
GRADUATE STUDENT COMPETITION:
ADSA PRODUCTION, MS

1139 (M122) Effects of supplemental garlic (*Allium sativum*) powder and probiotics on diarrhea and immunoglobulin response in pre-weaned dairy calves. T. W. Kekana*, *University of Venda, Thohoyandou, South Africa.*

This study was carried out to investigate the effects of feeding Garlic powder or Probiotics or both on diarrhoeal incidence and immunoglobulin response of pre-weaned Holstein calves. Sixteen Holstein calves (BW = 34.5 ± 1.65 kg) were randomly assigned at birth to 4 treatments to evaluate the effects of garlic powder or probiotics, or both on feed intake, diarrhea, serum glucose and immunoglobulin (IgG) in Holstein calves. The treatments were: C (control, no additive); G: supplemented with 5g/d garlic powder; P: supplemented with 4 g/d probiotics (total viable count: 1.3 x 10⁷ cfu/g) and G+P: supplemented with 5 g/d garlic powder and 4 g/d probiotic. Calves were given colostrum for the first 3 d of life followed by a standard whole milk feeding until weaning at 42 days. A commercial calf starter was offered ad libitum starting at 4 d of age until the end of the study. Fresh water was available throughout the study. Intake of whole milk and starter feed were measured daily and body weights were taken weekly. Blood samples were collected to determine glucose and IgG concentrations. Garlic and probiotics were diluted in milk and fed daily from day 4. Starter DMI tended to be higher ($P < 0.10$) in G+P calves compared to Control calves. Calves fed G and G+P had higher ($P < 0.05$) IgG than C and P calves (28.0 and 27.5 vs. 23.5 and 25.5 g/l: respectively). Calves fed C and G had lower ($P < 0.05$) final BW (56.0 kg) compared to G+P (60.3 kg). Garlic, P and their combination (G+P) did not affect ($P > 0.05$) serum glucose and body temperature. Calves in G+P and P groups had lower ($P < 0.05$) fecal score, days of diarrhea and days fed electrolytes compared to C and G calves. The results suggest complementary effects of the combined garlic powder and probiotics when fed to calves during the first 42 days of life. Improved starter feed intake and final body weight in group G+P suggest high concentrations of ruminal volatile fatty acid for a stimulated rumen development. Additionally, higher serum IgG in G+P may indicate an improved intake of nutrients responsible of immunity modulation and regulation.

Key Words: garlic powder, probiotics, IgG, Holstein calves

1140 (M123) Development of an application for touch-screen devices to capture defined calving-related events in dairy herds. A. A. Barragan*, J. D. Workman, and G. M. Schuenemann, *Dep. of Veterinary Preventive Medicine, Ohio State University, Columbus.*

Calving-related losses (survival, health, and productivity) and welfare practices have become known challenges for the dairy industry worldwide. Furthermore, management practices have been associated with this problem. It is common to observe large within- and between-herd variation in recording calving-related events and personnel performance (PP) over time. Successful identification of factors affecting stillbirth and personnel performance at the herd level can be challenging due to their multi-factorial nature. The objective was to assess a user-friendly mobile application (APP) for touch screen devices to aid in decision-making about calving-related events in dairy herds. The APP was developed to capture, identify, and rank risk factors (e.g., dystocia, PP, work shift transition, BCS, colostrum management) affecting stillbirth according to their contribution weights. Novel components of the APP included: 1) Login screen for individual herds, 2) Capture of selected calving-related events for both dam and calf (e.g., parity, breed, BCS, hygiene of perineum, calving ease, sex of calf, presentation, personnel), 3) Rolling list of active cows with an alarm to monitor calving progress and time in labor, 4) Rolling list of active calves (single or multiple) within 24 h after birth, 5) Colostrum management practices (quality, quantity, time of administration, calf vigor, birth weights, and personnel), and 6) Connectivity to dashboard to process data in real time. Using data from dairy herds, the APP accurately captured (100%) and integrated multiple calving-related events with PP (accounting for the effect of work shift transition), and ranked within-herd risk factors for stillbirth due to herd management. Dairywomen, consultants, and veterinarians often trouble-shoot stillbirth within-herd; however, the lack of meaningful records using defined events makes it difficult to implement corrective practices. Comprehensive assessment of several events occurring in real time around-the-clock will likely reduce calving-related losses (stillbirth) while improving herd productivity and welfare.

