
**ADSA-SAD UNDERGRADUATE
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PRESENTATIONS – ORIGINAL RESEARCH**

0024 Weaning age impacts growth, feed intake, and behavioral indicators of stress in Holstein calves fed a high plane of nutrition. H. E. Brown¹, E. C. Eckert¹, K. E. Leslie¹, T. J. DeVries¹, and M. A. Steele², ¹*University of Guelph, ON, Canada*, ²*Nutreco Canada, Guelph, ON*.

Recent research has revealed the short- and long-term advantages of feeding more nutrients preweaning. Unfortunately, calves that are fed more nutrients preweaning may be more susceptible to depressed growth and weaning stress during the transition from liquid to solid feed. The objective of this study was to investigate the relationship between age of weaning and feed intake, growth, and behavioral indicators in dairy calves fed higher planes of nutrition. To meet this objective, 20 Holstein female calves were randomly assigned at birth to be weaned at 6 or 8 wk. Milk replacer (mixed at 150 g/L) was offered at 1.2kg/calf/d in 2 meals until a 1-wk stepdown, where meals were reduced by 50% 1 wk before weaning. Measurements included daily starter, chopped straw, and water intake, as well as weekly body weight until d 70 of life. Behavioral indicators, including ruminating, lying/standing, vocalizing and non-nutritive oral behavior, were measured by visual observation each minute for 3 h/wk before the second feeding of the day. Data were analyzed using a repeated measures general linear mixed model; comparisons were made by week relative to weaning and week of life. The calves weaned at 8 wk compared with 6 wk had higher ($P < 0.01$) ADG for the week preweaning (0.79 ± 0.09 vs. 0.34 ± 0.10 kg/d) and post weaning (1.05 ± 0.09 vs. 0.35 ± 0.11 kg/day), and were heavier ($P < 0.01$) at the end of the experiment (99.92 ± 1.81 vs. 91.01 ± 2.26 kg). Starter, straw, and water intake were delayed in calves weaned at 8 wk of age. However, their overall starter intakes and growth rates were not different during the last week of the experiment. Furthermore, calves weaned at 8 wk compared with 6 wk had higher ($P < 0.01$) starter intake for the week preweaning (1.36 ± 0.13 vs. 0.40 ± 0.08 kg/d) and post weaning (2.51 ± 0.20 vs. 1.16 ± 0.15 kg/day). Treatment \times week relative to weaning interactions indicated that several behaviors varied between early- and later-weaned calves during the week before weaning; 6-wk calves tended ($P = 0.07$) to exhibit 75% more non-nutritive oral behavior, spent 55% less ($P < 0.01$) time ruminating, and 36% less ($P = 0.01$) time lying than 8-wk calves. These results suggest that calves fed higher planes of nutrition preweaning benefit from extending weaning age from 6 to 8 wk of age.

Key Words: age, calves, weaning

0025 Effects of AICAR, rapamycin, and non-essential amino acids on cell signaling in bovine mammary tissue. A. Felock*, S. I. Arriola Apelo, R. L. Garnett, and M. D. Hanigan, *Virginia Polytechnic Institute and State University, Blacksburg*.

