
0045 Breeding for strength may create frail cows.

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The Purebred Dairy Cattle Association Dairy Cow Unified Scorecard assigns 25% of weight to the dairy strength category, which is described as “a combination of dairyness and strength that supports sustained production and longevity.” Stronger cattle are assumed by many breeders to have longer herd-life, but data from several studies suggest otherwise. In a 2003 study, relative culling risks (RCR) were assigned based on strength scores (1 = weak to 50 = strong) from 268,008 Jersey cows. A score of 25 equated to a RCR of 1.00. RCR values below or above 1.00 indicated low or high culling risks, respectively. Scores from 11 to 20 were optimal, whereas cows with a score of 41 to 45 were at most risk of being culled (RCR = 1.30). A similar analysis was performed in a study of 891,524 Holstein cows (Caraviello et. al., 2003; 2004), and strength scores higher than 25 were associated with significantly elevated RCR. These two studies indicate that “stronger” cattle have greater culling risk, which may partially be attributed to unfavorable associations with disease. Genetic correlations of strength with displaced abomasum, ketosis, mastitis, and cystic ovaries indicated that selection for strength would elevate disease risks (Zwald et. al., 2004). A 2015 analysis (Dechow) compared chest width and body condition score (BCS) in Canadian Holstein genetic evaluations with the Canadian dairy strength trait and U.S. productive life (PL) and daughter pregnancy rate (DPR). In this study, 527 bulls with Canadian and U.S. daughters were divided into groups based on chest width and BCS. Sires that transmitted wide chests and low BCS had the highest dairy strength scores (+9.5), followed by wide chest and average BCS sires (+6.5). These groups had the lowest PL (-2.5 and -1.6 mo, respectively) and DPR (-2.75% and -1.6%, respectively). In contrast, sires that transmitted narrow chests and high BCS scored lowest for dairy strength (-5.5), highest for PL (+1.1 mo), and highest for DPR (+0.4%). Therefore, high scores for strength suggest decreased longevity and reproductive efficiency. This counterintuitive relationship of dairy strength with health and survival may result from poorly defined measures of strength in linear scoring programs; cows with extremely low BCS have minimal muscle mass but are still considered to have high dairy strength if they have a wide skeletal system. Dairy producers should take caution when breeding for strength.

Key Words: strength, longevity, genetics

0046 The links between uterine infection and infertility.

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The objective of this presentation is to explain the impact that uterine infections have on female reproductive fertility and dairy production. Uterine infections such as metritis and endometritis are prevalent among Holsteins primarily

after parturition. Anatomical barriers act as a natural defense against bacterial pathogens, but during parturition these barriers are compromised. While these infections can be treated, they pose lasting negative effects on fertility. *Escherichia coli* and *Trueperella pyogenes* are the most common pathogens that cause uterine infections. These pathogens initiate an inflammatory response in the endocrine signaling system, the endometrium, and the ovaries. The inflammatory responses in these organs, coupled with innate immunity, can overload the female reproductive tract and lead to infertility. It is not known why reproductive fertility is compromised even after the uterine infection is treated. Further research is needed to better understand the exact mechanisms that lead to infertility. When those mechanisms are discovered, there is a potential to intervene before fertility is compromised. There are also current developments for metritis vaccines to prevent uterine infections. Until further advancements are made in those areas, implementing good management practices such as nutrition and hygiene during partition are feasible solutions.

Key Words: cow, immunity, fertility, infection, uterus

ADSA-SAD (STUDENT AFFILIATE DIVISION) UNDERGRADUATE STUDENT ORAL COMPETITION: ORIGINAL RESEARCH

0047 Comparison of calving data among Jersey, Jersey × Holstein crosses, and Norwegian

Red × Holstein × Jersey crosses. S. M. Royal*, K. A. E. Mullen, and S. P. Washburn, *North Carolina State University, Raleigh.*

