Ruminant Nutrition: Dairy: Minerals, Vitamins, and Other Stuff

787 Effect of sodium chloride intake on urea concentration in milk from dairy cows. J. W. Spek*[1], J. Dijkstra[1], J. J. G. C. van den Borne[1], and A. Bannink[2], *[1]Wageningen University, Wageningen, the Netherlands, [2]Wageningen UR Livestock Research, Lelystad, the Netherlands.*

A reliable indicator of nitrogen (N) excretion by dairy cattle is required to easily estimate N excretion on farm and to evaluate N excretion mitigation strategies. Milk urea nitrogen (MUN, mg/dl) has been shown to be positively correlated to excretion of urea and total N in urine in dairy cows. However, a significant proportion of variation in urine N-excretion (UN) remains unexplained by MUN content. In the present experiment, it was hypothesized that urine volume is affected by dietary salt intake and affects MUN content and the relationship between MUN and UN. Twelve lactating Holstein Friesian cows (milk production 25.4 ± 2.53 kg/d and 207 ± 41.3 DIM), of which 4 were fitted with catheters in the urine bladder, were randomly assigned to 4 dietary levels of salt (3, 9, 13, and 18 g Na/kg DM) in a 4 × 4 Latin square design. Cows were fed at 95% of ad libitum feed intake to ensure equal N-intake across dietary levels of Na. During the last 2 d of each one-week treatment period, milk was sampled and analyzed for MUN. Urine and feces of catheterized cows were collected quantitatively during the last 2 d of each treatment week. Urine was analyzed for total N and urea, and feces for total N and DM. Data were analyzed with the PROC MIXED procedure of SAS in which the blocking factors cow and period were included as random and fixed effects, respectively. Dry matter and N intake were 21.4 ± 1.24 kg/d and 522 ± 32.0 g/d, respectively, and equal across treatments. A significant negative linear correlation was found between intake of Na and level of MUN: MUN = 12.8 ± 0.44 - 0.70 ± 0.075 × 100 g Na/d. Based on the 4 catheterized cows, for every 100 g increase in Na consumption, a significant linear increase was found for urine production (13.7 ± 0.87 L/d), UN (5.3 ± 2.07 g/d) and urinary non-urea N excretion (4.2 ± 0.57 g/d). However, excretion of urinary urea N was unaffected (1.2 ± 1.62 g/d) by Na intake level. It is concluded that salt intake level affects MUN without an effect on urinary urea excretion. Level of salt intake should hence be considered when using MUN as an indicator of urinary urea excretion or UN.

Key words: milk urea nitrogen, urinary nitrogen excretion, sodium chloride

788 2010 National survey of barriers related to precision phosphorus feeding. J. H. Harrison*[1], R. James[2], C. Stallings[2], E. Whitefield[1], M. Hanigan[2], and K. Knowlton[2], *[1]Washington State University, Puyallup, [2]Virginia Tech, Blacksburg.*

A national survey was conducted in cooperation with ARPAS to document barriers related to phosphorus feeding. The electronic survey link was sent to all ARPAS members with a dairy emphasis. Approximately 130 respondents replied to 8 questions. 53% of respondents indicated that balancing for ration P was a priority (rank of 7–10 out of 1–10 rank). 75.2% of respondents indicated that they perceived current NRC recommendations for P as adequate, while 8.5% indicated that they are too low, and 16.3% indicated they are too high. When asked to identify the most challenging aspect of reducing P in the diet, 54.8% indicated uncertainty of P content of feedstuffs, 36.8% indicated cost, and 9.6% indicated uncertainty of ration ingredients. 52 of approximately 130 respondents replied when asked if their recommendations were above those of NRC. They indicated: concern about negative impact on metabolic diseases (46.2%), mastitis (9.6%), foot problems (7.7%), heat detection efficiency (55.8%), conception rate (63.5%), and retained placenta (23.1%). Most respondents (99%) indicated that they had reduced their recommendations for dietary P content over the last 3 to 5 years. When asked what information is needed to assist them in ration formulation for P, 69.7% indicated availability of P from different sources; 56.3% indicated updated requirements for maintenance, production and reproduction; and 45.4% indicated that more documentation was needed that current NRC recommendations for P are adequate. Additional questions were asked about target level of P in the key production groups, and what sources of P were included in diets. Information collected from the survey indicate that more progress needs to be made to assure the P availability from feedstuffs and assure that no impairment of reproduction would be expected from feeding NRC recommended levels of P.