Key Words: app, calving management, dairy

1141 (M124) Effects of dietary crude protein levels during a twelve-week period on late-lactation dairy cow performance. M. A. Quaassdorff¹, T. Barros¹, J. J. Olmos Colmenero², M. J. Aguerre¹, S. J. Bertics¹, and M. A. Wattiaux¹, ¹*University of Wisconsin–Madison, Madison*, ²*University of Guadalajara, Tepatilan, México.*

The objectives were to determine the effects of feeding four dietary CP levels on late-lactation dairy cow performance, and whether there were any treatment by week interactions. One

hundred twenty-eight late-lactation Holstein cows (736 ± 18 kg BW; 224 ± 54 DIM) were used in a 16-pen study with 8 cows per pen, and fed a TMR once per day for 12 weeks (Pen = experimental unit). Treatments which included diets characterized by 11.8, 13.1, 14.6, or 16.2% CP (DM basis) were randomly allocated to pen for the entirety of the experiment. Rations consisted of approximately 67% forage (half corn silage; half alfalfa silage); and soy hulls (SH) replaced soybean meal (SBM) to achieve the desired dietary CP levels for each treatment. Pen-level data presented were covariate-adjusted and included DMI, milk yield (MY) and composition (bi-weekly), BW (final minus initial), and body condition score (BCS); (every 3 wk). There was no treatment by week interaction for any variables except MY ($P < 0.01$) and true protein % ($P < 0.01$), but there was a linear effect on DMI, MY, true protein %, fat yield (FY) and true protein yield (PY). No measured variables differed between treatments 14.6 and 16.2% CP except for true protein %. DMI, MY, FY and PY were lower on treatment 11.8% than other treatments. There was a quadratic effect ($P < 0.01$) for BW change, with the highest BW gain observed on the 14.6% CP treatment, but there was no difference in BCS. Results suggest that there was essentially no difference in late-lactation cow performance when diets of 14.6 or 16.2% CP were fed.

Key Words: soy hulls, soybean meal, protein nutrition

Table 1141.

| Item | Dietary CP% (DM basis) | | | | SEM | P-value ¹ | |
|-----------------------|------------------------|--------------------|-------------------|--------------------|------|----------------------|------|
| | 11.8 | 13.1 | 14.6 | 16.2 | | L | Q |
| DM intake, kg/d | 22.7 ^b | 24.0 ^a | 24.0 ^a | 24.4 ^a | 0.28 | <0.01 | 0.09 |
| Milk, kg/d | 25.2 ^c | 28.6 ^b | 31.0 ^a | 31.3 ^a | 0.76 | <0.01 | 0.06 |
| Milk composition | | | | | | | |
| Fat, % | | 4.32 | 4.11 | 4.27 | 0.07 | 0.23 | 0.24 |
| True protein, % | 3.34 ^c | 3.51 ^{ab} | 3.45 ^b | 3.57 ^a | 0.03 | <0.01 | 0.22 |
| Milk components yield | | | | | | | |
| Fat, kg/d | 1.09 ^b | 1.24 ^a | 1.28 ^a | 1.31 ^a | 0.04 | <0.01 | 0.17 |
| True protein, kg/d | 0.82 ^c | 0.98 ^b | 1.06 ^a | 1.12 ^a | 0.02 | <0.01 | 0.07 |
| BW change, kg/d | 0.07 ^{cb} | 0.37 ^{ab} | 0.44 ^a | 0.27 ^{ab} | 0.08 | 0.10 | 0.01 |
| BCS ² | 3.17 | 3.31 | 3.28 | 3.27 | 0.05 | 0.15 | 0.07 |

^{a-c} Least squares means within the same row with different superscripts differ ($P \leq 0.05$).

