W42 Effect of a live-yeast-based product on colostrum quality and milk yield in first month of lactation on a private dairy farm. C. Julien*[1,2], A. Fernandez[3], and J. P. Marden[3], *[1]INRA, UMR1289 TANDEM, Tissus Animaux Nutrition Digestion Ecosystème et Métabolisme, Castanet-Tolosan, France, [2]Université de Toulouse, INPT ENSAT, INP-ENVT, UMR1289 TANDEM, Castanet-Tolosan, France, [3]Lesaffre Feed Additives, Marcq-en-Baroeul, France.*

The objectives were to (i) evaluate the effect of a live-yeast-based product supplementation during dry period of dairy cows on colostrum quality and milk yield (ii) test the on-farm use of Brix refractometers (Optical-OBR and Digital-DBR) instead of colostrometer (CLM). Fifty Holstein dairy cows of a private farm (Sepx, France) were involved in the trial: 16 cows calving between December 2011 and February 2012 were used as control (CTRL) and the next 34 cows calving between March and September 2012 (YST) received 15 g/d of a mix of live yeast and yeast wall cells (Lesaffre Feed Additives, France) from dry to the calving. Two samples of colostrum were taken at first milking: one was measured within 1h of collection with both CLM and OBR by the farmer. The other sample was frozen for subsequent measurement by DBR (MA871, Milwaukee, WI) taken as reference. Data were analyzed using R.14.1 software with a linear model including the effects of rank of lactation, DIM at first control and treatment. Optical Brix measured on fresh colostrums on-farm and digital Brix measured on thawed colostrums were highly correlated ($R^2 = 0.89$, $P < 0.001$, n = 44). It showed clearly that on-farm measurement with OBR on fresh colostrums is as accurate as lab measurement with DBR on frozen colostrums. On the contrary, IgG content evaluated with CLM and DBR presented a correlation of $R^2 = 0.47$ ($P < 0.001$, n = 44) highlighting a less accurate on-farm assessment of colostrum quality perhaps due to the temperature non-sensitivity of CLM. Supplementation of dry dairy cows with live-yeast-based product did not alter colostrum quality. However, it tended to improved milk yield ($P = 0.13$) and protein yield ($P = 0.096$) measured at first control in the first month of lactation: +15% and +13%, respectively. To conclude, supplementation of cows during dry period with the live-yeast-based product seems not to alter colostrum quality but tended to improve milk and protein yields in first month of lactation. Also, colostrum quality can be easily and more accurately assessed by dairy farmers on-farm by means of a Brix refractometer than by a colostrometer.

Key Words: dairy cow, colostrum, live yeast

W43 Sugar cane silage additive for high production dairy cows. B. T. C. Silveira, M. I. Marcondes, K. G. Ribeiro*, O. G. Pereira, M. G. F. Teixeira, and L. L. Cardoso, *Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil.*

Sugar cane silage production process can be an alternative to reduce handling costs in dairy production systems. The objective was to evaluate sugar cane silage for Holstein high production cows. The experiment was carried out at UEPE-GL ranch, at Universidade Federal de Viçosa, Viçosa-MG, Brazil. The treatments were corn silage (CS), with roughage:concentrate relationship of 60:40 in dry matter (DM); and 4 diets based on sugar cane(SC), with roughage: concentrate relationship of 40:60 in DM, as it follows: Sugar cane silage (SCS), Sugar cane silage with *Lactobacillus buchneri*, and sugar cane silage with *Lactobacillus plantarum* plus *Pediococcus pentosaceus* (SCSLP). Fifteen Holstein cows were divided into 3 blocks by milk production (25, 30, 35 kg/d), and they were evaluated during 5 periods of 15 d. Animals were assigned in completely randomized block design in scheme of repeated measures. Diets were isonitrogenous and isoenergetic, and dry matter intake was daily regulated. Milk production was daily recorded in 2 milking, and at the end of each period milk was sampled to analyze milk fat, protein, lactose and total dry extract. Treatment affect milk production with SCS having the lowest production (23.69 kg/d) compared with other treatments ($P = 0.001$). SC is usually a low quality forage, with low fiber digestibility and reduced proportion of soluble carbohydrates, that possibly decreased energy availability for milk production. Sugar cane supplementation improved material quality and allowed similar performance with CS and SCIN. There was no effect of roughage over 4% fat corrected milk production and milk fat, lactose, total dry extract ($P > 0.05$). Milk protein reduced when SCSLP was used ($P = 0.019$), with no acceptable explanation to these results. SCS can replace SCIN or CS for high production cows when additives are used. Supported by CNPQ/FAPEMIG/INCT-CA/FUNARBE

Key Words: *Lactobacillus buchneri*, *Lactobacillus plantarum*, *Pediococcus pentosaceus*

