depending on bacterial species) where half of the udder was dried with a paper towel and the other half was dried with a cloth towel after sanitation. Immediately after drying, pre-moistened swabs were wiped over the teat ends in a repeated circular manner and transported back to the lab in a transport broth (Zadoks et al., 2003). Swabs were vigorously swirled in the broth before plating onto Petrifilm plates (3M Petrifilm) to quantify aerobic, coliform, and staphylococcus spp. Statistical analysis was done using SAS 9.2 (2009) where bacterial counts were log-transformed and a proc mixed procedure with cow as the repeated measure was used. Results indicated no

significant differences between cloth and paper towels for coliform or staphylococcus species ($P > 0.05$). The least squares means for log counts of coliform spp. for cloth towels were 1.75 ± 0.5 and paper towels were 1.78 ± 0.05 ; log counts of staphylococcus spp. for cloth towels were 2.05 ± 0.04 and paper towels were 2.02 ± 0.04 . There was a trend ($P < 0.10$) for log counts of aerobic spp. to be higher for cloth towels (2.93 ± 0.04) than for paper towels (2.85 ± 0.04). These results showed little difference between using either a cloth or paper towel to dry udders after sanitation, however, the trend for aerobic counts to be higher in cloth towels should be further evaluated.

Key words: teat, bacteria, milking preparation

M35 Metabolic and clinical responses of dairy cows to increasing oral doses of lipoteichoic acid. S. Iqbal*, Q. Zebeli, D. A. Mansmann, S. M. Dunn, and B. N. Ametaj, *University of Alberta, Edmonton, AB, Canada.*

Lipoteichoic acid (LTA), a cell wall component of gram-positive bacteria (GPB), might be involved in the pathophysiological and metabolic responses observed in dairy cows during infections by GPB. This study aimed at establishing metabolic and clinical responses to increasing oral doses of LTA and the oral dose that will initiate clinical symptoms in dairy cows. Seven late lactating Holstein dairy cows of an average BW of 800 ± 30 kg were randomly allocated to an oral administration of 2 mL saline solution containing one of the following LTA doses 20, 40, 70, 100, 120, 150, and 200 μg to each cow, respectively. Blood samples were collected from the tail vein at -15 min, 1, 3, and 5 h, whereas clinical responses were observed at -15 min, 1, 2, 3, 4, 5, and 6 h after the oral administration of each dose of LTA. Blood data demonstrated that oral administration of LTA increased concentration of glucose in the plasma with the highest doses (150 and 200 μg) having the highest plasma glucose ($P < 0.01$). Furthermore, plasma glucose linearly increased with time after oral administration of LTA ($P < 0.01$). Interestingly, cows also showed greater concentrations of plasma cholesterol at the highest doses of 150 and 200 μg ($P < 0.01$). Also, concentrations of nonesterified fatty acid in the plasma were found higher at 150 and 200 μg doses ($P < 0.01$). No effect of any of the doses of LTA used was observed on the concentration of β -hydroxybutyric acid in the plasma ($P > 0.05$). On the other hand, clinical data indicated that oral LTA influenced rectal temperatures and respiration rates, although the variations were within the normal ranges ($P < 0.01$ and $P < 0.01$, respectively). Interestingly, the highest doses of LTA (150 and 200 μg) lowered rumen contractions ($P < 0.01$), whereas all other doses did not have an effect on this variable. Overall, oral administration of increasing doses of LTA modulated plasma patterns of selected metabolites and clinical responses of late lactating dairy cows. It was also determined that the clinical safe dose of oral LTA to be used in future experiments was 120 μg .

