

Ruminant Nutrition: Dairy: Calves

390 Effect of feeding polyphenols from pomegranate extract on health, growth, nutrient digestion, and immunocompetence of calves. M. C. Perdomo^{*1}, R. A. Oliveira¹, C. D. Narciso¹, R. S. Bisinotto¹, M. A. Ballou², M. Dreher³, and J. E. P. Santos¹, ¹University of Florida, Gainesville, ²Texas Tech University, Lubbock, ³POM Wondersull, Los Angeles, CA.

Objectives were to evaluate the effects of feeding pomegranate extract (POMx) rich in polyphenols on performance, health, nutrient digestion, and immunocompetence of calves. Holstein calves (n = 67), at 2 ± 1 d of age were randomly assigned to 0 (control), 5 (POMx5), or 10 g/d (POMx10) of POMx containing 16.9% gallic acid equivalent. Calves received colostrum in the first 24 h, pasteurized milk thereafter until d 61, and grain was fed ad libitum for the first 70 d of age. Calves were housed in individual hutches and grain intake, attitude and fecal scores, incidence and duration of health disorders, and health treatments cost were evaluated. Body weight (BW) was measured at 2, 30 and 70 d of age. Concentrations of glucose and 3-hydroxybutyrate (BHBA) were measured in plasma. Nutrient digestion was measured using total fecal collection. Neutrophil phagocytic and killing activities and antibody response to ovalbumin were measured. Cytokine production by peripheral blood mononuclear cells was measured. Feeding POMx had no effect on intake or BW gain in the first 30 d of age, but grain intake and BW gain reduced ($P < 0.05$) with increasing addition of POMx after d 30, which resulted in calves that were 1.8 and 4.3 kg lighter at 70 d of age for POMx5 and POMx10, respectively, compared with controls. Feeding POMx did not influence DM, organic matter or starch digestibility, but it reduced ($P < 0.01$) protein and tended ($P = 0.06$) to affect fat digestion. Plasma concentrations of glucose and BHBA, attitude and fecal scores, rectal temperature, incidence of fever, health treatment cost, neutrophil phagocytic and killing activities did not differ among treatments. Feeding POMx increased ($P < 0.05$) interferon- γ , interleukin-4, and IgG to ovalbumin vaccination. These results suggest that feeding POMx top dressed onto the grain suppresses grain intake and digestibility of protein. Nevertheless, POMx enhanced mitogen-induced cytokine production and response to vaccination which might benefit immune competence of calves and potentially health.

Key Words: calf, polyphenols, pomegranate

391 Effect of high-protein milk replacer followed by high-protein starter on transcript profiles in ruminal tissue of Holstein bull calves. A. Naem^{*}, J. K. Drackley, J. Stamey, S. L. Rodriguez-Zas, R. E. Everts, H. A. Lewin, and J. J. Loor, *University of Illinois, Urbana.*

The calf must be adapted to its nutrition from milk or milk replacer to make the metabolic, nutritional, and behavioral changes to become a functional ruminant in a period of 6 to 8 wk after birth. Objective of this study was to evaluate ruminal epithelium transcriptomics in response to high-protein/low-fat milk replacer followed by high-protein starter for 10 wk. From 3 through 42 d of life, male Holstein calves were fed reconstituted control milk replacer (20% CP, 20% fat; 0.567 kg solids/calf) or a high-protein/low-fat milk replacer (28.5% CP, 15% fat; at ca. 2% of body weight). All calves were weaned on d 43. Calves in the control group were then fed a control starter containing 16% CP through d 70 of life. In contrast, calves in the high-protein/low-fat group were fed a starter containing 22% CP through d 70 of life. Groups of calves in control and high-protein/low-fat treatments were harvested after 43 (wk 5) and 71 d (wk 10) of feeding. Ruminal epithelium samples harvested from 5 animals in each group at each time point were used

for transcript profiling using a 13,257 bovine oligonucleotide (70-mers) array. Preliminary ANOVA of wk 10 data revealed 75 differentially expressed genes (DEG, $P < 0.01$) due to diet. Among DEG, the most enriched biological functions were cellular process (n = 34) and regulation of biological process (n = 17). In addition, genes with a 2-fold change between treatments were related to physiological processes including protein degradation (e.g., PGA3, pepsinogen 3, group I A) and growth (e.g., RDH10, retinol dehydrogenase 10). Preliminary results show that feeding a high-protein/low-fat milk replacer followed by a high-protein starter caused alterations in ruminal epithelium gene expression profiles.