Key words: phosphorus, feed management, nutrition

789 Evaluation of ruminally protected niacin on thermal regulation and productivity of high-producing dairy cows during summer heat stress. S. R. Wrinkle*[1], P. H. Robinson[1], and J. E. Garrett[2], *[1]Department of Animal Science, University of California, Davis, [2]Quali Tech Inc., Chaska, MN.*

Heat stress resulting in animal production losses costs the dairy industry hundreds of millions of dollars annually in the USA, especially in southern areas such as California. Niacin as a dietary supplement typically induces "flushing," or increased blood flow to the skin, causing a decrease in core body temperature which has been shown to reduce heat stress in dairy cows. Our objective was to determine if feeding ruminally protected niacin (RPNi) is effective in alleviating heat stress in dairy cows. Two 2x2 factorial experiments, each with 28 d periods, were conducted in the summer of 2010. In Expt. 1, 2 pens, each ~180 early lactation multiparity cows were used, and in Expt. 2, 2 pens of ~180 mid-lactation mixed parity cows were used. The basal total mixed ration, of 17% CP, 33% aNDF and 15% starch, was the same for all cows with the exception of RPNi added to RPNi diets. Treatment cows received 19 g RPNi/cow/d, estimated to deliver ~7 g of intestinally absorbable niacin/cow/d as determined by ruminal in sacco incubation. In Expt. 1, respiration rate (RR) and panting score (PS) were measured 4 times/d. RR was lower ($P = 0.02$) at 09:00 h, but not impacted at other times, while PS was lower ($P \leq 0.01$) at 04:30, 09:00 and 20:30, but not impacted at 16:30 h, in cows fed RPNi. Side udder (SU) and back udder (BU) temperatures did not differ at 14:15 or 22:15, but BU was lower ($P = 0.03$) at 06:00 h in cows fed RPNi. There was no difference in DM intake or milk and milk component yields, but milk fat % for RPNi cows was lower ($P < 0.01$). In Expt. 2, where PS, RR, SU and BU were not measured, DM intake and milk yield did not differ between treatments, and there were no differences in milk yield, or milk protein or lactose %. However, fat % was higher in RPNi cows ($P = 0.01$). While symptoms of heat stress were reduced for cows fed RPNi, the increase in cow comfort did not result in increased productivity. Differences in the milk fat % response between stages of lactation suggests that niacin affects metabolism differently if cows are in negative (early lactation) or positive (mid-lactation) energy balance.

Key words: niacin, heat stress, milk fat

790 Effects of feeding a rumen protected lysine (AjiPro-L) from calving to the fourth week of lactation on production of high-producing dairy cows. J. E. Nocek*[1], T. Takagi[2], and I. Shinzato[2], *[1]Spruce Haven Farm and Research Center, Auburn, NY, [2]Ajinomoto Co., Inc., Tokyo, Japan.*

Sixty-five multiparous Holstein cows were used to examine the effects of feeding a rumen protected lysine (AjiPro-L, Ajinomoto Co., Inc., Japan) from calving to the 4th week of lactation on production of dairy cows. Cows were balanced across treatments based on the previous ME305 and body condition score at 21 d pre-partum and assigned to 3 dietary treatments. The experimental diets contained either 0 (Control), 100 or 200g/d of AjiPro. Cows were individually housed in tie-stalls and were fed the experimental diets for 4 weeks from calving, and all cows were moved to free-stall barns and fed a common lactation TMR from 5th to 12th week of lactation to see the carry-over effects. Individual milk yield was measured daily, and milk component contents were measured weekly throughout the study. Individual dry matter intake (DMI) was measured daily during the first 4 weeks of lactation. During the supplementation period, mean yields of milk, FCM and fat were significantly higher ($P < 0.01$) for cows receiving 100 or 200g AjiPro than Control, but neither DMI nor milk protein yield differed between treatments. Milk production efficiency was significantly higher for cows receiving 200g AjiPro than the other 2 treatments. In the post-supplementation period, 100g AjiPro resulted in significantly higher yields of FCM and fat than 200g AjiPro with Control being intermediate. Protein yield was higher ($P < 0.01$) for Control and 100g AjiPro than 200g AjiPro. MUN was higher for 200g AjiPro ($P < 0.05$) than Control. In this study, 100g AjiPro supplementation resulted in increased milk production during the supplementation period and showed a numerical tendency for positive carry-over effects in the post-supplementation period compared with Control, whereas an over-feeding (200g AjiPro) had slight adverse effects in the post-supplementation even if it resulted in the best performance during the supplementation period. These results suggest that optimal lysine supplementation maybe involved with triggering nutrient (both energy and protein) partitioning in early lactation cows.