Key words: oral lipoteichoic acid, plasma metabolites, dairy cows

M36 Repeated oronasal application of lipopolysaccharide affected milk yield and composition in transition dairy cows. A. Hosseini*, D. A. Mansmann, Q. Zebeli, S. Iqbal, S. M. Dunn, and B. N. Ametaj, *University of Alberta, Edmonton, Alberta, Canada.*

Previously we showed that ruminal endotoxin was associated with depression of milk fat content and lowering of milk energy efficiency (MEE) in mid-lactation dairy cows. In this study, we tested the hypothesis that repeated oronasal application of lipopolysaccharide (LPS)

during the transition period might affect milk yield and composition, MEE, and feed intake in transition dairy cows. One hundred primiparous (PP) and multiparous (MP) Holstein dairy cows, with average body weights of 620 and 720 kg, respectively, were randomly assigned into control (CTR; PP = 18; MP = 32) and treatment (TRT; PP = 19; MP = 31) groups. Either carrier alone (3 mL of 0.85% saline) or 3 increasing doses (0.01, 0.05, and 0.1 $\mu\text{g}/\text{kg}$ BW) of LPS from *E. coli* 0111:B4 were applied oronasally (1 mL nasally and 2 mL orally) twice a week on wk -4, -3, and -2. Milk fat, protein, lactose, urea nitrogen (UN), somatic cell counts (SCC), and total solids (TS) and milk fat, protein, and lactose yields were determined weekly during wk 1-4 postpartum. Milk energy efficiency was calculated as milk fat yield over DMI consumed. Dry matter intake was recorded daily starting at 4 wk before and up to 4 wk after parturition, whereas milk yield data were recorded daily during the first 4 wk after parturition. All data were processed statistically by the MIXED procedure of SAS. Overall data indicated that TRT tended to increase milk yield in all cows ($P < 0.1$) with higher impact on MP cows ($P < 0.01$) during 4 wk postpartum. Milk fat, fat yield, TS, and MEE tended to decrease ($P \leq 0.07$) in relation with TRT \times parity \times week, although TRT did not affect ($P > 0.1$) milk fat, protein, lactose, UN, SCC, TS and MEE. The overall DMI was affected ($P \leq 0.001$) by parity with higher levels in MP cows. An effect of parity was obtained in relation with fat ($P < 0.01$), protein ($P < 0.001$), and lactose yields ($P < 0.01$) with greater levels in MP cows. In conclusion results of this study showed potential involvement of LPS in modification of milk yield and composition, and that the oronasal treatment with LPS might be used to increase milk yield in dairy cows.

Key words: LPS, oronasal application, milk metabolites

M37 Mortality patterns in Midwest DHIA herds. M. Q. Shahid*, M. I. Endres, J. K. Reneau, R. Chebel, and H. Chester-Jones, *University of Minnesota, St. Paul.*

The objective of this study was to describe the mortality patterns and identify risk factors for mortality in Midwest dairy herds. A total of 5,080,849 lactation records for cows that calved between January 2006 and December 2009 from 10 Midwest states were used. Overall mortality rate was 6.4 per 100 cow years with an increasing trend from 6.2 in 2006 to 6.7 in 2009. Herd level mortality rate was 5.6 ± 2.0 (mean \pm SD). The distribution of mortality rates were estimated by categories of parity, stage of lactation and season. The association between mortality rate and different risk factors was investigated by using proportional hazards regression. Low first test day milk, parity, somatic cell score (SCS), fat to protein ratio (FPR), previous lactation dry period length, and breed were significantly associated with mortality ($P < 0.001$). Within herd, cows with higher 1st test day milk yield ($>$ mean plus 1SD) had 0.95 times (5% less) hazard rate of mortality than cows with average milk yield (mean plus 1SD); however, cows with lower 1st test day milk yield (mean minus 1SD) had 1.49 times (49%) higher hazard rate of mortality than cows with average milk yield. Similarly, cows with FPR > 1.7 and < 1.0 at first test had 48 and 18%, respectively higher hazard rate of mortality than cows with FPR between 1.0 and 1.7. Every 1 unit increase in SCS was associated with a 6% increase in hazard rate of mortality. Cows with dry period > 70 and < 30 d had 1.38 and 1.22 times higher hazard rate of mortality, respectively than cows with dry period between 30 and 70 d. Crossbred cows had 14% less hazard rate of mortality than Holsteins; however, Jersey cows had 19% higher hazard rate of mortality than Holsteins. These results indicate that first test day records could be a useful tool to identify

cows at high risk of mortality. In addition, higher milk yield was not associated with higher mortality.