¹ Linear (L) or quadratic (Q) effect of CP% level in the diet.

² BCS on scale of 1 (emaciated) to 5 (obese).

1142 (M125) Patterns of circulating serotonin (5-HT), calcium, and glucose in lactating Jersey and Holstein dairy cows. S. A. E. Moore*, J. Laporta, and L. L. Hernandez, *University of Wisconsin-Madison, Madison.*

Dairy cows are challenged to maintain calcium (Ca) and glucose homeostasis during the transition period. Serotonin (5-HT) is a monoamine, which modulates Ca and glucose homeostasis in rodents. Serotonin was positively correlated with Ca and glucose status in dairy cows on d1 of lactation. How-

ever, the pattern of circulating concentrations of 5-HT over the course of a 305-d lactation is unknown. In this longitudinal study, we examined the metabolite patterns of 5-HT, Ca, and glucose on two commercial dairy farms in southcentral, Wisconsin. Cows sampled on farm 1 were multiparous Jersey cows ($n = 30$, avg lact = 3.2), which calved within a 23d period and on farm 2 were multiparous Holstein cows ($n = 35$, avg lact = 2.8), which calved within a 20-d period. Blood samples were collected daily during the transition period (d-5 through d10 relative to parturition) and on d30, 60, 90, 150, and 300. Data was analyzed using PROC MIXED and correlations were estimated using PROC CORR in SAS. Overall, there was a time effect ($P < 0.0001$) and a farm and time interaction ($P < 0.0003$). Near parturition, 5-HT decreased as compared to pre-partum by 57.8% ($P < 0.0001$) and 29.6% ($P = 0.056$) on farm 1 and farm 2, respectively. Transition period 5-HT nadir was observed at d2 on farm 1 (879 ± 215 ng/ml), and d1 on farm 2 (1064 ± 186 ng/ml). Serotonin was recovered to 1637 ± 211 ng/ml by d5 on farm 1, with a second decrease of 25.8% ($P = 0.11$) on d7. Farm 2 showed a 5-HT recovery to 1577 ± 184 ng/ml by d5 and subsequent decrease of 34.7% ($P = 0.02$) by d9. Furthermore, 5-HT increased markedly on both farms near peak lactation (d60, 90, 150) and decreased at d300. Calcium decreased compared to pre-partum levels by 35.3% ($P < 0.0001$) and 10.9% ($P < 0.0001$) on farm 1 and 2, respectively. Calcium nadir was observed at d1 on farm 1 (1.79 ± 0.06 mmol) and farm 2 (2.29 ± 0.06 mmol). Serotonin and Ca were positively correlated on farm 1 ($r = 0.24$; $P < 0.0001$) and farm 2 ($r = 0.15$; $P = 0.0003$). No significant correlation was detected between 5-HT and glucose. These results show that 5-HT concentrations change dynamically through the transition period and this change is positively correlated with circulating Ca patterns. Further research should be aimed at discerning how 5-HT affects Ca in different dairy breeds.

Key Words: calcium, serotonin, transition period

1143 (M126) Ruminal degradability and intestinal digestibility of protein and amino acids in canola meal. N. Jayasinghe*, K. F. Kalscheur, J. L. Anderson, and D. P. Casper, *Dairy Science Dep., South Dakota State University, Brookings.*

Differences in processing by different plants may result in canola meal (CM) with varying nutritional composition. The Dairy NRC (2001) estimated CM to be 35.7% rumen undegradable protein (RUP) with an intestinal digestibility of 75% when DMI was set at 4% of BW. Seven CM samples were obtained from different processing plants and 1 soybean meal (SBM) to evaluate the variability in ruminal degradability and intestinal digestibility of CP. Dacron bags containing 5 g of each feed were incubated in the rumen in duplicate for 0, 2, 4, 8, 12, 16, 24 and 48 h using three ruminally cannulated lactating cows. The rate of passage was calculated at 6.6%/h. The A fraction (rapidly degradable CP) varied from 26.6% to