Key words: rumen protected lysine, milk production, early lactation

791 Feeding a C16:0-enriched fat supplement increased the yield of milk fat and improved feed efficiency. A. L. Lock*, C. L. Preseault, K. E. DeLand, and M. S. Allen, *Michigan State University, East Lansing.*

Previous work has indicated that dietary palmitic acid (C16:0) may increase milk fat yield over and above expected values either without additional fat supplementation or compared with other dietary fatty acids. The effect of dietary C16:0 on feed intake, yield of milk and milk components, and feed efficiency was evaluated in an experiment with a crossover arrangement of treatments with 25 d periods. A fermentable starch challenge (FSC) on the last 4 d of each period was utilized as a split-plot within period. Sixteen midlactation Holstein cows (249 ± 33 DIM) were assigned randomly to treatment sequence. Treatments were either a C16:0-enriched (~85% C16:0) fat supplement (FAT, 2% DM) or a control diet (CON) containing no supplemental fat. Diets containing dry ground corn grain were fed from d 1 through 21 of each period. On the last 4 d of each period, dry ground corn was replaced by high-moisture corn grain on an equivalent DM basis. Response variables were averaged for d 18 to 21 for the dry corn diet and d 22 to 25 for the FSC. There were no treatment effects on milk yield (32.0 kg/d) or milk protein yield (1.1 kg/d). FAT increased milk fat concentration from 3.88 to 4.18% and fat yield from 1.23 to 1.33 kg/d compared with CON ($P < 0.001$). Consequently FAT increased 3.5% fat-corrected milk yield by 1.7 kg/d ($P < 0.05$). FAT decreased DMI by 0.7 kg/d ($P < 0.05$) and increased feed efficiency (3.5% fat-corrected milk yield/DMI) 7.5% ($P < 0.001$) compared with CON. The FSC did not affect milk fat, DMI or feed efficiency. The increase in milk fat yield by FAT was entirely accounted for by an increase in C16:0 output into milk. Data demonstrates the potential for a dietary C16:0-enriched fat supplement to improve milk fat concentration and yield as well as efficiency of feed conversion into milk. Further studies are required to verify and extend these results and to determine whether responses are similar across different diets and levels of milk production.

Key words: palmitic acid, milk fat, feed efficiency

792 Characterizing the effect of Amaferm on forage NDF digestibility. J. E. Nocek*[1] and H. Jensen[2], *[1]Spruce Haven Farm and Res. Ctr, Auburn, NY, [2]Biozyme Inc., St Joseph, MO.*

Amaferm is a fermentation extract shown to stimulate ruminal bacterial and anaerobic fungal growth and enzymatic activity. Our aim was to evaluate the effect of Amaferm on extent and rate of ruminal NDF digestion from a random samplings of corn silage, haylage and hay . Samples (~75 each) of corn silage, haylage and hay of various NDF concentrations and digestibilities were subjected to in situ digestion. Limited sample size restricted cow numbers and rumen residence times used. Two lactating, ruminally cannulated cows (40–120 DIM) were used to determine rumen digestibility: one received control diet only with no Amaferm, the other received the same diet with Amaferm. A standardization procedure with grass hay was used to evaluate cow variation before and after Amaferm supplementation. Rumen polyester bag residence times were 12, 24 and 36 h which allowed time point calculation of rumen NDF disappearance and linear digestion rate determination. Grass hay DM digestibility was not ($P > 0.10$) affected by cow in time. Twelve and 24 h of ruminal incubation of corn silage demonstrated no difference in residual NDF between Control and Amaferm. However at 36 h, Amaferm supplementation resulted in a 8.2% increase ($P < 0.01$) in NDF disappearance, which translated into an increased (15.2%, $P < 0.01$) rate of corn silage NDF digestion. Amaferm supplementation had little effect on Hay NDF digestion at 12 h, however, at 24 h of ruminal exposure, NDF disappearance was higher (11.5%, $P < 0.05$) with Amaferm supplementation. Haylage NDF disappearance at 12, 24 and 36 h was increased by 13.3, 12.6 and 10.0% respectively with Amaferm supplementation. Linear NDF rate of haylage digestion was 16.6% higher ($P < 0.01$) with Amaferm supplementation compared with Control. In summary, Amaferm affected NDF digestibility differently for each forage type evaluated. All forage types tested experienced a significant enhancement in extent of NDF digestibility at some point through 36 h of ruminal exposure when supplemented with Amaferm.