Studies in animal and cell culture models have revealed that essential amino acids play a role in regulating protein synthesis not only as substrates but also through direct signaling to the protein synthetic machinery. Essential AA affect the mammalian target of rapamycin- (mTOR) signaling pathway in bovine mammary cells, which is associated with increased milk protein synthesis. Three experiments were conducted to study the effect of AICAR, an activator of AMP kinase, rapamycin, a mTOR complex 1 inhibitor, and non-essential AA on mTOR signaling in mammary tissue. Three Holstein cows in late lactation were slaughtered and mammary tissue was collected from uninfected rear quarters. Tissue slices (120 ± 30 mg) were incubated for 4 h in the respective treatment medium. In the first experiment, treatments consisted of complete Dulbecco Modified Eagle Medium (DMEM) or DMEM with essential AA (EAA) at 5% of regular concentrations, and AICAR at 0, 0.4, or 4.0 mM. The second experiment consisted of the same EAA treatments supplemented with rapamycin at 0, 0.5, and 10 μ M. In the third experiment, tissue slices from 2 cows were incubated in minimum essential medium supplemented with 4.5 g glucose, 10 μ g insulin, and per liter of media. The AA examined were Ala, Asx, Glx, Gly, Pro, and Ser, where Asx represented Asn plus Asp, and Glx represented Glu plus Gln. Phosphorylated and total forms of mTOR, eukaryotic elongation factor 2, and ribosomal protein S6 were determined by Western blotting and the ratio of phosphorylated to total ratio was calculated. Essential AA had no effect on signaling proteins in either experiment. The AICAR significantly reduced mTOR phosphorylation but had no effect on phosphorylation of eEF2 or rpS6. Rapamycin did not affect phosphorylation of mTOR or eEF2. However, rapamycin significantly reduced rpS6 phosphorylation. Non-essential AA had no effect on phosphorylation of signaling proteins in the mTOR pathway. There was no effect of EAA on protein synthesis rates, implying that there are other causes regulating synthesis rates besides cell signaling.

Key Words: AICAR, mTOR, rapamycin

0026 Within day alteration of ration starch fermentability had no effect on feed intake, total tract NDF digestibility, and milk fat concentration of cows in late lactation. B. C. Oglesby* and M. S. Allen, *Michigan State University, East Lansing*.

The objective of this experiment was to evaluate the effects of feeding lactating cows diets differing in starch fermentability twice per day on DMI, total tract NDF digestibility, and milk fat concentration. Feeding highly fermentable starch sources

to ruminants is expected to increase short-chain fatty acid production by rumen microbes, increase the flux of propionate to the liver during meals, and potentially decrease ruminal pH, NDF digestibility, and milk fat concentration. Diurnal variation in feeding results in lower digesta mass and rumen buffering, and increased plasma NEFA and hepatic acetyl CoA concentrations before the morning feeding. We previously reported that propionic acid is more hypophagic when hepatic acetyl CoA concentration is elevated. Therefore, we hypothesized that the negative effects of greater starch fermentability would be more pronounced following the morning feeding compared with the evening feeding. Sixteen multiparous cows (291 ± 68 DIM; mean \pm SD) were used in a crossover design experiment with 14-d periods, including 10 d for diet adjustment and 4 d for sample collection. Cows were offered diets containing either dry corn grain (DC, less fermentable) or high (33%) moisture corn grain (HM, more fermentable), at 0900 h and 1700 h each day in opposite sequences: 1) HM at 0900 h, DC at 1700 h, and 2) DC at 0900 h, HM at 1700 h. Sequence DC:HM tended to increase the amount of DMI following the morning feeding (10.6 vs. 9.7 kg, $P = 0.07$) and decrease DMI following the afternoon feeding (14.4 vs. 15.4 kg, $P = 0.08$), compared with HM:DC, resulting in no overall effect of treatment ($P > 0.15$). Treatment did not affect digestibility of NDF or DM, or yields of milk, fat, protein, lactose, or milk composition. Sequence DC:HM tended to decrease BW (776 vs. 771 kg, $P < 0.10$) but not BCS compared with HM:DC. Lack of treatment effects on digestibility of NDF and concentration of milk fat indicate that the buffering capacity of rumen contents was likely adequate to maintain ruminal pH during the morning when digesta mass is normally lowest. Opposite effects of treatment on DMI following the morning and afternoon feedings suggest that HM tended to decrease DMI compared with DC similarly at each feeding. These results indicate that potential advantages to altering ruminal starch fermentability within a day are minimal for late lactation cows.