The dairy at the Center for Environmental Farming Systems (CEFS) has been a pasture-based herd of Holstein (H), Jersey (J), and crosses of those breeds, but now is transitioning into three breed groups: Group A includes pure J and mostly J being bred to become pure Jerseys; Group B includes a two-way criss-cross of H and J breeds by alternating sire breeds each generation; whereas Group C is a three-way rotational cross with Norwegian Red (NR) introduced as the third breed in 2014. The objective of the study is to examine differences in calving characteristics among breed groups across two calving years. Groups included: A (83 calves, J sires), Bh (48 calves, H sires), Bj (60 calves, J sires), and C (94 calves, NR sires), respectively. Breed group ($P < 0.05$), interaction of parity × calving year ($P < 0.01$), and the three-way interaction (breed group × parity × year; $P < 0.05$) significantly affected gestation length. Least squares means for birth weight for groups A, Bj, Bh, and C, respectively were: 26.8 kg ± 0.5 kg, 27.7 kg ± 0.7 kg, 32.9 kg ± 0.7 kg, and 34.5 kg ± 0.5 kg. Parity ($P < 0.001$), breed group ($P < 0.001$), and calf gender ($P < 0.001$) all affected birth weight. Multiparous cows had heavier calves than first parity cows ($P < 0.001$). Group C calves were heavier

than Group Bj ($P < 0.001$) and Group A ($P < 0.001$) calves. Group Bh calves were also heavier than Group A calves. Male calves weighed more than female calves ($P < 0.001$). Breed group was associated with calving difficulty ($P < 0.05$). Cows delivering NR crossbred calves had more difficulty than cows having Group Bj calves ($P < 0.05$). Based on current data and earlier studies, use of either NR or H sires results in heavier birth weights and potentially more challenges at calving.

Key Words: crossbreeding, gestation, calving

0048 Effects of a low moisture block supplement on cow distribution and time budget. A. J. DiGennaro*,

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The objective of this study was to compare the visitation effects of cows between a low moisture block supplement barrel (LMB; Buffer-lyx®, Ridley Block Operations, Flemingsburg, KY) and an empty control barrel (ECB). The study was conducted in two freestall pens ($n = 40$ and $n = 43$) at the University of Kentucky Coldstream Dairy from January 21, 2015 to February 25, 2015. Both LMB and ECB were placed in low traffic areas in the pens. All cows were exposed to a 7 d acclimation period with an ECB, an initial 14 d period with either LMB or ECB (P1), a 7 d washout period with ECB, and a second 14 d period of the opposite treatment (P2). Cows receiving LMB followed by ECB were characterized as treatment control (TC) and cows receiving ECB followed by LMB were characterized as control treatment (CT). Time spent around the barrels was measured using SmartBow (MKW Electronics, Jutogasse, Austria), an eartag based real-time location system. Smartbow recorded per second XY coordinate data to calculate cow location within the housing facility in h/d. When a cow entered or exited the 3 m radius around either barrel, a start or stop time was recorded. All collected data was analyzed using a mixed linear model performed with the MIXED procedure of SAS 9.3 (SAS Institute, Inc., Cary, NC). Cows spent more time around the LMB than the ECB (16.49 ± 1.57 and 4.98 ± 1.62 min, $P < 0.01$). Period (P1: 15.68 ± 1.62 and P2: 5.78 ± 1.57 min, $P < 0.01$) and sequence (TC: 19.79 ± 1.84 and CT: 1.67 ± 1.82 min, $P < 0.01$) effects were also observed. Period and sequence effects may be attributed to inclement weather during P2 or cows becoming conditioned to expect the ECB. Strategic placement of LMB appears to modify dairy cattle movement and behavior in a freestall setting. Dairy farmers may consider the use of LMB to entice cows toward an automated milking system.

Key Words: low moisture block, real-time location system

0049 The influence of age and weaning on the structure of the gastrointestinal epithelium in Holstein bull calves. S. I. Pletts*, *Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, Canada.*