Key Words: transcriptomics, development, metabolism

392 Field evaluation of the effects of free-access feeding of acidified milk replacer on the growth performance of dairy replacement heifers and veal calves. C. G. Todd^{*1}, K. E. Leslie¹, S. T. Millman², T. J. DeVries³, N. G. Anderson⁴, and J. M. Sargeant¹, ¹Department of Population Medicine, University of Guelph, Guelph, Ontario, Canada, ²Veterinary Diagnostic and Production Animal Medicine, Biomedical Sciences, Iowa State University, Ames, ³Department of Animal and Poultry Science, University of Guelph, Kemptville Campus, Kemptville, Ontario, Canada, ⁴Ontario Ministry of Agriculture, Food and Rural Affairs, Elora, Ontario, Canada.

The objective of this research was to determine the effects of free-access feeding of acidified milk replacer on pre and post-weaning growth of Holstein replacement heifers and veal calves. The study was conducted at a commercial dairy operation in central Ontario. Heifer calves were reared as replacement animals and male calves were marketed as grain-fed veal. Calves (n = 495) were randomly assigned at birth to 1 of 2 milk feeding programs: free-access (ad libitum) feeding of acidified milk replacer (ACID, n = 250) or conventional (3 L fed twice daily) feeding of milk replacer (CONV, n = 245). Calves were fed milk replacer containing 24% crude protein and 18% fat. Formic acid was used to acidify the milk replacer for the ACID treatment. The target pH for acidified milk replacer was between 4.0 and 4.5. Calves were gradually weaned from milk replacer at approximately 6 weeks of age (mean ± SD: 41.1 ± 7.7 d of age). Body weight, hip width, hip height, body length and heart girth were measured at birth and weaning. A post-weaning body weight measurement was also collected for each calf (mean ± SD for heifer calves: 283.3 ± 57.2 d of age; mean ± SD for veal calves: 235.0 ± 25.1 d of age). There was no difference between the ACID and CONV calves for any of the measurements collected at birth. The ACID calves had significantly higher pre-weaning body weight gain compared with the CONV calves (28.2 vs. 21.2 kg, SE = 0.9, $P < 0.05$), as well as greater change in hip width (3.6 vs. 2.5 cm, SE = 0.1, $P < 0.05$), hip height (8.5 vs. 7.0 cm, SE = 0.4, $P < 0.05$), body length (11.9 vs. 9.5 cm, SE = 0.7, $P < 0.05$) and heart girth (12.4 vs. 9.8 cm, SE = 0.4, $P < 0.05$). The ACID and CONV calves did not differ for post-weaning weight gain (heifer calves: 224.7 vs. 226.8 kg, SE = 6.0, $P > 0.05$, respectively; veal calves: 257.1 vs. 257.2, SE = 2.0, $P > 0.05$, respectively). These results indicate that free-access feeding of acidified milk replacer supports improved body weight gain and structural growth during the pre-weaning period, but does not affect post-weaning weight gain.

Key Words: milk replacer, free-access feeding, acidification

393 Comparison of raw colostrum, colostrum replacer, and pasteurized colostrum on IgG, growth, and health of dairy calves. C.

