STUDENT RESEARCH PRESENTATION COMPETITION

ABSTRACTS

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What are the risk factors for digital dermatitis and how big is their influence?

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Digital dermatitis (DD) is considered to be the main contributor to infectious lameness in dairy cows worldwide and accounts for close to 20% of the lameness cases in dairy cattle in Alberta. Therefore our research questions is: what are the most important risk factors for DD in Alberta dairy herds and how big is their influence?

Cow lesion data were collected during the Alberta Hoof Project (2009-2012) and combined with farm characteristics gathered as part of a nation-wide lameness study (2011-2012). In total, 17,000 cows originating from 76 farms took part in this study. A cow was considered positive for DD if at least one lesion was present on one or more feet.

The statistical analysis showed that:

- Cows are less likely to have DD when a thick layer of sawdust or straw is used as stall bedding compared to the commonly used wood-shavings. The thick layer of bedding is essential in order to be effective.
- On farms that use a footbath at least once a week, cows are less likely to have DD. Copper sulphate is the preferred product and it is not recommended to combine it with other footbath products.
- Cows in their 2nd parity are 2.5 times more likely to have DD compared to first parity cows; in 3rd parity cows this is more than 4 times.

Implications: Thick sawdust/straw bedding and a proper footbath protocol can reduce to risk for DD up to 9 times. In addition, 2nd and 3rd parity cows should be monitored closely as they are more at risk at developing DD.

Genetic analysis of subclinical mastitis resistance in early lactation

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Subclinical mastitis (SCM) causes economic losses for producers by affecting milk production and leading to higher incidence of clinical mastitis and premature culling. The incidence of SCM in first lactating cows is usually higher during early lactation. The somatic cell count (SCC) can be used for the diagnosis of subclinical mastitis. The objective of this study was to estimate genetic parameters for SCM in early lactation. Test-day records for SCC were collected monthly between 2005 and 2009 in 90 Canadian herds participating in the national cohort of dairy farms of the Canadian Bovine Mastitis Research Network. Only the first test-day record available between 5 to 30 days in milk was considered for the analysis. The final dataset contained 8,518 records from Holstein first lactating heifers. Six alternative traits were defined as indicators of subclinical mastitis using different cut-off values of SCC (between 150,000 to 400,000 cells/mL). Linear and threshold animal models were used for the analysis. The prevalence of subclinical mastitis ranged from 15 to 24%. Estimated heritabilities from linear and threshold model varied between 0.037 to 0.057 and 0.040 to 0.050, respectively. High genetic correlations were found among alternative SCC traits (from 0.90 to 0.99), indicating that these six traits were genetically similar. Despite a low heritability, estimated breeding values (EBVs) predicted from both models showed a large genetic variation among sires. Higher EBV of SCM resistance corresponded to sires with higher percentage of healthy daughters. The percentage of diseased daughters varied between 5 to 13% and 19 to 33% among sires with best and worst EBV. The Spearman's rank correlations between EBVs of sires predicted from linear (0.76 to 0.95) and threshold (0.74 to 0.95) models were moderate to high.

Implications: Results from this research provides insight into exploitable genetic variation of sires of heifers associated with subclinical mastitis in Canadian dairy herds. This knowledge can be used by dairy improvement organizations, the AI industry and dairy farmers to improve genetic resistance to mastitis through genetic selection.

The quantity of concentrate offered in an automated milking system on dry matter intake, milking frequency, milk and component yield, and ruminal fermentation when provided isocaloric diets

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The objective was to determine if the amount of concentrate offered in an automatic milking system (AMS) affects dry matter intke (DMI), milking frequency, milk and milk component yield, and ruminal fermentation when fed isocaloric diets. Eight ruminally-cannulated primiparous cows were used in a replicated 4 × 4 Latin square design with 28-d periods. Cows were provided pellet in the AMS to achieve 0.5, 2.0, 3.5 or 5.0 kg/d dry matter (DM) of pellet in the AMS and a corresponding decrease for the same pellet provided in the partial mixed ration (PMR). Forage-to-concentrate ratio and dietary energy density were balanced among treatments. On d 21 to 24 of each period, DMI and milking performance were evaluated, with d 25 to 28 used for ruminal fermentation measures. Consumption of AMS pellet linearly increased ($P < 0.01$), as per the experimental design, equating to 0.50, 2.00, 3.49, and 4.93 kg/d for the 0.5, 2.0, 3.5, and 5.0 kg treatments ($P < 0.01$). Deviation in AMS concentrate intake linearly increased with increasing AMS concentrate provision ($P < 0.01$) with variability of 0.06, 0.42, 0.51, and 0.85 kg/d for the 0.5, 2.0, 3.5, and 5.0 kg AMS treatments. PMR DMI linearly decreased with increasing AMS concentrate allocation ($P < 0.01$), but total DMI (PMR +AMS) was not affected, averaging 25.3 kg/d ($P = 0.40$). Milking frequency (3.22/d), milk yield (37.5 kg/d), and milking duration (7.03 min/milking) were not affected ($P > 0.30$). Milk fat yield (1.43 kg/d, $P = 0.72$) and protein yield (1.22 kg/d, $P = 0.57$) were not affected, but milk urea nitrogen linearly decreased within increasing AMS concentrate ($P= 0.02$). Ruminal pH was not affected by AMS concentrate. Total short-chain fatty acid concentration was affected cubically ($P = 0.02$) and ruminal ammonia decreased linearly ($P = 0.01$) with increasing AMS concentrate. Implications: When isocaloric diets are fed, the amount of concentrate provided in the AMS did not affect milk production and had little effect on ruminal fermentation. Feeding greater quantities of concentrate in the AMS increased variability in AMS concentrate intake among days, thereby increasing variability in nutrient intake, without affecting DMI.