The objective of this study was to characterize how age and weaning influence structural adaptations of the gastrointestinal tract (GIT) in calves. Tissues from the GIT were taken from 21 Holstein bull calves that were randomly assigned to 1 of 3 treatments: preweaned calves sampled at d 16 (PRE; $n = 7$); weaned calves sampled at d 42 (WN; $n = 7$); and control calves sampled at d 42 (CON; $n = 7$). A step down weaning approach was used (from d 35 to d 42 of life), while CON calves were not weaned. Histological analysis was performed on the rumen, duodenum, jejunum, ileum, proximal and distal colon, and the cecum. Tissues were processed and fully imaged under $40\times$, and minimum of 10 images under $100\times$. Measurements were taken of rumen sloughing, papillae dimensions, crypt depth throughout the small intestines, mucosal width in the hindgut, and goblet cell counts in all intestinal compartments. Treatments were compared using the mixed procedure in the statistical analysis system. Weaning effects were most notable in the rumen and duodenum: rumen sloughing scores were highest ($P < 0.01$) in WN (2.64 ± 0.25) relative to CON (1.50 ± 0.25) and PRE (1.51 ± 0.25); duodenal villi length was longer ($P = 0.02$) in CON ($356.5\mu\text{m} \pm 32.67$) than in WN ($218.9\mu\text{m} \pm 32.67$). Crypt depths were consistently deeper ($P < 0.01$) for duodenum, jejunum, proximal, and distal colon of PRE calves compared with CON and WN. Mucosa thickness in the hindgut compartments was greater ($P < 0.01$) in the PRE group. There were no treatment differences on goblet cell count except in the proximal colon, with PRE (0.08 ± 0.01) having less ($P < 0.01$) goblet cells in $100\mu\text{m}^2$ than WN (0.15 ± 0.01) and CON (0.15 ± 0.01). These data suggest that during weaning there is significant structural alteration in the rumen and intestine. The most notable differences were detected in the rumen and the beginning of the small and large intestine. Future research is needed to assess the functional adaptation of the entire GIT, and how these adaptations may relate to calf health and performance.

Key Words: GIT, weaning, histology

0050 Effects of supplementing a commercial blend of anaerobic probiotic bacteria, MBiotix Calf, on the growth and health of preweaned and immediately postweaned Holstein calves.

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The objectives of these studies were to determine the effects of supplementing a blend of anaerobic bacteria on the growth and health of preweaned and immediately postweaned Holstein calves. Holstein calves within 1 d of birth were randomly

assigned to 1 of 2 dietary treatments ($N = 35$). Treatments included a negative Control and MBiotix Calf (BTX) treatment, which was administered in the milk replacer and top-dressed on the starter during the preweaned and immediately postweaned periods, respectively. The BTX treatment dose was 2×10^9 CFU/d of a proprietary blend of *Lactobacillus casei* and *Enterococcus faecium* strains; however, during the first 3 d of the study, the BTX calves were given a $10\times$ dose. The study was conducted in 3 periods ($n = 20$ Control and $n = 15$ BTX). Calves were individually housed and fed between 250 and 350 g depending on the period of a 22% CP and 20% fat milk replacer twice daily at 0730 and 1630. Calves had ad libitum access to a calf starter and water. Calves were individually housed until they were weaned at 56 d when they were grouped by treatment for an additional 28 d. Peripheral blood samples were collected on d 0, 7, 21, 56, 70, and 84, and analyzed for hematology. Data were analyzed as a repeated measures ANOVA with treatment, time, and treatment \times time as the fixed effects and period as a random effect. Calf nested within treatment was the subject of the repeated statement. Data are reported as Control vs. BTX, respectively. There was a treatment \times time interaction ($P = 0.001$) on calf starter intake during the preweaned period, whereas BTX calves began to consume more starter during the fourth week of life, and the difference in starter intake was different ($P \leq 0.05$) during the sixth to eighth week of life. BTX calves were consuming more starter at weaning (1.065 vs. 1.305 ± 0.141 kg/d; $P = 0.025$). Further, the BTX calves had greater ADG during the 84 d observation period (0.701 vs. 0.883 ± 0.079 kg/d; $P = 0.016$). There were no treatment or treatment \times time effects on hematocrit percentage (34.3 vs. $35.9 \pm 1.98\%$; $P \geq 0.235$). Further, there were no treatment or treatment \times time effects ($P \geq 0.178$) on any hematological variable. These data indicated that supplementing MBiotix Calf improved calf starter intake and average daily gain during the preweaned and immediate postweaned periods.