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Colostrum consumption is key to the health and survival of dairy calves. However, feeding raw colostrum can spread disease from dam to calf. Pasteurized colostrum and colostrum replacer can be used when disease spread is a concern. A direct comparison between pasteurized colostrum and colostrum replacer is lacking. The primary objective was to determine serum immunoglobulin G (IgG) concentration of calves fed colostrum replacer (CR, 150 g globulin protein/dose), pasteurized colostrum (PC), and raw colostrum (RC). Other objectives were to evaluate intake, growth, feed efficiency, and health of calves. Male and female dairy calves born at Eastern Kentucky University Steland Dairy Center were randomly assigned to 1 of 3 treatments ($n = 11/\text{trt}$): RC, PC, or CR and fed their respective treatment twice (1.89 L/feeding) on d 1 of life. Calvings were monitored so that calves did not suckle the dam. High quality (green) colostrum, as measured by a colostrometer, was pooled for the RC and PC treatment. Blood was collected before colostrum feeding and again between 46 and 60 h for analysis of serum IgG. Calves were raised similarly after 1 d of age and data was collected until weaning at 7 wk of age. Statistical analysis used the GLM procedure of SAS. Calves fed RC or PC had greater concentrations of serum IgG than CR ($P < 0.01$), but no difference existed between RC and PC. Average fecal scores and rectal temperatures taken daily during the first 2 wk of age were not different. Total intake of starter and milk replacer, initial and final growth parameters, feed efficiency, and average daily gain were not different. No major health challenges were noted in these calves. It is possible that if CR calves had been exposed to major illnesses, health and growth parameters may have been compromised due to low immunity. Results indicate that if properly pasteurized, PC does not compromise immunity, health or growth parameters.

Key Words: colostrum, calf, immunoglobulin

394 Effect of the ingredients on acid binding capacity and pH of calves starter ration. Y. Tu¹, Q. Y. Diao¹, S. S. Feng², Y. Zhou¹, and Q. Yun¹, ¹*Feed Research Institute of Chinese Academy of Agricultural Sciences, Beijing, China*, ²*Beijing University of Agriculture, Beijing, China.*

This experiment was conducted to study on the effects of the ingredients and its acid binding capacity (ABC) or pH on the ABC or pH of calves starter ration. Nine feed raw ingredients (5–7 samples each) including corn, wheat bran, soybean meal, whey powder, CaHPO₄, limestone, salt, mineral premix and vitamin premix, which were ordinarily used in the northern China, were mixed with calves starter rations based on L₂₇(3¹³) orthogonal test table. The ABC and pH of the ingredients and starter rations were determined, and then multiple regression method was used to analyze the data. The results showed that, 1) the ABC of limestone was highest (2040.00), while that of salt was lowest (0.40). The order of ABC from high to low was soybean meal, wheat bran, corn in plant feed ingredients, which were 47.82 ± 4.51 , 27.31 ± 3.47 , 7.11 ± 0.54 , respectively; 2) The pH of minerals were alkaline, and that of corn, wheat bran and soybean meal were 5.79 ± 0.23 , 5.65 ± 0.20 and 5.92 ± 0.11 , respectively; 3) All the ingredients had significant effect on the ABC and pH of starter ration ($P < 0.05$). 4) When the ABC of starters was Y_1 (mmol/100 g), pH of starters were Y_2 (mmol/100 g), and the proportions in starter and ABC of soybean meal, wheat bran, whey powder, CaHPO₄, limestone, salt, vitamin premix, corn were X_1 - X_8 (%) and a_1 - a_8 (mmol/100 g), respectively, the regression equation $Y = f(a_i X_i)$ was: $Y_1 = 1.0944a_1X_1 + 0.4817a_2X_2 + 1.2354a_3X_3 - 0.1568a_4X_4 + 0.1136a_5X_5 + 62.5969a_6X_6 + 60.2618a_7X_7 + 0.9150a_8X_8$ ($S_{Y.X} = 1.85603, R^2 = 0.9945, P < 0.0001$); $Y_2 = 1.0792b_1X_1 + 0.9830b_2X_2 +$

$0.7687b_3X_3 + 1.0101b_4X_4 + 0.8997b_5X_5 - 0.3266b_6X_6 - 27.0485b_7X_7 + 1.0142b_8X_8$ ($S_{Y.X} = 0.05691, R^2 = 0.9999, P < 0.0001$). These results indicate that in the range of the experiment design, the suitable content of ingredients in calves starter ration were: soybean meal $\leq 20\%$, wheat bran 0–10%, whey powder $\leq 20\%$, CaHPO₄ $\leq 2\%$, limestone $\leq 2\%$, salt 0–1.0%, vitamin premix 0–0.04%. There were significant multiple linear correlation between the ABC or pH of calves starter ration and content, ABC or pH of ingredients.