Table 1143.

| Item ² | Feeds ¹ | | | | | | | | SEM |
|-------------------|--------------------|--------------------|---------------------|--------------------|---------------------|---------------------|---------------------|---------------------|------|
| | SBM | CM5 | CM6 | CM7 | CM9 | CM10 | CM11 | CM12 | |
| A, % | 23.0 ^c | 17.8 ^b | 21.7 ^{bc} | 26.4 ^c | 24.8 ^c | 26.6 ^a | 25.1 ^a | 23.1 ^{ab} | 1.18 |
| B, % | 76.5 ^{ab} | 79.9 ^a | 76.8 ^{ab} | 66.3 ^{cd} | 69.8 ^{bcd} | 69.6 ^{bcd} | 72.6 ^{abc} | 62.4 ^d | 1.84 |
| C, % | 0.6 ^b | 2.3 ^b | 1.5 ^b | 7.4 ^b | 5.4 ^b | 3.8 ^b | 2.3 ^b | 14.6 ^a | 1.42 |
| Kd, % h | 11.1 ^a | 5.6 ^{bc} | 5.2 ^c | 9.1 ^{ab} | 4.6 ^c | 9.7 ^{ab} | 6.2 ^{bc} | 4.0 ^c | 1.32 |
| RUP, % of CP | 31.0 ^d | 46.1 ^b | 44.8 ^b | 35.4 ^{cd} | 46.6 ^b | 32.3 ^d | 40.8 ^{bc} | 53.8 ^a | 2.05 |
| IDP, % | 94.5 ^a | 76.8 ^{bc} | 75.8 ^{bcd} | 72.0 ^{de} | 77.4 ^b | 71.6 ^c | 75.3 ^{bcd} | 73.0 ^{cde} | 2.50 |
| TDP, % | 98.2 ^a | 89.3 ^{bc} | 89.1 ^c | 90.1 ^{bc} | 89.4 ^{bc} | 90.8 ^b | 89.3 ^{bc} | 85.1 ^d | 0.73 |

^{a-c} Means in rows with different superscripts differ significantly ($P < 0.05$)

17.8%, respectively, for CM10 and CM5 ($P < 0.05$). The B fraction (slowly degradable CP) was highest for CM5 (79.9%) and lowest for CM12 (62.4%), whereas the C fraction (undegradable CP) was highest for CM12 (14.6%) and lowest for SBM (0.6%). The rate of degradation of B fraction, Kd (%/h) was highest for SBM (11.1%/h) and lowest for CM12 (4.0%/h). The RUP (% of CP) was highest for CM12 (53.8%), whereas lowest for SBM (31.0%), while the IDP (measured by pepsin-pancreatin digestion) ranged from 94.5% for SBM to 71.6% for CM10. The total digestible protein (TDP) was highest for SBM (98.2%) and CM ranged from 85.1% to 90.8% for CM12 and CM10 ($P < 0.01$), respectively. The mean ruminal and intestinal digestibilities of CM are in agreement with NRC, however considerable variation exists between CM processing plants.

Key Words: canola meal, rumen degradability, intestinal digestibility

and 0.73 respectively; $n = 107$). Regression analysis was used to determine cut points for 10, 12, and 14 mg IgG/mL and diagnostic characteristic test characteristics were calculated to determine the sensitivity and specificity of refractometry to identify failure of passive transfer (serum IgG < 10 mg/mL at 24 h old). The % Brix were 7.1, 7.3, and 7.6 and the nD cut-points were 1.24332, 1.34271 and 1.3448, respectively. The 7.3% Brix and 1.34271 nD cut-point resulted in the greatest percentage of samples being correctly classified (92.59 and 93.52%, respectively) and the best combination of diagnostic test characteristics. Our data suggest that a digital refractometer is an acceptable, rapid and low cost method to estimate immunoglobulin G in Jersey calf serum but that breed-specific cut points may need to be utilized.