Key Words: calf, health, nutrition, probiotic

0051 Assessing the correlation between teat end scores and presence of mastitis in lactating Holstein cows. K. J. Alward*, J. F. Bohlen, L. O. Ely, and S. C. Nickerson, *University of Georgia, Athens*.

Mastitis is an inflammation of the mammary gland caused by bacteria that affects one in every three cows, and costs the producer an average of \$180/cow/year. Penetration of bacteria into the teat canal causing mastitic infections may be enhanced by hyperkeratosis, a thickening of the teat canal keratin, which provides a breeding ground for bacteria. The objective of this project was to determine if a correlation exists between elevated teat end scores (degree of hyperkeratosis) and presence of mastitis as indicated by elevated somatic cell counts (SCC). Purebred Holstein cows ($n = 30$) were assessed and sampled between 30 and 100 d in milk. Each animal

was given a teat end score (TES) at sampling on a scale of 1 (smooth) to 4 (rough ring) according to level of severity, and teat canal swabs as well as milk samples were collected aseptically from each quarter for microbiological examination to determine infection status and, if infected, the pathogen(s) present. All milk samples were further evaluated for SCC using a DeLaval Cell Counter. The association of TES, infection status, and SCC was analyzed using the CORR procedure of SAS. A strong positive correlation was seen between level of infection and SCC for each quarter ($P = 0.001$) and for TES and age of the cow ($P = 0.001$). The average TES for uninfected quarters was 2.00, while the average TES for infected quarters was 2.42. However, there was no correlation between presence of infection and TES ($P = 0.444$) or SCC and TES ($P = 0.439$). When infected quarters were compared for pathogen and average TES, the following observations were made: CNS (TES = 1.9), *Streptococcus* (TES = 2.), *Prototheca* (TES = 2.0), *S. aureus* (TES = 2.6), mold (TES = 3.0) and *E. coli* (TES = 3.0). While no correlation was found for the presence of infection and teat end scores, the observation regarding the presence of specific mastitis causing bacteria and elevated teat end scores is an area for future investigation. This observation also suggests that teat end hyperkeratosis is associated with presence of mastitis caused by certain pathogens and that management practices should be in place to promote healthy teat ends for decreased mastitis incidence rates.

Key Words: hyperkeratosis, somatic cell count, mastitis pathogens

0052 Evaluating the effects of heat stress on rumen pH and temperature. L. Beckett*, R. R. White, and M. D. Hanigan, *Virginia Tech, Blacksburg*.

As the climate changes, heat stress is becoming an increasing concern for heavily utilized agriculture assets like dairy cattle. The goal of this study is to evaluate the effects of ambient temperature change on ruminal pH and temperature. The study was conducted using eight Holstein heifers (250 kg) housed in climate-controlled rooms (four heifers per room). Heifers were housed at a thermoneutral (20°C) temperature for 2 wk after which room temperature was raised to 30°C. Measurements were taken with a ruminal pH and temperature bolus that was manually inserted into the reticulum through a rumen cannula. Each bolus wirelessly transmitted ruminal pH and temperature every 10 min for the duration of the study. Response variables included: hourly mean, minimum, and maximum pH; proportion of hourly time spent below 5.5 or 5.75; and mean, minimum, and maximum rumen temperature. Data was used from 2 d prior and 2 d after changing the ambient temperature to specifically assess this temperature transition. A mixed-effect model was used to evaluate the data with fixed effects for group (heat stress; HS; or thermoneutral; TN), period (thermoneutral, P1; stressed, P2), and group by period interaction and a random effect for cow. The results

Table 0052.

Table 1. Mean and significance of differences between group and periods

Response ¹	Group 1		Group 2		P-Values		
	P1 (20 °C)	P2 (30 °C)	P1 (20 °C)	P2 (20 °C)	Group	Period	Group x Period
Time Below 5.5, h/h	0.06	0.01	0.13	<0.01	0.662	0.067	0.418
Time Below 5.75, h/h	0.25	0.07	0.29	0.16	0.560	0.074	0.778
Min. pH	6.16	6.09	6.25	6.23	0.010	0.055	0.266
Mean pH	6.28	6.20	6.36	6.34	0.077	0.004	0.053
Max. pH	6.40	6.30	6.47	6.45	0.060	<0.001	0.005
Max. T, °C	39.7	39.7	39.5	39.4	0.019	0.044	0.165
Mean T, °C	39.5	39.4	39.3	39.2	0.101	0.010	0.310
Min. T, °C	39.2	39.1	39.1	38.9	0.384	0.057	0.241