Key Words: diurnal variation, feeding management, starch fermentability

0027 Growth of periruminant Holstein bull calves fed a fermentation extract of *Aspergillus oryzae*.

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A fermentation extract of the fungus *Aspergillus oryzae* can be used as a direct fed microbial. The objective was to determine if dietary inclusion of an extract of *A. oryzae* would improve the growth of Holstein bull calves from birth through 1 wk postweaning; it was hypothesized that it would. Bull calves ($n = 52$) were used in this experiment. Calves were randomly assigned to a slaughter age, 4 wk ($n = 16$) or 8 wk ($n = 36$), and treatment, control (CON; $n = 27$) or direct fed

microbial (DFM; $n = 25$). Calves averaged 43.2 ± 1.0 kg BW and 2.8 ± 0.3 d of age at the beginning of the experiment. Calves were housed and fed individually; no bedding was used. Calves assigned to DFM were fed 2 g of DFM daily. Liquid DFM was delivered in milk replacer for the first 4 wk of the trial; solid DFM was top dressed on texturized grain thereafter. Calves were fed non-medicated milk replacer twice daily (22.0% CP, 20.0% fat DM basis; 680 g/d) and were weaned on consumption of 0.91 kg of grain (20% CP, 2.0% fat; medicated with decoquinatone) for 3 consecutive days or on d 45 of the study, whichever came first. Calves had ad libitum access to grain and water throughout the trial. Feed intake was recorded daily. Body weight was recorded weekly. There was no effect of treatment on BW; 8 wk BW was 74.5 ± 1.9 kg for CON and 74.6 ± 1.9 kg for DFM. Total DMI per calf did not differ: from 0 through 4 wk (19.48 ± 0.67 kg of DM), 5 through 8 wk (39.44 ± 2.05 kg of DM), or for the whole trial (58.70 ± 3.30 kg of DM). Lastly, the gain to feed ratio did not differ by treatment: from 0 through 4 wk (0.59 ± 0.05), 5 through 8 wk (0.53 ± 0.03), or for the whole trial (0.56 ± 0.04). Here, dietary inclusion (2 g/d) of an extract of *A. oryzae* did not result in improved calf growth when supplemented animals were compared with cohorts not fed the direct fed microbial. It is possible that the dose used here was not high enough to elicit treatment effects. Given that effects have been noted in other species, a follow-up dose titration study with similar diets as used here seems warranted.

Key Words: dairy calf, direct fed microbial, growth, nutrition

0028 [Withdrawn]

0029 Case study: Effect of alley floor scraping frequency on environmental mastitis-causing pathogen counts. J. L. Lowe*, K. A. Akers, A. E. Sterrett, J. D. Clark, and J. M. Bewley, *University of Kentucky, Lexington.*

The objective of this case study, conducted at the University of Kentucky Coldstream Dairy from 21 August 2013 to 29 September 2013, was to determine if increased alley scraping frequency decreased teat end and milk environmental mastitis-causing pathogen counts (EMC). Sixteen Holstein cows were monitored during two, 3-wk treatments; removing manure from the alley floors once (1X) or twice (2X) daily. Milk and teat end swab samples were collected twice weekly to observe changes in EMC and somatic cell score (SCS). The GLM procedure of SAS (SAS Institute, Inc., Cary, NC) was used to evaluate fixed effects of treatment, parity group (1 or ≥ 2), and days in milk group (≤ 150 or > 150), and their interactions on teat end and milk *Escherichia coli*, total coliform, *Klebsiella* spp., and streptococci counts, with cow as subject. Stepwise backward elimination was used to remove

nonsignificant interactions ($P \geq 0.05$) and all main effects were kept in each model, regardless of significance level. The CORR procedure of SAS was used to evaluate the correlations between all study variables. The least squares means (\pm SE) indicated increased scraping frequency decreased milk sample total coliform count from 0.30 to $0.05 \pm 0.09 \log_{10}$ cfu/g ($P < 0.05$). Likewise, teat end total coliform, *E. coli*, and streptococci counts decreased between 1X and 2X; 2.11 to $1.56 \pm 0.14 \log_{10}$ cfu/g, 1.86 to $1.30 \pm 0.14 \log_{10}$ cfu/g, and 5.06 to $4.10 \pm 0.19 \log_{10}$ cfu/g, respectively ($P < 0.01$). Increased scraping frequency did not significantly affect SCS, milk *E. coli*, streptococci, and *Klebsiella* spp. counts, or teat end *Klebsiella* spp. counts ($P > 0.05$). Teat end total coliform and streptococci counts were moderately correlated with the same bacteria counts within the milk ($r = 0.53$, $P < 0.01$ for both species). Milk streptococci counts were moderately correlated with SCS ($r = 0.40$, $P < 0.05$). Because increased scraping frequency decreased EMC, which could reduce intramammary infection risk, this practice could reduce mastitis caused by environmental mastitis-causing pathogens.