Key words: forage, fermentation extract, NDF digestibility

793 Methionine availability to dairy cows when added to mechanically extracted soybean meal with soy gums. D. W. Brake*[1], E. C. Titgemeyer[1], B. J. Bradford[1], J. F. Smith[1], and C. A. Macgregor[2], *[1]Kansas State University, Manhattan, KS, [2]Grain States Soya Inc., West Point, NE.*

We investigated availability of supplemental DL-Met fed to dairy cows when added to soy gums before application to a mechanically extracted soybean meal (meSBM) at the time of manufacture. Holstein

cows (25) were assigned to treatment sequences in 5 replicated 5 × 5 Latin squares with 14-d periods. Cows were fed 1 of 5 treatment diets as TMR supplemented with 0, 2.5, or 5 g/d metabolizable Met provided as a commercially available ruminally protected (RP) Met (MetiPEARL brand, Kemin Industries, Des Moines, IA) or with 4.2 or 8.4 g/d DL-Met added as part of a meSBM product. For the diets providing added Met from meSBM, a product containing 0.3% Met replaced one-half or all of a meSBM product containing no added Met (Soy Best®, Grain States Soya, Inc., West Point, NE). Diets were designed to be first-limiting in metabolizable Met and contained (DM) 14.3% CP. The diet without added Met was estimated to deliver 6.53% of MP as Lys and 1.76% of MP as Met. Diets contained (DM): 35% ground sorghum grain, 25% corn silage, 15% alfalfa hay, 10% soybean hulls, 9% meSBM, and RP-Lys (LysiPEARL brand, Kemin Industries) to provide 0.055% of diet DM as metabolizable Lys. Plasma Met and Ser concentrations increased with supplemental RP-Met ($P < 0.05$), but were not affected by Met supplied in meSBM. Yields of milk (45 kg/d), protein, fat, and lactose were not different among treatments. Concentrations of milk protein were increased ($P \leq 0.05$) by RP-Met, and concentration of SNF tended to increase with RP-Met. Intakes of DM (25.4 kg/d) and N were not different among treatments nor were apparent digestibilities of DM or N. Milk N:N intake was not different among treatments. Increases in BCS were greater ($P < 0.05$) and N retention was numerically greater when Met was supplied by meSBM. Milk protein yield was not responsive to metabolizable Met supply, but based on concentrations of plasma Met and of milk protein there was little evidence to suggest that supplemental Met provided as meSBM markedly increased supply of metabolizable Met to dairy cattle. The unresponsiveness of milk protein yield may suggest our model was not optimal for assessing Met supply.

Key words: methionine, dairy, soybean meal

794 Effects of chromium propionate fed through the periparturient period and starch source fed postpartum on productive performance and dry matter intake of Holstein cows. R. J. Rockwell* and M. S. Allen, *Michigan State University, East Lansing.*

Holstein cows (n = 48) entering second or later lactation were used in a randomized block design experiment with a 2 × 2 factorial arrangement of treatments to determine production and dry matter intake (DMI) responses to chromium propionate supplementation throughout the periparturient period and starch source in the postpartum (PP) diet. Treatments were chromium propionate (KemTRACE Chromium Propionate, Kemin Industries, Cr–Pr, 8 mg Cr/cow/d) or control (CONT, ground corn) top–dressed (20 g/d) daily at feeding from 28 ± 3 d before expected parturition until 28 ± 3 d PP, and dry corn (DC) or high moisture corn (HMC) in diets fed from parturition until 28 ± 3 d PP. Cows were fed a common diet from 28 ± 3 to 84 ± 3 d PP. Data was analyzed using a mixed model with repeated measures. No treatment effects were detected for daily DMI from parturition until 28 ± 3 d PP, but an interaction of chromium, corn and days PP was detected ($P = 0.06$) when cows were fed a common diet. An interaction among chromium, starch source, and week was detected for 3.5% fat–corrected milk (FCM, $P = 0.07$) from parturition until 28 ± 3 d PP. The Cr–Pr/HMC and CONT/DC treatments resulted in consistent and higher (54.9 kg/d) and lower (49.3 kg/d) FCM, respectively throughout the period compared with the other treatments in which FCM decreased over time. After treatment ceased, Cr–Pr tended to increase milk yield (55.4 vs. 51.9 kg/d, $P = 0.09$) and FCM (52.0 vs. 48.3 kg/d, $P = 0.108$) from 28 ± 3 to 84 ± 3 d PP. There was also an interaction of starch source by week for FCM ($P < 0.001$) with FCM increasing throughout the period for DC, but decreasing for HMC; yield of FCM was greater for HMC compared with DC at 42 ± 3 d PP (57.0 vs. 48.0 kg/d), but lower at 84 ± 3 d PP (48.3 vs. 49.3 kg/d). No main effects of treatment or interactions with time relative to parturition were observed for body weight or body condition score. Cr–Pr interacted with starch source throughout the periparturient period in PP diets and days PP to affect production responses that were also affected after treatment application ceased.

Key words: peripartum, starch, chromium propionate