Offering differing planes of nutrition to Holstein heifer calves in the pre- and post-weaning phases and the effects on intake, growth, and efficiency

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Early-life nutritional management of dairy heifers is not often an area of focus on-farm, despite the importance of these animals as the future of the milking herd. In addition, there is a paucity of information about how pre-weaning feeding regimes influence growth and feed efficiency following weaning. The objective of this study was to determine the effects of pre-and post- weaning diets on the overall development, feed intake, and efficiency of growing Holstein heifer calves. Twenty-eight purebred Holstein heifer calves were randomly assigned to 1 of 4 treatment groups at birth. Calves received 5 L of whole milk per day pre-weaning and a 70% concentrate diet post-weaning (LL,n=7), 5 L of milk per day pre-weaning and an 85% concentrate diet post-weaning (LH,n=7), 10 L of milk per day and an 85% concentrate diet post-weaning (HH,n=7), or 10 L of milk per day and a 70% concentrate diet post-weaning (HL,n=7). Free choice starter was available in the pre-weaning phase, with weaning occurring at 60 days of age. Feed intake was recorded daily, while body weight, hip height, and withers height were recorded weekly. Heifers were on trial from birth until 6 months of age, with each month being treated as a separate period for analysis. Mean hip and withers heights between treatment groups did not differ at any point during the study. The mean weights of heifers (kg; 227.1) offered the HH plane of nutrition were significantly greater than those offered HL (213.9) during month 6. Mean weights between treatment groups did not significantly differ during any other month. During months 1 and 2, the mean daily digestible energy (DE) intake was significantly greater in HH (kcal; 36.9, 40.6) and HL (36.4, 39.4) groups than in the LL (22.8, 23.9) and LH (22.8, 23.8) groups. In month 3, immediately following weaning, no significant differences in DE intake were noted. Through months 4, 5, and 6, mean daily DE intake was significantly greater for groups HH (14.0, 17.8, 20.9) and LH (14.1, 18.5, 21.2), when compared to HL (11.2,14.3,17.1) and LL (9.8,13.6,16.5). Conversely, feed conversion ratio (kg DMI/kg gain) did not significantly differ between treatment groups at any point in the experiment. These findings demonstrate the notable ability of calves to grow under a variety of nutritional regimes, and suggest that the advantages of a high plane of nutrition in the pre-pubertal period may be limited.

Effects of *Saccharomyces cerevisiae* fermentation product supplementation and starch content of fresh diets on performance of dairy cows in early lactation

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Maintaining dry matter intake (DMI) during the periparturient period is of great importance to increase milk production and reduce the extent of negative energy balance after calving. The objective of this study was to determine the effects of feeding a *Saccharomyces cerevisiae* fermentation product (SCFP; NutriTek®, Diamond V Mills Inc., Cedar Rapids, IA) during the periparturient period on performance of dairy cows fed diets differing in starch content during the first 3 weeks after calving. A total of 117 Holstein cows were fed diets without (CON) or with the inclusion of SCFP (SCFP) from wk 4 prior to the expected calving date until wk 6 after calving. Cows were fed a common basal controlled-energy close-up diet containing barley straw at 29% of diet dry matter (1.43 Mcal NE_L/kg DM) before calving. From wk 1 to 3 after calving, cows within each treatment (CON or SCFP) were fed either a low- (LS, 21% starch) or high-starch (HS, 27% starch) diet, and from wk 4 to 6 after calving, all cows were fed HS. From wk 1 to 3 after calving, LS cows produced more milk than HS cows (34.1 vs. 32.1 kg/d, $P = 0.05$) whereas dry matter intake (DMI) was similar among them, and LS cows tended to lose more body condition score than HS cows (-0.42 vs. -0.35 /21d, $P = 0.06$). From wk 4 to 6 after calving, LS cows tended to have higher milk yield than HS cows (42.2 vs. 40.3 kg/d, $P = 0.09$) with no difference in DMI. Although SCFP supplementation had no effect on prepartum DMI, higher DMI was observed for SCFP cows than CON at d 1 ($P = 0.02$) and d 5 ($P = 0.04$) after calving. However, overall DMI and milk yield from wk 1 to 3 after calving were not affected by SCFP supplementation, and yield of milk fat and 3.5 % fat-corrected milk (FCM) were similar among treatments. The cows fed SCFP tended to have lower DMI than CON cows (19.8 vs. 20.6 kg/d, $P = 0.10$) during wk 4 to 6 after calving, but yield of milk, milk fat, and 3.5% FCM were not different between two groups, resulting in higher feed efficiency (3.5% FCM/DMI; $P = 0.01$) for cows supplemented with SCFP.

Implications: A low starch diet can be fed during the immediate postpartum period to increase milk production of dairy cows fed a controlled-energy close-up diet. Supplementation of SCFP in transition diets may contribute to greater feed intake around calving.