Key words: mortality, risk factors

M38 Cost analysis of feeding varying doses of *Saccharomyces cerevisiae* fermentation product on a commercial dairy. C. M. Shriver-Munsch¹, E. M. Ramsing¹, J. R. Males¹, W. K. Sanchez², I. Yoon², and G. Bobe¹, ¹Department of Animal Science, Oregon State University, Corvallis, ²Diamond V, Cedar Rapids, IA.

Feeding 56 g/d of *Saccharomyces cerevisiae* fermentation product (Diamond V Original XP; XP) improves milk production in most studies, suggesting increased profit margin. A double dose of XP may further increase profit. This study focused on the cost benefits associated with feeding a single or double dose of XP on a commercial dairy. Multiparous Holstein cows were fed a supplementation mixture of 0 (n = 32), 56 (n = 33), or 112 g/d (n = 31) of XP, corn, and molasses, provided as a top dressing starting at 28 d before the expected calving date and ending 28 d postpartum. During the supplementation period, milk yield and composition were measured twice weekly from the afternoon milking on non-consecutive days. The incurred cost included expenses for XP, medical treatment, and milk profit lost due to discarded milk and culling. Income was calculated from milk and cow sales. The difference between incurred costs and income was defined as net gain. Because we could not measure feed intake or hours of labor, general feed and labor costs were not included in the calculation. Overall, supplementation with XP did not significantly increase net profit, however, a double versus a single dose of XP decreased total daily cost by \$2.00/cow ($P = 0.06$) and tended to increase daily milk income by \$1.65/cow ($P = 0.17$), resulting in a greater daily net profit of \$2.73/cow ($P = 0.15$). The daily net profit was significantly greater in second lactation cows (\$5.99/cow; $P = 0.05$). Although there were several potential confounding factors that could not be controlled on the commercial dairy, our results support the original hypothesis that higher dosages of XP during the periparturient period may further increase profit.

Key words: cost analysis, dairy, yeast culture

M39 The effect of feeding pasteurized or non-pasteurized waste milk on fecal populations and prevalence of *Salmonella* in dairy calves. J. A. Garcia^{*1}, T. S. Edrington², G. R. Hagevoort¹, R. F. Farrow², T. R. Callaway², N. A. Krueger², R. C. Anderson², and D. J. Nisbet², ¹NMSU Ag Science Center, Clovis, NM, ²Food and Feed Safety Research Unit, Southern Plains Agricultural Research Center, USDA-ARS, Collee Station, TX.

Waste milk is often used as a feed source for young calves. To reduce the potential transmission of pathogens, some producers pasteurize waste milk. To assess the effect of pasteurization on *Salmonella* in dairy calves, 2 groups of calves were randomly allotted to receive either pasteurized (PWM; n = 128 calves) or non-pasteurized waste milk (NPWM; n = 83 calves) and fecal samples collected weekly for the first month of life and at weaning (approximately 2 mo of age). Calves were housed and managed on a single commercial dairy in the southwestern United States; however some calves were born on other dairies and transported at one day of age. A total of 8 collections were made and fecal samples (n = 1118) were quantitatively and qualitatively cultured for *Salmonella*. Fecal concentrations of *Salmonella*, as determined by direct plating, were significantly different at a few collections but similar ($P > 0.10$) when averaged over all collections

[3.2 and 3.1 cfu (log₁₀)/g feces for NPWM and PWM, respectively]. The percentage of *Salmonella* positive fecal samples following qualitative culture averaged 68 and 69% for NPWM and PWM, respectively, and ranged from a low of 23 to a high of 88% positive during the experimental period. A treatment effect ($P < 0.05$) was observed only during the fifth collection. Dairy of origin for the calf had a far more significant impact on *Salmonella* prevalence during individual collections, but not when data was combined across collection ($P = 0.12$). Nine different serogroups were identified: C1 (41%), C2 and E1 (approx. 17%), and B (12%). No treatment differences were observed in serogroup prevalence with the exception of the B group which was more common in the PWM treatment (19 versus 6%). Four calves died during the study, 3 in the PWM and 1 in the NPWM treatments. While the results did not find any significant effect of waste milk pasteurization on *Salmonella* prevalence in dairy calves, we do not discourage this practice due to beneficial effects of killing other pathogens such as *Mycobacterium paratuberculosis* possibly present.

