STUDENT RESEARCH PRESENTATION COMPETITION

ABSTRACTS

WCDS Advances in Dairy Technology (2017) Volume 29: 161-166

Milk Progesterone Profiles Before and After AI and Their Association with Pregnancy and Pregnancy Loss in Alberta Dairy Farms

T.C. Bruinjé[1], M. Colazo[2], M. Gobikrushanth[1], D.J. Ambrose[1,2]

[1]Department of AFNS, University of Alberta; [2]Livestock Research & Extension Branch, Alberta Agriculture and Forestry, Edmonton, AB, Canada T6H 5T6
E-mail: tcbruinje@ualberta.ca

The assessment of reproductive function through in-line milk progesterone (mP4) profiles is a new opportunity to evaluate characteristics of ovarian activity associated with fertility. No such report currently exists for North American herds. The objectives were to evaluate if postpartum ovarian activity before first AI and mP4 levels around time of AI are associated with fertility in primiparous and multiparous cows. In-line mP4 records were assessed from two dairies in Alberta using the Herd Navigator system (DeLaval Inc). Days in milk (DIM) to first ovulation (FOV) and presence of abnormal cycles (short/long) from ~20 DIM until first AI were defined based on mP4 levels (high vs. low; 5ng/mL threshold) in 785 cows. Levels of mP4 from ~7d before to ~14d after 605 AI were also evaluated, and outcomes of AI determined based on mP4 levels until ~55d after AI to define pregnancy (PREG) and pregnancy loss (P-Loss). Effects of FOV and presence of abnormal cycles were tested using logistic regressions, while mP4 levels around AI were compared using mixed-effects ANOVA. Only significant differences ($P \leq 0.05$) are presented. Fewer primiparous cows had FOV by 28 DIM than multiparous cows (20 vs 30%). Primiparous cows having early FOV (≤28 DIM) had higher PREG per AI than those with later FOV (47 vs 32%), while multiparous cows with delayed FOV (>56 DIM) had lower PREG per AI (11 vs 29%) and higher P-Loss (62 vs 35%) than those with earlier FOV. The absence of abnormal cycles increased PREG per AI (40 vs 30%) and reduced P-Loss (11 vs 29%) in primiparous cows. Levels of mP4 were greater in primiparous than in multiparous cows from 5 to ~17d after AI. Primiparous cows that suffered P-Loss had higher mP4 at d5 after AI than those PREG (5.7 vs 4.4ng/mL), while multiparous cows that suffered P-Loss had higher mP4 2d before AI than those PREG (3.5 vs 3.2ng/mL). Beyond d10 after AI, PREG cows had higher mP4 levels than open cows. **Take Home Messages**: An early first ovulation highly benefited pregnancy per AI, while a late first ovulation and the presence of abnormal cycles reduced pregnancy per AI and increased pregnancy loss. Greater milk P4 levels near time of AI and lesser milk P4 beyond d10 were negatively associated with fertility. Using in-line milk P4 data, we determined significant effects of ovarian activity and milk P4 levels on parity and fertility. A wider use of this technology in future research will improve our understanding of the factors affecting reproductive physiology of the modern dairy cow, facilitating informed decision making to enhance fertility in dairy herds.

Use of Canola Meal and Micro-Encapsulated Sodium Butyrate in Starter Feed for Dairy Calves

K. Burakowska[1], G.B. Penner[1], P. Górka[2]

[1]University of Saskatchewan, 51 Campus Dr., Saskatoon, SK S7N 5A8, Canada, greg.penner@usask.ca
[2]University of Agriculture in Kraków, al. Mickiewicza 24/28, 30-059 Kraków, Poland

The objective of the two studies was to compare the use of canola meal (CM) and soybean meal (SM) with or without micro-encapsulated sodium butyrate (MSB) in starter feed for Holstein-Friesian calves. Sixty heifer calves (9.1 ± 0.8 d of age; 43.2 ± 4.2 kg) were used in a performance study, while twenty-eight bull calves (8.7 ± 0.8 d of age; 43.0 ± 4.4 kg) were used in a performance and metabolism study. Calves were weaned using a step-down approach. Weaning occurred for heifers at 59.1± 0.8 d of age and for bulls at 51.7 ± 0.8 d of age. Data collection continued post-weaning for 2 wk for heifers and 3 wk for bulls. In both studies, pelleted starters contained: 1) SM; 2) SM+MSB; 3) CM; and 4) CM+MSB. The CM constituted 35.2%, SB 24.2%, and MSB 0.3% of the respective starters on DM basis. Data were analyzed as a 2 × 2 factorial design using PROC MIXED of SAS (ver. 9.4). In the heifer study, there were no differences (P>0.05) observed for the MSB inclusion on starter intake and average daily gain (ADG). Protein source have not affected ADG; however, CM tended to increase starter intake post-weaning relative to SM (2.08 vs. 2.25 kg/d; P=0.086). In the bull study, SM had greater (P = 0.012) pre-weaning starter intake (256 g/d) than CM (229 g/d) and tended (P = 0.10) to have greater ADG (708 g/d vs. 648 g/d) than CM. Feeding CM resulted in greater jejunum tissue weight (2.13 vs. 2.43 kg; P = 0.046) and length (20.65 vs. 22.51 m; P = 0.065). Bulls fed CM also tended to have lower rumen fluid ammonia concentration (19.1 vs. 13.9 mg/dL; P = 0.084); however, there were no differences for the short-chain fatty acid concentrations (P > 0.05). Inclusion of MSB tended to increase pre-weaning starter intake (233 vs. 253 g/d; P = 0.064) and had a negative effect on the rumen absorptive surface area in the ventral sac (1192.9 vs. 954.3 mm2/cm2; P = 0.019).