Key Words: calves starter ration, acid-binding capacity and pH, mathematical model

395 Study on in vitro evaluation of acidifier and its effect on growth in calves fed milk replacer. Y. Tu^{*}, Y. Zhou, Q. Yun, Y. Q. Fu, and Q. Y. Diao, *Feed Research Institute of Chinese Academy of Agricultural Sciences, Beijing, China.*

This experiment was conducted to study on the in vitro evaluation method of acidifiers in calves milk replacer, and then validated the effect of the acidifier in calves using feeding trials. In the in vitro test, antibacterial activity in vitro (Y1), pH of 1% acidifier solution (Y2), buffering capacity of 1% acidifier solution (Y3), volume of acidifier solution to reduce the pH of milk replacer solution from 6.3 to 5.0 (Y4) and buffering capacity of milk replacer solution added acidifier (Y5) were chosen as the indices to evaluate the effect of the tested acids including formic acid, acetic acid, citric acid, fumaric acid, lactic acid and hydrochloric acid. Eighteen and 12 healthy neonatal Chinese Holstein male calves were assigned randomly to Treatment A1, A2, A3 in trial A and Treatment B1, B2 in trial B, respectively, and each treatment had 6 calves. The pH of milk replacer solution were reduced by hydrochloric acid from 6.3 to 5.5 or 5.0 in Treatment A1 or A2, respectively, and was reduced by formic acid from 6.3 to 5.0 in Treatment B2. Body weight, feed efficiency and the incidence of diarrhea were determined. The results indicated that, in the in vitro test, Y1 were highest when hydrochloric acid (95.12%) or formic acid (94.19%) was used, Y2 was lowest in hydrochloric acid solution, Y3 was best in hydrochloric acid solution, Y4 was least when formic acid solution used, and Y5 was best in acetic acid solution. So formic acid and hydrochloric acid were selected to be the acidifier in calf milk replacer. In the feed trails, comparing with that in Treatment A1, ADG improved 5.2% and 12.1% in Treatment A2 and A3. The incidence of diarrhea was 9.7% in Treatment A3, which decreased by 29.7% comparing with the 13.8% in Treatment A1. ADG of calves was significantly higher in Treatment B2 than that in Treatment B1 ($P < 0.05$), the incidence of diarrhea decreased by 37.5% in Treatment B2 (16.2%) than that in Treatment B1 (25.9%). It is concluded that, the growth performance of calves may be improved by using hydrochloric acid or formic acid as acidifier in milk replacer, and the in vitro evaluation method of acidifier was viable.

Key Words: calf milk replacer, acidifier, in vitro evaluation

396 Simulated straw bedding intake and effect of high and low cereal grain starters on rumen development of neonatal Holstein calves. W. B. Fokkink^{*}, T. M. Hill¹, H. G. Bateman II¹, J. M. Aldrich¹, R. L. Schlotterbeck¹, and A. F. Kertz², ¹*Nurture Calf Research, Provimi North America, Lewisburg, OH*, ²*ANDHILL, LLC, St. Louis, MO.*

Our hypothesis was that simulated straw bedding intake would be minor and that calves fed a texturized high cereal grain starter (TEX) would have greater rumen papillae development than calves fed a fine particle, pelleted, low cereal grain starter (PEL). Male Holstein calves (initially 45 ± 1.1 kg BW, 2 d of age; 4 calves/treatment) were fed TEX or PEL and long-stem wheat straw over a 56-d trial. Starter TEX contained