Key words: *Salmonella*, waste milk, dairy calf

M40 Effect of paste or wrap oxytetracycline treatment on papillomatous digital dermatitis. J. H. Higginson^{*1}, J. Walter¹, G. Cramer^{1,2}, and D. F. Kelton¹, ¹University of Guelph, Guelph, Ontario, Canada, ²Cramer Mobile Bovine Veterinary Services, Stratford, Ontario, Canada.

The objective of this study was to determine if application of oxytetracycline in a topical paste without bandaging would be as effective as an oxytetracycline wrap for the treatment of papillomatous digital dermatitis (PDD). Mature lactating Holstein cows diagnosed with PDD during routine trimming were randomly assigned to one of three treatments, oxytetracycline in a paste, oxytetracycline powder under a wrap, or a negative control. The paste treatment consisted of oxytetracycline 1000 mixed with glycol and vinegar, while the wrap treatment consisted of an equivalent amount of oxytetracycline 1000 powder held against the lesion with a wrap for 3 days. Examination of the affected hooves was carried out at Day 0 (Exam=1), Days 3-7 days post-treatment (Exam=2), and Days 8-12 days post-treatment (Exam=3). Data were analyzed using a logistic model with a binary outcome (lesion active or lesion healed). Lesions were considered active if the cow reacted to pressure from an algometer and tissue was still pink and/or inflamed. Sixty-five and 54 cows enrolled in the trial were re-examined at Days 3-7 and 8-12 days post-treatment, respectively. Both Exam and treatment were significant ($P < 0.05$). Cows receiving the paste treatment had 9.5 (1.88, 95.62) times greater odds of recovering from digital dermatitis over the study period than the no treatment cows ($P = 0.01$). Similarly, cows receiving the wrap treatment had 18.6 (3.70, 188.56) times greater odds ($P < 0.0001$) of recovering from digital dermatitis over the study period than cows receiving no treatment. There was no statistically significant difference between the paste and wrap treatments ($P = 0.20$). Oxytetracycline is effective for the treatment of PDD and the use of it in a paste form rather than a powder alone could eliminate the need for bandage application and subsequent removal.

Key words: lameness, dairy cattle, digital dermatitis

M41 Association between virulence factors of *Escherichia coli*, *Fusobacterium necrophorum*, and *Arcanobacterium pyogenes* and uterine diseases of dairy cows. M. Bicalho^{*}, R. Bicalho, and V. Machado, Cornell University, Ithaca, NY.

The objective of this study was to evaluate the relationship of bacteria specific virulence factors (VF) present at 3 different stages of lactation (4 ± 2 , 12 ± 2 , and 35 ± 2 d in milk (DIM)) with the incidence of metritis and clinical endometritis. The following VFs were investigated in this study; for *A. pyogenes* - plo (pyolysin - hemolytic exotoxin, which promotes hemolysis of red blood cells and immune cells), cbpA (collage- binding protein, necessary to collagen rich tissue), and fimA (fimbriae expression, key component in the cell-to-cell or cell-to-surface adherence), for *Escherichia coli*, fimH (type 1 pili), and for *Fusobacterium necrophorum* lktA (leukotoxin). Uterine swab samples were collected from 117 postpartum dairy cows housed on a commercial dairy farm located near Ithaca, New York. Samples were collected from April 2010 through June 2010. Isolation of total DNA was performed using a QIAmp DNA minikit (Qiagen, Santa Clara, CA) according to manufacturer instructions for DNA purification from blood and body fluids. PCR was used for the evaluation of the presence plo, cbpA, fimA, fimH, and lktA. Cows were classified as VF positive when the appropriate amplicon size was observed in the electrophoresis gel and negative when no amplicons were visible in the gel. Data was analyzed by multivariable logistic regression using the logistic procedure of SAS (Cary, NC). The *A. pyogenes* virulence factor cbpA was only detected in 4 samples and was excluded from the association analysis. In summary, *E. coli* (fimH) was significantly associated with metritis and endometritis when detected at 4 ± 2 DIM, *Fusobacterium necrophorum* (lktA) was significantly associated with metritis when detected at 4 and 12 ± 2 DIM and with endometritis when detected at 35 ± 2 DIM, and *Arcanobacterium pyogenes* (fimA and plo) was associated with metritis (fimA) when detected at 4 DIM and endometritis (fimA and plo) when detected at 12 and 35 ± 2 DIM. These findings support the hypothesis that the bacterial etiology of uterine infection is dynamic and multifactorial.