Implications: Results of this study suggest that MSB may not be beneficial in starter feeds for calves following weaning; however, its use pre-weaning, especially in early stages of development, might still be considered. Canola meal can be used a replacement for soybean meal in calf starters for dairy calves. Our results further suggest that canola meal use may positively affect gastrointestinal tract development with no, or only minor, effects on ADG. Thus, use of canola meal may be one strategy to optimize calf starter cost.

Effect of Delaying Colostrum Feeding on Passive Transfer and Intestinal Bacterial Colonization in Neonatal Male Holstein Calves

A.J. Fischer, Y. Song, Z. He, L.L. Guan, M.A. Steele[1]

Department of Agricultural, Food, and Nutritional Science, University of Alberta, Edmonton, AB, T6G 2P5, Canada
[1]Corresponding Author: Michael A. Steele. Telephone: +1(519) 400-6556. Fax: +1(780) 492-4265. E-mail: masteele@ualberta.ca

Dairy calves are born without an active immune system, and therefore rely on good-quality, adequate volumes of colostrum to ensure the passive transfer of IgG. Despite this knowledge, poor colostrum management still occurs on farm, with one of the main reasons for failure of passive transfer being due to feeding colostrum more than 6 hours after birth. The objective of this study was to investigate how delaying the first colostrum feeding can impact the passive transfer of IgG, as well as bacterial colonization in the distal intestine of neonatal dairy calves. Twenty-seven male Holstein calves were randomly assigned to 1 of 3 treatments at birth: calves were fed colostrum at 45 minutes after birth (0hr, n=9), at 6hr after birth (6hr, n=9), or at 12hr after birth (12hr, n=9). Calves were fed pooled colostrum containing 62g/L of IgG at their respective feeding times at 7.5% of birth body weight, and fed milk replacer at 2.5% every 6hr thereafter. Blood samples were taken every three hours using a jugular catheter. At 51hr of life, calves were euthanized and tissue and digesta of the distal jejunum, ileum and colon was collected. Calves fed colostrum at 0hr of life had significantly higher ($P<0.001$) serum IgG concentration (g/L;24.77 ±1.91) when compared to 6hr calves (17.13 ±0.91) or 12hr calves (16.88 ±1.50). However, there were no differences in IgG concentration between 6hr and 12hr calves throughout the study. In addition to increased passive transfer, calves fed colostrum at 0hr had greater ($P<0.05$) *Bifidobacteria* (copy number of 16S rRNA gene/g; $3.39 \pm 1.48 \times 10^7$) attached to colon tissue compared to those fed at 6hr ($5.74 \pm 8.44 \times 10^6$) and 12hr ($5.74 \pm 1.44 \times 10^6$), respectively. In addition, calves fed colostrum at 0hr tended ($P<0.10$) to have a higher abundance of total bacteria (copy number/g; $2.27 \times 10^8 \pm 4.28 \times 10^7$) attached to the distal jejunum. In contrast, there were no differences ($P>0.05$) in *E. coli, Clostridium*, and *Faecalibacterium* colonization among treatments in the digesta or tissue of the distal intestine. These findings suggest that feeding dairy calves colostrum immediately after birth can increase the passive transfer of IgG and the colonization of beneficial bacteria in the colon; both of which are hypothesized to assist in protecting the calf from enteric infections during the pre-weaning period.

Fresh Cow Illness Detection Using Milk and Rumination Data in Robotic Milking Systems

M. T. M. King[1], E. A. Pajor[2], S. J. LeBlanc[3], T. C. Wright[1], and T. J. DeVries[1,*].

[1]Dept. of Animal Biosciences, University of Guelph, 50 Stone Rd E, Guelph, ON, N1G 2W1. [2]Fac. of Veterinary Medicine, University of Calgary, 2500 University Dr NW, Calgary, AB, T2N 1N4. [3]Dept. of Population Medicine, University of Guelph.
*Corresponding author: Trevor DeVries, Email: tdevries@uoguelph.ca

The objective of this study was to investigate potential changes in productivity and behaviour useful for earlier or automated illness detection in early lactation.

