1626 Annual rhythms of milk, fat, and protein production in U.S. dairy cattle. I. J. Salfer*, C. D. Dechow, and K. J. Harvatine, *Penn State University, State College.*

An annual pattern of milk composition has been well appreciated in dairy cattle with highest milk fat and protein observed during the winter and lowest in the summer. However, the rhythm has not been well quantified. The cosine function is commonly used to model repeating daily and seasonal rhythms and allows determination of the amplitude (mean to peak), phase (time at peak), and period (time between peaks) of the rhythm. The objective of this study was to use cosine analysis to characterize the annual rhythm of milk, fat, and protein production using both national milk production and herd-level data. First, 10 yr of monthly average milk butterfat and protein concentration by milk market were obtained from the USDA Agricultural Marketing service database. We first determined if the data fit a cosine function with a 12 mo period using the linear form of the cosine function by random regression in PROC Mixed. A zero amplitude test was used to determine significance of the rhythm. Fat and protein concentration fit a cosine function with a 12 mo period in all milk markets. There was an interaction between milk marketing order and milk fat and protein concentration ($P < 0.01$). The phase (time at peak) ranged from October 6 to January 6 for fat and from November 21 to December 12 for protein. The amplitude of the rhythm ranged from 0.07 to 0.14% for fat production and from 0.08 to 0.12% for protein production. The amplitude of milk fat rhythm generally was lower in southern markets and higher in northern markets. Second, the annual rhythm of milk yield and milk fat and protein yield and concentration were analyzed in monthly test day data from 1684 cows from 11 tie-stall herds in Pennsylvania. Milk, fat, and protein yield and fat and protein concentration followed yearly annual rhythms. Milk and protein yield were highest in May, fat yield and concentration were highest in February, and protein concentration was highest in November. There was an interaction of herd with the rhythm of milk yield, fat yield, and fat concentration. In conclusion, there is an annual rhythm of milk yield and milk fat and protein yield and concentration that fits a cosine function and varies by geographical location and herd.

Key Words: annual rhythms, milk synthesis, yearly pattern
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1627 Molecular physiology of rumen papillae following an acidosis challenge. C. E. Kent-Dennis*, J. A. Pasternak, and G. B. Penner, *University of Saskatchewan, Saskatoon, Canada.*

The objective of this experiment was to evaluate the effect of ruminal acidosis on transcript abundance and localization of proteins regulated by local inflammation in the ruminal epithelium. Seven ruminally cannulated beef cows were used in a crossover design with two periods and two treatments (acidosis or control). Heifers were fed a baseline TMR with 50:50 forage to concentrate ratio and DMI was recorded daily. The acidosis induction consisted of feed restriction (25% of DMI for 1 d) followed by a grain challenge (30% of baseline DMI) and provision of the full TMR. Ruminal pH was monitored using indwelling probes and ruminal papillae biopsies were collected on d 2 and 6 following the induction of acidosis for RNA extraction and immuno-histofluorescence. Prostaglandin-endoperoxide synthase (PTGS1) and PTGS2 facilitate prostaglandin synthesis and were selected as targets because expression is thought to be regulated by inflammation. Gene expression was measured by quantitative real-time PCR, normalized to the geometric mean of three housekeeping genes within period. Immuno-histofluorescence of toll-like receptor (TLR)-9 and TLR-4 were used to evaluate localization in a subset of samples. Statistical analysis was performed using the MIXED procedure of SAS 9.4, with treatment and period as fixed effects. A pH threshold of 5.8 was used to define the occurrence of ruminal acidosis. During the day of the grain challenge, ruminal pH for acidosis cows was below pH 5.8 for 543 min, whereas pH of controls did not fall below the threshold at any time ($P = 0.02$). Minimum and mean pH were less on the challenge day (min: 5.4 vs. 6.2 ± 0.17 and mean: 5.9 vs. 6.6 ± 0.14, respectively; $P < 0.01$) for acidosis than control cows. Two days after acidosis induction, transcriptional abundance of PTGS1 and PTGS2 in ruminal papillae were decreased by 1.37 ($P = 0.02$) and 2.08 ($P < 0.01$) fold, respectively, relative to controls. When evaluated at d 6, no differences were observed. TLR-9 was not ubiquitously expressed, but rather was concentrated in small areas within regions of the ruminal epithelium. TLR4 was intracellularly expressed in the stratum basale, stratum spinosum, and stratum granulosum regardless of treatment. The results of this study suggest a potential acute anti-inflammatory response following acidosis, which was also tightly regulated. However, the downregulation of PTGS2 was unexpected; related transcripts are being studied to elucidate these effects.

Key Words: acidosis, inflammation, rumen papillae
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1628 Endocannabinoid and lipid metabolism gene network expression in adipose tissue of peripartal cows with low or high body condition score at calving. A. S. Alharthi*[1], Z. Zhou[1], D. N. Luchini[2], and J. J. Loor[1], [1]*University of Illinois, Urbana,* [2]*Adisseo S.A.S., Alpharetta, GA.*

Our previous research revealed a strong inflammatory response within adipose tissue during the transition into lactation. Whether this localized effect is a result of oxidative stress induced by lipolysis and fatty acid oxidation or via the