Key words: metritis, *E. coli*, FimH

M42 Repeated oronasal application of lipopolysaccharide lowered the incidence of metabolic diseases in periparturient dairy cows. A. Hosseini*, D. A. Mansmann, Q. Zebeli, S. Iqbal, S. M. Dunn, and B. N. Ametaj, *University of Alberta, Edmonton, Alberta, Canada.*

Metabolic diseases such as udder edema (EU), laminitis, retained placenta (RP), and mastitis are common in dairy cows around parturition, and have major consequences on health and economic sustainability of dairy farming. In this study, we evaluated the hypothesis that repeated oronasal application of lipopolysaccharide (LPS), during the transition period, might influence the incidence of the aforementioned diseases, body condition score (BCS), and manure score (MS) in both primiparous (PP) and multiparous (MP) dairy cows. One hundred Holstein dairy cows (PP and MP with ~BW 620 and 720 kg, respectively) were randomly assigned into control (CTR; PP = 18; MP = 32) and treatment (TRT; PP = 19; MP = 31) groups, and were allowed for ad libitum access to feed and water. Either carrier alone (3 mL of 0.85% saline) or 3 increasing doses (0.01, 0.05, and 0.1 $\mu\text{g}/\text{kg}$ BW) of LPS from *E. coli* O111:B4 were applied oronasally (1 mL nasally and 2 mL orally) twice a week on wk -4, -3, and -2. The UE was evaluated on wk -2, -1, 1 and 2, whereas RP was evaluated during 72 h postpartum. Laminitis was approved in 2 d intervals from -28 to 28 d, while mastitis was evaluated once a wk for 4 wk. The BCS was measured every 2 wk from -4 to 4 wk, whereas MS evaluated on wk -2, 1, 2 and 3. All data were processed statistically by Chi-squared test and the MIXED procedure of SAS. Overall results indicated that TRT lowered the incidence of UE in PP cows ($P = 0.041$), while week, parity and their interaction ($P < 0.001$) on UE was obtained. Data indicated that TRT

tended to reduce ($P = 0.074$) the incidence of RP in all cows, while no effect was observed on laminitis and mastitis. In both PP and MP cows BCS decreased ($P < 0.001$) postpartum. The MS decreased by parity ($P = 0.027$), week ($P < 0.001$), and TRT \times parity interaction ($P = 0.015$) in PP cows. In conclusion results of this investigation indicated potential involvement of LPS in the etiology of metabolic diseases, and that the oronasal treatment with LPS might be used to lower the incidence of UE and RP in periparturient dairy cows.

Key words: oronasal, lipopolysaccharide, metabolic disease

M43 Peripartal intravaginal application of probiotic bacteria lowered the incidence of uterine infections and improved fertility in dairy cows. S. Sharma*, Q. Zebeli, S. Iqbal, S. M. Dunn, J. F. Odhiambo, M. Gäenzle, and B. N. Ametaj, *University of Alberta, Edmonton, Alberta, Canada.*