Key Words: passive transfer, refractometer, jersey, validate

1144 (M127) Estimate of serum immunoglobulin G concentration in Jersey calves using refractometry. M. M. Spring^{*1}, K. M. Morrill², A. L. Robinson¹, and H. D. Tyler¹, ¹Iowa State University, Ames, ²Cornell University, Ithaca, NY.

Previous data from our lab demonstrated that refractometry could be used to estimate serum IgG in Holstein calves; data suggested that a % Brix cut-point of 7.8 should be used to identify failure of passive transfer in 1 day old Holstein calves. The objective of the present study was to validate the use of refractometry to determine serum IgG concentrations and evaluate failure of passive transfer in Jersey calves. Blood samples ($n = 108$) were obtained from 1-3 day old Jersey calves and centrifuged at $3,300 \times g$ for 20 minutes at 25°C. The serum was analyzed for %Brix and refractive index (nD) using a digital refractometer and IgG concentration was determined by radial immunodiffusion. The mean serum IgG concentration for all calves was 23.7 mg/ml (SD = 12.2), with a range of 2.2 to 65.0 mg/ml. Mean serum %Brix for all calves was 8.8 (SD = 1.1), with a range of 6.5 to 12.0. Mean serum nD for all calves was 1.34596 (SD = 0.00173), with a range of 1.34280 to 1.35110. Serum %Brix and nD were positively correlated with IgG concentration ($r = 0.74$

1145 (M128) Examination of pre-milking teat disinfectant contact times using the excised teat model. B. D. Enger^{*}, L. K. Fox, J. M. Gay, and K. A. Johnson, Washington State University, Pullman.

Use of pre-milking teat disinfectants is a common practice used to aid in the control of mastitis which is the most common and expensive disease in the U.S. dairy industry. Effectiveness of pre-milking teat disinfectants in reducing pathogen load on teat skin is influenced by the duration these disinfectants remain on the teat skin, although this has not been adequately investigated. The objective of this study was to determine the percentage reduction in mastitis pathogen load, four environmental and four opportunistic ($n = 8$), on teat skin with disinfectant contact times of 15, 30, and 45 sec. Three commercially available disinfectants were tested: 0.25% (A) and 0.5% (B) iodophor, and 1% H₂O₂ (C). Excised teats, collected from an abattoir, were washed, dried, hung from a dowel rod, dipped in 70% isopropyl alcohol and allowed to dry. Once dry, teats were dipped in challenge solution of approximately 10^7 colony forming units/ml of a pathogen. After 5 minutes, teats were dipped with desired disinfectant and rinsed with quench solution upon achieving test contact time. Rinse was serially diluted, plated, incubated for 18-48 hr, and enumerated. Main effect differences were observed within dips, contact times, and

species ($P < 0.0001$). Dip A percentage log reduction across all species was 28% at 15 sec, 35.7% at 30 sec, and 39.2% at 45 sec, SE $\pm 1.7\%$. Dip B, percentage log reduction was 36% at 15 sec, 41.2% at 30 sec, and 43.8% at 45 sec, SE $\pm 1.7\%$. Dip C, the least efficacious disinfectant, had log reductions of 26% at 15 sec, 25.5% at 30 sec, and 28% at 45 sec, SE $\pm 1.7\%$. In summary percentage log reductions across all pathogens and dips at 15, 30, and 45 sec were $30\% \pm 0.97\%$, $34\% \pm 0.97\%$, and $37\% \pm 0.96\%$ respectively, all significantly different from one another ($P < 0.05$). The relationship between duration of contact time and percentage log reduction demonstrates the importance of allowing adequate contact time to maximize pathogen reduction and reduce the risk of mastitis.

Key Words: mastitis, teat disinfectant, contact time

1146 (M129) The effects of feeding an algae supplement on milk yield, milk components, and dry matter intake. M. E. Weatherly¹, A. M. Gehman², A. M. Lisembee², J. D. Clark¹, D. L. Ray¹, and J. M. Bewley¹, ¹University of Kentucky, Lexington, ²Alltech, Inc., Nicholasville, KY.