¹Response variables included minimum (min.), mean, and maximum (max.) pH and temperature (T; °C), proportion of time pH was below 5.5 and 5.75 (hour/hour).

are summarized in Table 1. The significance of the group by period interaction for mean ($P = 0.053$) and maximum ($P = 0.005$) pH demonstrates that that heat stress lowers average rumen pH by reducing the height of pH peaks occurring in between digestion events. However, this pH shift is not associated with decreases in minimum pH or a change in time spent below cutoff pH values ($P > 0.05$). Further work must be conducted to evaluate what effects this pH shift has on rumen fermentation kinetics during heat stress.

Key Words: heat stress, rumen pH, rumen temperature

ADSA-SAD (STUDENT AFFILIATE DIVISION) UNDERGRADUATE STUDENT POSTER COMPETITION

0053 Validation of a commercially available β -hydroxybutyrate meter for assessing rumen development in dairy calves. M. A. Richard¹, C. C. Williams², R. M. Orellana¹, S. J. Blair¹, and A. H. Dolejsiova², ¹Louisiana State University, Baton Rouge, ²Louisiana State University AgCenter, Baton Rouge.

Previous research has shown that glucometers used for testing blood glucose levels in humans are accurate for testing blood glucose in dairy calves and cows. Ketone monitors have been developed for assessment of ketoacidosis in human diabetics. Both acetoacetic acid and β -hydroxybutyric acid (BHBA) are classified as ketones, but BHBA is the metabolite of interest when assessing rumen development. The Abbot Precision Xtra meter measures BHBA in whole blood. Thus, this instrument would be beneficial from both a basic and applied standpoint in dairy calf nutrition and management. The objective of this experiment was to validate the use of a commercially available hand held β -hydroxybutyrate meter for assessing rumen development in young dairy calves. Blood was collected from 24 Holstein calves at the LSU Dairy Farm via jugular venipuncture during weeks 2, 4, 6, 8, 10, and 12

for analysis of BHBA. Blood was immediately tested for BHBA concentrations using the Abbot Precision Xtra meter. The remainder of each sample was separated and frozen until analyzed for BHBA using a commercial spectrophotometric kit. The BHBA concentrations obtained with the Abbot Precision Xtra meter were strongly correlated with overall plasma BHBA concentrations. Correlations were good when monitoring BHBA concentrations in different age groups. The meter values were not accurate when compared with plasma BHBA concentrations. Beta-hydroxybutyrate meters can be useful tools for monitoring changes in blood ketone concentrations but are not accurate for use in research data collection.

Key Words: β -hydroxybutyrate, dairy calves, ketone monitors

0054 The effect of the liquid nitrogen level on the temperature in a semen storage tank. A. Hale^{*1}, A. Ahmadzadeh¹, B. Shafii¹, and J. Dalton², ¹University of Idaho, Moscow, ²University of Idaho, Caldwell.

The temperature in semen storage tanks is critical to maintain the viability of semen stored within the tanks. The objective was to investigate the effect of liquid N level on the temperature in a semen storage tank. Using an electronic thermometer, semen tank temperature was measured at three locations: (a) 2 cm below the top of the neck, (b) 7 cm below the top of the neck (below the frost line), and (c) 2 cm above the level of liquid N. Liquid N volume in the tank was incrementally decreased from 45 to 19 L. The experiment was repeated twice, and temperatures at each location and N level were recorded four times. The data on the effects of N level, location, and two-way interaction on the tank's temperature were analyzed using a general linear mixed model and procedure GLIMMIX in SAS. There was an effect of location and volume by location interaction on tank temperature ($P < 0.01$). Mean tank temperature was greater ($P < 0.01$) 2 cm below the top of the neck as compared with 7 cm below the top of the neck (below the frost line; $6.3 \pm 0.1^\circ\text{C}$ vs. $-38.4 \pm 0.3^\circ\text{C}$). Results showed that the