37% whole corn, 25% whole oats, 35% supplement pellets (containing 68% soybean meal, 16% wheat middlings, and 16% other ingredients) and 3% molasses. Starter PEL contained 43% dried distillers grains, 26% wheat middlings, 15% soybean hulls, 10% fine rolled corn, and 6% other ingredients. Starters contained equal concentrations of CP (20% DM basis), Ca, P, and salt. Calves were fed a 27% CP, 17% fat milk replacer at 0.66 kg DM daily and weaned at 35 d. Calves were fed wheat straw, starter, and water ad libitum and housed in individual pens with geotextile fabric over rock as flooring with no bedding. After sacrifice on d 56, gastro intestinal tracts were divided at the pyloric sphincter (stomach and intestine sections) and weighed. Rumen wall and rumen papillae samples were measured. Data were analyzed as a completely randomized design. Straw intake averaged 7 g/calf daily or 0.8% of total intake, and did not differ by starter type. Calves fed TEX had greater final BW and greater ADG than calves fed PEL. Empty stomach weight was greater for calves fed TEX. Intestine and digesta weights were lower and stomach and intestine plus digesta weights were lower for calves fed TEX vs. PEL. Rumen papillae length was greater for calves fed TEX vs. PEL. Feeding a texturized high cereal grain diet developed rumen papillae better and contributed to less stomach, intestine, and digesta as a percent of BW than feeding a fine particle, pelleted low cereal grain diet.

Key Words: calf, rumen, starters

397 Growth and health of calves pre- and post-weaning fed milk replacers with differing levels of neomycin sulfate and oxytetracycline. N. B. Litherland^{*1}, B. Ziegler², D. Schimek², D. Carlson³, D. Ziegler⁴, M. L. Raeth-Knight¹, G. G. Golombeski¹, H. Chester-Jones⁴, and J. G. Linn¹, ¹University of Minnesota, St Paul, ²Hubbard Feeds Inc., Mankato, MN, ³Milk Products Inc., Chilton, WI, ⁴University of Minnesota Southern Research and Outreach Center, Waseca.

New regulations for the use of medicated milk replacers (MR) containing neomycin sulfate (NEO) and oxytetracycline (OXY) have resulted in a need to explore the effects of amount and duration of antibiotic feeding on calf growth and health. Previous work by our group showed removal of antibiotics from MR at 14 d reduced growth compared with feeding antibiotics through 42 d. The aims of this study were to evaluate growth and health of calves fed MR containing varying amounts of antibiotics for 0, 14, 26, or 42 d. Holstein heifer calves (n = 100, 2 to 4 d of age) were assigned randomly to 1 of 4 MR programs. All calves were fed 20% CP, 20% fat MR at 0.57 kg/d (as-fed powder weight) from d 1–35 and 0.28 kg/d from d 36–42. Four different antibiotic amounts and durations were included in the above MR to yield 4 treatments; TRT1 - 400 g NEO/200 g OXY per ton of MR on d 1–42; TRT2 - 0 g NEO/0g OXY per ton of MR on d 1–42; TRT3 - 1600 g NT/1600 g OXY per ton of MR on d 1–14; TRT4 - 1600 g NEO/1600 g OXY per ton of MR on d 1–14 and d 16–28. Calves were fed MR twice daily from d 1–35, and once daily from d 36–42. An 18% CP (as-fed) texturized calf starter was offered free choice along with water throughout the study. Calves were housed in individual pens within a naturally ventilated barn. Average daily gain and total body weight gain was lower ($P < 0.05$) for TRT2 when compared with TRT1 and TRT4. Total starter intake and total dry matter intake was lower ($P < 0.05$) for TRT 2 compared with TRT1 and TRT 4 through 42 d of age. Dry matter required for gain was higher ($P < 0.05$) for TRT2 compared with all other treatments. Fecal scores were not different and averaged 1.3 across treatments. Scouring days (fecal score of 4) were significantly higher ($P < 0.05$) for TRT 2 compared with TRT 4 through d 42. Calves fed increasing amounts and duration of NT and OT grew more efficiently, ate more starter, and had fewer days scouring than calves fed no antibiotics. The future of antibiotic

use in calf MR is unclear. Non-medicated MR additives that promote growth and health should be explored.