Feeding docosahexaenoic acid (DHA) via algae supplementation could increase milk polyunsaturated fats. The objective of this study, conducted at the University of Kentucky Coldstream Dairy, was to determine the effects of feeding cows *Schizochytrium* sp. Microalgae (SP-1, Alltech, Inc., Nicholasville, KY) on milk fat and DHA content, dry matter intake, and milk yield. Eight multiparous, mid-lactation, Holstein cows were housed in a tie-stall barn and fed a basal ration 2X. Cows were blocked by milk production and DIM and assigned to 1 of 4 treatments: 0, 100, 300, or 600 g of algae per day for 28 d. Milk samples were composited by week and analyzed for fat and DHA composition. Dry matter intake and milk yield were recorded daily and averaged by week. The PROC MIXED of SAS (SAS Institute, Inc., Cary, NC) was used to evaluate fixed effects of week, treatment, and their interactions on milk fat percentage and DHA content (g/d), milk yield (kg/d), and DMI (kg/d), with block within treatment as subject repeated by week. Stepwise backward elimination was used to remove non-significant interactions ($P \geq 0.05$). All main effects were kept in each model regardless of significance level. Week affected milk yield ($P < 0.01$) but treatment did not ($P = 0.30$). Milk yield (mean \pm SE) for periods 1 to 4 was 30.44, 29.10, 25.10, and 25.21 ± 4.58 kg, respectively. Treatment and week affected fat percentage ($P = 0.02$). Fat percentage was greater ($P < 0.05$) for cows on treatments 0 and 100 (4.20 and $3.54 \pm 0.18\%$, respectively) than cows on treatments 300 and 600 (2.52 and $2.52 \pm 0.18\%$, respectively). Treatment, week, and the interaction of treatment \times week affected DMI ($P < 0.01$, $P < 0.01$, and $P = 0.02$, respectively). Dry matter intake decreased across time across treatments until wk 4. Treatment and the interaction of treatment \times wk affected milk DHA ($P = 0.03$ and $P = 0.02$, respectively). DHA content in milk was

greater ($P < 0.05$) for cows on treatment 300 and 600 (3.30 and 5.18 ± 0.66 g/d, respectively) than cows on treatment 0 and 100 (0.00 and 0.39 ± 0.66 g/d, respectively). This data suggests supplementing lactating dairy cows with high-DHA microalgae may allow for the incorporation of polyunsaturated fats, including DHA, into milk; however, decreases in milk fat percentage and DMI may limit on-farm application.

Key Words: algae, milk fat, DHA

1147 (M130) Rumen morphology measurements in periruminant Holstein bull calves fed a fermentation extract of *Aspergillus oryzae*.

T. T. Yohe*, E. M. Dudash, K. M. O'Diam, and K. M. Daniels, *Dep. of Animal Sciences, Ohio State University, Wooster.*

Age and diet not only affect calf BW, they can impact rumen growth and development too. A fermentation extract of *Aspergillus oryzae* has previously been utilized as a direct fed microbial (DFM) to increase rumen bacterial numbers and promote starter intake in calves. Effects of feeding an extract of *A. oryzae* on rumen morphology in periruminant calves are largely unknown. Objectives were to determine if age and dietary inclusion of an extract of *A. oryzae* affect: organ size, muscle and sub-mucosal thickness of rumen tissue, and papillae area in periruminant Holstein bull calves. Individual calves ($n = 52$) were randomly assigned to a slaughter age, 4 wk ($n = 16$) or 8 wk ($n = 36$), and treatment, control (CON; $n = 27$) or DFM ($n = 25$). Calves were housed and fed individually; no bedding was used. Liquid DFM was delivered in milk replacer (2 g per day) for the first 4 wk of the trial; solid DFM (2 g per day) was top-dressed on grain thereafter. Calves were fed non-medicated milk replacer twice daily (22.0% CP, 20.0% fat DM basis; 680 g/d) and had ad libitum access to texturized grain (20% CP, 2.0% fat) and water. Treatment and the interaction of treatment and age did not affect full or empty rumen weights. However, full and empty rumen weights were greater at 8wk (5.29 ± 0.21 and 1.31 ± 0.04 kg, respectively) than 4 wk (1.81 ± 0.30 and 0.52 ± 0.06 kg, respectively). Muscle thickness (894.15 ± 69.50 μ m, 4 wk; 1098.58 ± 47.64 μ m, 8wk) and sub-mucosal thickness (247.57 ± 43.48 μ m, 4 wk; 583.67 ± 29.80 μ m, 8 wk) were both affected by age, but not by treatment or interaction. Lastly, within the cranial ventral region of the rumen of 8-wk-old calves (4-wk samples not measureable), treatment had no effect on papillae area (6.52 ± 0.39 mm², CON; 6.65 ± 0.41 mm² DFM). In summary, dietary inclusion (2g/d) of an extract of *A. oryzae* did not affect rumen morphological development when supplemented animals were compared to cohorts not fed DFM. It is possible that the dose used here was not high enough to elicit treatment effects. Evaluation of other measures of performance, such as calf growth, may add further information on the efficacy of this DFM in periruminant calf diets. A higher dose of DFM may yield different effects.