Key Words: environmental mastitis, pathogen counts, scraping frequency

0030 Dry matter intake and efficiency in lactating Holstein cows grouped by direct genomic values for feed utilization.

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Feed costs represent the largest expense for lactating dairy cows, yet the dairy industry does not currently select directly for feed efficiency. The purpose of this study was to observe how accurately genomic predictions of feed utilization developed from a small reference population could predict feed utilization in lactating Holsteins. Feed intake data were collected from 970 Holstein cows across 11 commercial Pennsylvania herds. Genetic evaluations of 4 feed utilization traits were conducted: DMI, dry matter efficiency (DME; energy corrected milk/DMI), crude protein efficiency (CPE; protein yield protein intake), and residual feed intake (RFI). A genome-wide association study was performed using 45,138 SNP genotypes from 340 cows with the e-BIGS program (<http://biggs.ansci.iastate.edu>) and SNP associations were used to generate direct genomic values (DGV) of feed utilization. Cows were subsequently separated into feed utilization groups, with pen milk yield and feed intake monitored for 2 wk. High and low DGV groups of 20 cows for each of the 4 feed utilization traits were observed at Penn State, whereas cows from a commercial dairy farm were divided into high, medium, and low DGV groups of 51 cows for DMI and 68 cows for DME. Mixed models were used to evaluate differences in feed utilization between high, medium (commercial herd only), and low DGV groups, and included DGV group, a random effect for date, and random error. The high DMI group consumed 10.8 kg more dry matter per day ($P < 0.01$) than the low DMI group at Penn State.

Likewise, the high CPE group produced 0.04 kg more protein per kilogram of protein intake ($P < 0.05$). The high DME group tended ($P < 0.10$) to produce more milk (+0.17 kg) per kilogram of intake than the low group. Differences among high and low RFI groups were opposite of expectations, with the low group consuming significantly more dry matter than predicted ($P < 0.01$), based on milk yield and body weight, compared with the high group. Differences in DMI ($P = 0.36$) and DME ($P = 0.14$) were not significant among groups on the commercial dairy farm. This research demonstrated that it is feasible to apply genomic predictions of feed utilization developed from a reference population to select for improved efficiency in commercial dairy herds. However, not all the predictions were as expected and a larger reference population is required to increase prediction accuracy.

Key Words: feed efficiency, genomics

0031 Can prior subjection to pre-heating enhance the heat tolerance of mesophilic bacterial cultures?

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The enhancement of heat tolerance of mesophilic bacterial cultures is important for withstanding the elevated temperatures in the development of probiotic processed cheeses. The objective was to determine whether prior subjection to pre-heating would enhance heat tolerance of mesophilic cultures. *Lactococcus lactis* ssp. *lactis* and *Lactococcus lactis* ssp. *cremoris* were suspended in a 0.1% peptone and exposed to the preheat temperatures of 30°C, 40°C, 50°C, 60°C, 70°C, or 80°C for 1, 5, or 10 min. The cultures were then grown in M17 broth at 32°C for 72 h. After the first generation of growth, the cultures were then subjected to the same preheat temperature and time, and then grown in M17 broth at 32°C for 72 h. The second generation was also subjected to the same preheat temperature and time, and grown in M17 broth at 32°C for 72 h. After 3 generations of growth, the cultures were then subjected to the challenge conditions of 95°C for 5 min. The control cultures were exposed to the challenge conditions without the subjection to any of the preheat temperatures and times. The cultures were plated in M17 agar and allowed to incubate aerobically at 32°C for 72 h. Three replications were conducted. No growth was obtained when any of the pre heat treated cultures were subjected to the challenge temperature and time conditions. Heat tolerances of mesophilic cultures studied were not enhanced under these conditions.

Key Words: cheese, heat tolerance, mesophilic cultures