Key Words: dairy calf, neomycin sulfate, oxytetracycline

398 Meta-analysis for designing an empirical model to predict growth of neonatal Holstein calves through eight weeks of age. H. G. Bateman II^{*1}, T. M. Hill¹, J. M. Aldrich¹, R. L. Schlotterbeck¹, and J. L. Firkins², ¹Nurture Research Center, Provimi North America, Lewisburg, OH, ²The Ohio State University, Columbus.

A data set was constructed from individual animal means gathered in the Nurture Research Center (a curtain-sided, naturally ventilated nursery) and used in a meta-analysis to parameterize an empirical model predicting growth measures. This data set contained 993 observations from 20 research trials in all seasons. Growth measures gathered included average daily gain (ADG) pre-weaning, post-weaning, and through 8 weeks of age. Independent variables gathered included: age at weaning (WEAN), total starter intake (SI), total milk replacer intake (MRI), milk replacer CP % (MRCP) and fat % (MRfat) contents, number of days with abnormal fecal scores (AFS), average environmental temperature pre-weaning (temp-pre), post-weaning (temp-post), and through 8 weeks of age (temp-all), minimum (mintemp) and maximum (maxtemp) during the entire 8 weeks, BW at d 0 (BW0), and initial serum protein concentration (SERP). Additionally the interactions of SI, MRI, and MRCP and MRfat were considered for the model. Backward elimination multiple regressions were conducted using a mixed model with a random effect of trial. Terms least probable to differ from zero were removed sequentially from the model except that when interactions terms appeared in the model their constituent terms remained regardless of level of significance. When all terms were significant at $P < 0.05$ variance inflation factor (VIF) was calculated. If VIF was greater than 100 the term with the lowest probability of being different from zero was removed until the VIF was 100 or less. The final model for total ADG indicated that increasing SI or MRI improves calf growth. Also increasing MRCP increased growth but increasing MRfat depressed growth due to the interactions among SI, MRI, and MRfat. Growth of neonatal dairy calves appears more controlled by nutrient intake and their interactions than surrogates for health status of the calves (AFS and SERP) or environmental temperature.

Key Words: calf, growth, meta analysis

399 Effect of different fiber sources on performance and feed intake of Holstein calves. L. Castells^{*1}, A. Bach^{1,2}, and M. Terré¹, ¹Department of Ruminant Production, IRTA, Caldes de Montbui, Spain, ²ICREA, Barcelona, Spain.

The objective of this study was to evaluate the effect of different fiber sources on performance and feed intake of Holstein calves. Sixty Holstein male calves (initial BW = 43.9 ± 5.86 kg) were randomly assigned to one of 3 different dietary treatments that consisted on a common starter plus alfalfa hay (A), rye-grass (R), and no access to forage (C). All calves were offered 2 L of milk replacer (MR) at 12.5% DM twice daily via a bottle until 50 d of age, and then only one daily dose of 2 L of MR at 12.5% DM during the week before weaning (57 d of age). Starter, MR, and forage intakes were recorded daily and BW was recorded weekly. Calves were individually housed using wood shavings as bedding material. Intake data were transformed using square root to achieve a normal distribution and were analyzed using a mixed-effects model with repeated measures that included initial BW as a covariate, and dietary treatment, week of study and their 2-way interaction as fixed effects, and the animal as a random effect. Starter

intake tended to be greater ($P = 0.05$) in R (1.2 ± 0.03 kg/d) than in A calves (0.9 ± 0.03 kg/d), but no differences were observed between C calves (1.0 ± 0.03 kg/d) and the other 2 treatments. Forage intake was greater ($P < 0.05$) in A (144 ± 0.26 g/d) than in R calves (59 ± 0.26 g/d). Total dry matter intake (DMI) tended to be greater ($P = 0.10$) in R (1.7 ± 0.03 kg/d) than in C (1.4 ± 0.03 kg/d) and A calves (1.5 ± 0.03 kg/d). No differences were observed among treatments on ADG and feed efficiency. Offering forages to calves does not compromise total DMI, and it may foster consumption of starter, especially when the forage offered is rye-grass.