Key Words: dairy calf, rumen, direct fed microbial

1148 (M131) Response of dairy cows supplemented with antioxidants and/or chelated trace minerals to intra-mammary bacterial challenge.

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The effects of chelated trace minerals (TM) of Zn, Cu, and Mn (Minitrex, Novus International, St. Charles, MO) and dietary antioxidant (Agrado Plus, Novus International) supplementation on responses to experimental mastitis in lactating cows were evaluated. Sixty cows were blocked by parity, expected date of parturition, and initial BW. Cows were individually fed a basal diet formulated according to NRC (2001) from d -39.3 ± 4.6 prepartum until d 38 postpartum. Treatments were top-dressed as: 1) Negative control – no TM nor antioxidant (NEG), 2) TM provided with 100% sulfates without antioxidant (ITM), 3) TM provided with 100% sulfates with antioxidant (ITMAOX), 4) TM provided 50% of sulfates and 50% of chelated TM without antioxidant (OTM), and 5) TM provided 50% of sulfates and 50% of chelated TM with antioxidant (OTMAOX). Treatments were iso-mineral except NEG; all were iso-methionine. Animals were vaccinated against *Escherichia coli* (Enviracor J-5, Pfizer Animal Health) at drying-off, -27.3 ± 4.6, and 14 d from parturition, and against rabies (IMRAB, Merial) at parturition. On d28 after calving, the right front quar-

ter of each animal was infused with 1.74×10^4 CFU of *E. coli* P4:O32 diluted in 5 mL of sterile PBS and the contralateral quarter with the same volume of sterile PBS. Blood and milk samples were collected regularly during the experiment. Primiparous had higher rabies titers concentrations on d14 compared to multiparous cows, but no difference between parities on d28 (parity x time, $P < 0.001$). OTMAOX showed the highest rabies titer concentrations compared to other treatments on d14 (treatment x time, $P = 0.04$). Higher milk yield was observed for the first 3 days post-infusion in primiparous compared to multiparous cows (parity x time, $P < 0.05$). *Escherichia coli* CFU were higher in infected quarters of multiparous cows (parity x quarter, $P = 0.03$). Milk SCC were higher in AOX and OTMAOX in response to challenge than in other treatments (treatment, $P = 0.01$). Additionally, SCC in primiparous peaked earlier and higher compared to multiparous cows (Parity x time, $P = 0.004$). Blood GSH:GSSG peaked at 48 h post-infusion ($P = 0.01$). Blood GSH:GSSG in OTMAOX was highest in primiparous, but lowest in multiparous cows ($P < 0.05$). Antibody titer and SCC recruitment results suggest OTMAOX may have improved some aspects of periparturient immune function. Additionally, the earlier and elevated milk SCC in primiparous cows may have limited the severity of *E. coli* infection, thereby allowing for increased DMI and milk production.

Key Words: *Escherichia coli*, mastitis, supplementation