Uterine infections affect cow performance and the efficiency of dairy farming. The objective of this study was to investigate the prophylactic effect of intravaginal probiotic bacteria on postpartum uterine infections, uterine involution patterns, and the overall reproductive performance of dairy cows. Eighty-two pregnant primiparous and multiparous Holstein cows, 2 wk before the expected day of calving, were randomly assigned into treatment (TRT; received 1 mL of probiotic bacteria in reconstituted skim milk at 10^{10} to 10^{12} cfu/treatment) and control group (CTR; received 1 mL of carrier only; reconstituted skim milk). Intravaginal infusions were performed once during wk -2, -1, +1, +2, +3, and +4 relative to parturition with probiotic bacteria isolated from the vaginal tracts of healthy cows including a mixture of *Lactobacillus sakei* FUA 3089, *Pediococcus acidilactici* FUA 3140, and *P. acidilactici* FUA 3138. Results showed that probiotic treatment lowered the incidence of metritis (17.1 vs. 51.2%; $P < 0.001$) and tended to lower the incidence of pyometra (12.2 vs. 26.8%; $P = 0.06$) in TRT cows. Treatment also lowered the overall incidence of cases with vaginal purulent discharges between 3 and 5 wk postpartum (10.1 vs. 27.8%; $P < 0.01$). Furthermore, a decrease in the number of cows with abnormal cervical size (28.5 vs. 43.0; $P < 0.0001$), abnormal uterine horn symmetry (40.8 vs. 67.2%; $P < 0.001$), and abnormal uterine fluctuations (18.5 vs. 36.8%; $P < 0.05$) was obtained. Additionally, differences were observed with regard to uterine infections and involution indicators at 3 wk postpartum in treatment group. A tendency to increase the overall pregnancy rates (87.9 vs. 73.5%; $P = 0.08$) was demonstrated in TRT group. The peak concentration of Hp was lower ($P < 0.0001$) in probiotic treated cows than in the CTR group. In summary, intravaginal application of a mixture of lactobacilli in periparturient dairy cows improved the overall postpartum uterine health and performance and warrants further research into the mechanism(s) involved and potential applications in the future.

Key words: dairy cows, reproduction, probiotic lactobacilli

M44 Partitioning innate immune response variation: How much variation is due to the animal? M. D. Sellers*¹, L. E. Hulbert^{1,2}, C. J. Cobb¹, and M. A. Ballou¹, ¹Department of Animal and Food Sciences, Texas Tech University, Lubbock, ²Department of Animal Sciences, University of California-Davis, Davis.

The objective was to partition the between-calf variation in ex vivo innate immune responses from Holstein bull calves. Innate immune responses evaluated included total leukocyte and differential counts, neutrophil L-selectin expression, tumor necrosis factor- α (TNF α) secretion from lipopolysaccharide (LPS)-simulated whole blood,

and neutrophil phagocytosis and oxidative burst responses to *E. coli* 0111:H8. Sixty 8 Holstein bull calves were observed for a period of 12 wk. At 21, 24, 28, 45, 49, 63, 66, 70, and 84 ± 2.3 d of age, peripheral blood was collected in heparinized vacutainers for ex vivo immunological analyses. Between-calf variation was partitioned using PROC MIXED in SAS (SAS v9.2). The model included the fixed effect of day. The compound symmetry covariance structure was used for the within-calf variation measurement. The between-calf variation ($V_{between}$) was determined as the variation between subjects after the fixed effect of day was removed. The within-calf variation (V_{within}) was estimated as the mean of the residual variation after the effects of day and $V_{between}$ were removed. Data are reported as ranges on 95% confidence intervals of the proportion of the variation due to $V_{between}$ ($[V_{between} / (V_{within} + V_{between})] \times 100$). The study was conducted during February–April, 2010. These data suggest that a calf's immune response is highly dependent upon its interaction with the environment. Identifying and controlling for environmental variation decreases V_{within} , which increases the consistency in immune responses within a calf. This could lead to identifying and managing subpopulations with unique immune responses.

Table 1. Between-calf variation in innate immune parameters in Holstein bull calves

Parameter	Day	$V_{between}$	$V_{between}$ MIN	$V_{between}$ MAX	$CV_{between}$	CV_{total}
$P <$	%					
Total leukocyte count	0.001	34.2	21.0	45.3	9.5	27.6
Neutrophil percentage	0.001	22.5	12.1	33.2	8.9	39.4
Whole blood TNF- α secretion	0.001	31.4	19.3	42.0	23.1	73.5
Neutrophil L-selectin expression	0.001	11.3	4.2	18.8	10.3	91.0
Neutrophil phagocytosis	0.001	43.1	29.3	54.0	20.1	46.6
Neutrophil oxidative burst	0.001	33.8	21.0	44.6	9.5	28.1
Cortisol	0.001	14.4	6.2	22.6	11.1	76.8
Glucose	0.001	12.4	4.3	20.7	2.2	17.8

Key words: cattle, immune, variation

M45 Effect of various dosages of *Saccharomyces cerevisiae* fermentation product on health and metabolism of multiparous dairy cows. C. M. Shriver-Munsch^{*1}, E. M. Ramsing¹, J. R. Males¹, W. K. Sanchez², I. Yoon², and G. Bobe¹, ¹Department of Animal Science, Oregon State University, Corvallis, ²Diamond V, Cedar Rapids, IA.