We collected daily production and behaviour data for early lactation cows in two studies: (1) one research herd for 13 months (n = 57 cows), and (2) nine commercial herds for 6 months (n = 607 cows). Data on rumination time, milk yield, and many other parameters were recorded electronically. Cases of illness were diagnosed and recorded, including subclinical ketosis (SCK), displaced abomasum (DA), mastitis, and pneumonia. For each disease, analyses were performed to identify the day on which each measure deviated significantly from a healthy baseline. The following results describe reductions in daily milk yield and rumination time, while accounting for DIM, from that day of deviation until the day before diagnosis, when treatment took place and recovery began.

In the first study, daily rumination time declined by 41, 20, and 51 min/d from 8, 6, and 5 d prior to diagnosis of DA (n = 5), SCK (n = 23), and pneumonia (n = 8), respectively. Milk production declined by 4.7 and 4.0 kg/d from 4 d prior to DA and pneumonia diagnoses, respectively, and by 1.1 kg/d from 5 d before SCK detection, when accounting for DIM.

In the larger study of 9 farms, daily rumination time declined by 29 min/d from 6 d before DA (n = 7), by 17 min/d from 5 d to mastitis diagnosis (n = 39), and by 5 min/d for 10 days before SCK detection (n = 199). Milk production dropped by 2.7 kg/d from 5 d before DA and by 1.7 kg/d from 4 d before mastitis. In the case of SCK, milk yield did not decline with illness or increase as it should with DIM, but plateaued before SCK detection and declined afterwards.

Implications: Before the diagnosis of many different types of early lactation health disorders, daily rumination time often declined prior to milk yield. This suggests that rumination behaviour, in addition to milk production, could contribute to more refined alerts for fresh cow illness detection. Accounting for DIM could further improve the sensitivity of alerts to identify more subtle deviations in early lactation.

Early Post-Partum Physical Activity and Estrus Expression and Their Associations with Fertility and Ovulation Rate in Lactating Dairy Cows

A.M.L. Madureira[*], L. B. Polsky[*], B.F. Silper[*], T. A. Burnett[*], J. L. M. Vasconcelos[‡], R.L.A. Cerri[*]

[*]University of British Columbia, 2357 Main Mall, Vancouver, BC, V6T1Z4; email: a.ml.madureira@gmail.com; [‡]São Paulo State University, Botucatu, Brazil 18168-000

The aim of this study was to evaluate the effect of early post-partum physical activity at estrus and artificial insemination (AI) on pregnancy per AI (P/AI) and ovulation rates. A total of 436 lactating Holstein cows were enrolled. Cows were monitored continuously by a leg-mounted pedometer (AfiMilk®, Afitag™). Data was recorded and retrieved at each milking (every 8 h). Ovulation was induced in cows by a timed AI protocol based on estradiol and progesterone. Body condition score (BCS; 1 to 5 scale) was measured at the time of AI and the ovaries were scanned on d 7 post-AI to check for the presence of a corpus luteum. Calving score and incidence of endometritis were recorded. An estrus event was recorded when the relative increase in activity exceeded 100% of the cow's baseline activity, within the first 30 DIM (30D) and at AI. Pregnancy diagnosis was performed 30 d after AI. Only first AI were included in the analysis. Relative increase in physical activity was (mean ± SE) 274.1±97.3% at estrus within the first 30 DIM and 494.9±159.6% at the time of AI. Low BCS (≤2.75) tended to affect relative increase of physical activity at both 30D (P=0.09) and AI (P=0.12). Milk production was not correlated with increased physical activity (r=0.06; P=0.20). Multiparous cows expressed lower activity than primiparous (479.8±11.3% vs. 513.1±12.3%; P=0.04). Cows with endometritis and difficult calving had lower physical activity at 30D compared with those that were healthy and without dystocia (204.3±21.9% vs. 285.7±8.9%; 213.8±26.9% vs. 282.3±13.0%, respectively). Cows that had at least one episode of high activity at 30D had higher fertility (47.5% vs. 32.8% P/AI; P<0.05) and higher intensity of activity at AI (533.1 ± 14.8% vs. 477.7 ± 9.9% relative increase; P<0.05). Cows with high estrous expression at AI had higher fertility (43.6 % vs. 22.8%; P < 0.05) and higher ovulation rates (94.8% vs. 85.7%; P = 0.03). Cows that had increased activity at 30D as well as at AI had higher fertility when compared with those that did not express estrus at either (52.7% vs. 32.9%, P<0.001) and were more likely to ovulate (98.8% vs. 91.6%; P=0.01). Greater activity at 30D and at AI improved fertility and ovulation rates.

Implications: Quantitative data from AAM can be used to identify and predict fertility measures in dairy cows. Animals with higher relative increase in activity at estrus early post-partum and at AI have higher fertility and ovulation rates.