Key Words: forage, calves, performance

400 Effect of housing and management on dairy calves less than two months of age. T. M. Hill*, H. G. Bateman II, J. M. Aldrich, R. L. Schlotterbeck, D. L. Carr, and A. B. Chestnut, *Nurture Research Center, Provinci North America, Lewisburg, OH.*

Housing (hutches, naturally ventilated nursery), bedding (straw, sand), and summer cooling with fans were management conditions evaluated in 3 trials. Holstein calves (42 ± 2 kg BW) initially 2 to 4 d of age were managed at the Nurture Research Center in southwest Ohio. Calves were fed milk replacer (27% CP, 17% fat fed at 0.657 kg DM per calf daily), starter (20% CP DM, textured, fed free-choice), and water (free-choice). Measurements were for 56 d. In Trial 1, 28 calves per treatment were bedded with straw and housed either in poly hutches or wire mesh nursery pens. This trial was conducted from September to March. The average temperature was 8°C and ranged from -17 to 31°C. In Trial 2, 16 calves per treatment were managed in wire mesh nursery pens bedded with straw, in nursery pens bedded with sand, or in poly hutches bedded with sand. This trial was conducted from May to September. The average temperature was 21°C and ranged from 7 to 33°C. In Trial 3, 26 calves per treatment were housed in wire mesh nursery pens and bedded with straw with or without supplemental cooling with fans between 8AM and 5 p.m. This trial was conducted from May to September. The average temperature was 22°C and ranged from 8 to 34°C. Data were analyzed by trial as completely randomized block designs with calf as the experimental unit. Differences were declared at $P < 0.05$. In Trial 1, daily gain of calves in nursery pens was 7% greater than that of calves in hutches. In Trial 2, daily gain and starter intake of calves in the nursery with straw bedding were greater and scouring was less than calves bedded with sand in the nursery or hutches. In Trial 3, daily gain, feed efficiency, and hip width change were greater and

breaths per minute were less for calves cooled with fans than calves that were not cooled. Straw bedding was preferred to sand, nursery pens were preferred to hutches, and summer daytime cooling with fans was preferred to no cooling.

Key Words: bedding, temperature, cooling

401 The effect of oral supplementation of selenium on passive transfer of immunoglobulins in dairy calves. B. Nelson*¹, S. M. Godden², B. W. McBride¹, T. F. Duffield¹, and K. E. Leslie¹, ¹*Department of Population Medicine, University of Guelph, Guelph, ON, Canada,* ²*Department of Veterinary Population Medicine, University of Minnesota, St. Paul.*

The objective of this study was to evaluate the effects of oral selenium supplementation by the addition of sodium selenite to colostrum or colostrum replacer, on the success of passive transfer of immunoglobulin G (IgG) and on whole blood selenium status. During the summer of 2008, a total of 122 Holstein calves were enrolled at the Transition Management Facility, Emerald, Wisconsin. Calves were randomly assigned to receive either colostrum from their dam, or a commercially available colostrum replacer product. Calves were further randomized to receive selenium (sodium selenite) or placebo added to their respective colostrum treatments, at a concentration of 3 ppm. Blood samples were collected from every calf at birth, before feeding of colostrum, and again 24 h following feeding of colostrum. Whole blood samples were analyzed for selenium concentration using a fluorometric method. Serum samples were analyzed for IgG concentration using a radial-immunodiffusion assay. Statistical analysis was conducted using linear regression techniques in STATA. Calves that received colostrum or colostrum replacer with selenium had significantly increased whole blood selenium concentrations compared with placebo calves ($\mu\text{g/mL}$: 0.31; 0.22; $P < 0.001$). Calves fed colostrum from their dam had significantly higher serum IgG concentrations 24 h following colostrum feeding than calves fed the colostrum replacer product (g/L : 35.95; 17.6; $P < 0.001$). There were no significant differences in serum IgG at 24 h between calves fed maternal colostrum with or without selenium supplementation and calves fed colostrum replacer with or without selenium supplementation (g/L : 36.02, 35.87; 18.72, 16.58, respectively). From the results of this study, selenium supplementation of colostrum or colostrum replacer for improvement of passive transfer of IgG is not warranted.

Key Words: selenium, colostrum, passive transfer