Increased nutritional demands and suppressed immune function increase the risk for metabolic and infectious diseases in dairy cows during the transition period. These problems increase with parity number and result in significant losses in milk production and early culling. Supplementation of *Saccharomyces cerevisiae* fermentation product (Diamond V Original XP; XP) may support immune function and greater nutritional demands; thereby, XP may decrease the risk of infectious and metabolic diseases. Doubling feeding rates of XP

may provide greater health benefits to dairy cows. The objective of the current study was to evaluate whether feeding a single or double dose of XP during the transition period may decrease the risk of metabolic and infectious diseases in multiparous dairy cows. Multiparous Holstein cows housed in the same pen were given a supplement containing either 0 (control; n = 32), 56 (n = 33); or 112 g (n = 31) of XP daily during morning lock-up as a top dressing to their TMR. The supplement consisted of 0, 56, or 112 g of XP mixed with 84 g of molasses and 168, 112, or 56 g of corn meal, respectively. Serum samples were analyzed for glucose, BUN, NEFA, and BHBA. Feeding XP, regardless of dosage, decreased BHBA concentrations ($P = 0.04$) and increased serum glucose ($P = 0.08$) and BUN concentrations ($P = 0.02$) at the d of calving. Feeding a double dose of XP additionally increased supplement consumption at the d of calving ($P = 0.05$ versus control) and decreased log₁₀ somatic cell scores (SCS) in milk during the supplementation period ($P = 0.10$ versus control). Cows fed a single dose of XP also tended to have lower SCS by wk 4 versus control-fed cows ($P = 0.14$). Our results support the original hypothesis that XP may support immune function and greater nutritional demands in transition dairy cows. Higher XP doses may provide greater health benefits during time periods of increased stress.

Key words: dairy, health, yeast culture

M46 Influence of starch sources in prepartum diet on colostrum quality and blood immunoglobulin concentration of calves. F. Fatahni¹, H. Mirzaei Alamouti^{*2}, and A. Shahsavari¹, ¹Department of Animal Science, University of Ilam, Iran, ²Department of Animal Science, University of Zanjan, Iran.

The main objective of this study was to evaluate the effect of dietary inclusion of wheat or corn as the main source of starch in prepartum diets on plasma metabolites of cows, colostrum composition, colostrum IgG1 and IgG2 concentrations and calves serum IgG1 and IgG2 concentrations. For this purpose, 30 primiparous and 20 multiparous Holstein cows were used in a randomized complete block design and cows were blocked by parity and expected calving dates and assigned to treatments at 22 ± 7 d before calving. Dietary treatments were either a corn-based diet or a diet containing wheat at 18.5% of diet dry matter. The cows blood were sampled at -21, -14, -7, and -1 d relative to expected calving dates. Calves blood samples were drawn before the first colostrum feeding (0 h) at birth and 24 h of life. The results indicated that Prepartum diets did not affect plasma concentrations of glucose, nonesterified fatty acids and triglyceride of cows, however, plasma total concentrations of proteins in cows fed the wheat-based diet was higher compared with those fed the corn-based diet. Lactose, fat and IgG2 concentrations in colostrums did not respond to dietary treatment, but protein, total solids, IgG1 and total IgG concentrations in colostrums were significantly higher for cows fed wheat containing diet. At 24 h of age, calves fed colostrums from cows fed wheat containing prepartum diet had significantly higher serum IgG1 and total IgG concentrations. But serum IgG2 concentrations were similar between treatments. Prepartum starch source did not affect apparent efficiency of IgG1, IgG2 and total IgG absorption. Results suggested that feeding wheat-based diet in prepartum increased colostrum quality and serum IgG1 concentrations of calves and may have a profound effect on the survival, health and growth of newborn calves.

Key words: prepartum diet, colostrums, calf