W44 Effects of evaporative cooling prepartum and vitamin E supplementation on performance of Holstein cows during summer in Florida. G. C. Gomes*[1], J. E. Zuniga[1], L. F. Greco[1], L. D. P. Sinedino[1], E. S. Ribeiro[1], N. Martinez[1], R. S. Bisinotto[1], F. S. Lima[1], E. Karakaya[1], M. A. Engstrom[2], J. E. P. Santos[1], and C. R. Staples[1], *[1]University of Florida, Gainesville, [2]DSM, Belvidere, NJ.*

The objective was to evaluate vitamin E (VitE) supplementation above NRC recommendations to cows managed in cooled (C) or noncooled (NC) environments prepartum on performance. Holstein cows (n = 70) were blocked by parity, milk yield, and body weight, and assigned randomly to 1 of 4 treatments arranged in a 2 × 2 factorial starting at 4 wk prepartum. Cows were housed until parturition in either a sand-bedded free-stall barn equipped with fans and sprinklers (C) or in an open lot provided with shade only (NC). After calving, cows were housed together in free-stall facility equipped with fans and sprinklers. All-rac-α-tocopherol (DSM, Belvidere, NJ) was top dressed daily at 1000 IU prepartum and 500 IU postpartum for moderate VitE (M) or 3000 IU prepartum and 2000 IU postpartum for high VitE (H) resulting in treatments: CH, CM, NCH, and NCM. The study lasted from 4 wk pre- to 15 wk postpartum. Measurements included intake of DM, yields of milk and milk components, body weight, respiration rate, and 4 times hourly measurement of vaginal temperatures for 7 d. Data were analyzed by ANOVA for repeated measures with the PROC MIXED of SAS. During prepartum, temperature and humidity index (THI) averaged 74.8 ± 4.9, and cows were exposed to THI > 70 during 85% of the day. Cooling prepartum reduced body temperature by 0.38°C in the afternoon. Results are in Table. Providing evaporative cooling during the last 4 wk of gestation improved lactational performance of dairy cows. Supplementation with VitE above NRC recommendations increased fat and protein concentration of milk, but did not influence yields of milk and milk components.

Table 1. Evaporative cooling (EC) and vitamin E (VitE) for periparturient dairy cows

	Treatment					*P*-value		
Item	NCM	NCH	CM	CH	SEM	EC	VitE	EC × VitE
DMI, kg/d								
Prepartum	9.2	8.7	10.1	10.4	0.3	0.01	0.72	0.24
Postpartum	21.9	21.9	21.4	21.4	0.6	0.41	0.93	0.95
Milk, kg/d	31.7	30.4	33.2	34.5	1.1	0.01	0.98	0.25
ECM, kg/d	31.3	30.5	33.4	35.6	1.1	0.01	0.52	0.18
Fat, %	3.55	3.64	3.69	3.88	0.05	0.01	0.01	0.31
Protein, %	2.97	3.01	2.94	3.04	0.02	0.88	0.01	0.30
FCM/DMI	1.57	1.48	1.69	1.77	0.07	0.01	0.94	0.21
Respiration rate, breaths/min	67	71	42	44	3	0.01	0.33	0.73

Key Words: dairy cow, heat stress, vitamin E

W45 Macromineral maintenance requirements for Holstein young calves. J. P. P. Rodrigues*[1], J. C. M. Lima[1], M. I. Marcondes[1], M. Campos[2], F. S. Machado[2], A. S. Trece[1], M. M. D. Castro[1], B. P. Moreira[1], and P. G. Castro[1], *[1]Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil, [2]Embrapa Gado de Leite, Juiz de Fora, Minas Gerais, Brazil.*

The aim was to determine the calcium (Ca), phosphorus (P), magnesium (Mg), sodium (Na) and potassium (K) retention efficiency and maintenance requirements of Holstein calves from birth to 87 d of age. The comparative slaughter method was used. Fourty-2 male Holstein calves were utilized (3 d of age, 35.56 ± 5.86 kg). Thirty 2 calves were randomized in 4 diets (2; 4; 6; 8 kg of raw milk), with starter (20% CP; 80% TDN; 0.57% Ca; 0.46% P; 0.08% Na; 0.38% K; 0.34% Mg) ad libitum. Each treatment had 8 replications: 4 slaughtered at 57d and 4 slaughtered at 87d. Those animals with 58d were fed Coast-cross hay plus starter ad libitum after weaning. Dry matter intake was registered daily. After slaughtering, the digestive tract was cleaned and empty body weight (EBW) was obtained. Each animal was separated into carcass (CC) and non-carcass components (NCC; head, legs, tail, leather, blood, organs, viscera), both milled using a cutter and sampled after homogenization. The relationship between body weight (BW) and EBW was 0.886. The reference group was used to estimate initial EBW composition. The mineral composition from milk, starter, hay, CC and NCC was performed by inductively coupled plasma mass spectroscopy (ICP-OES). The retained minerals (RM; mg/kg EBW/d) were regressed on mineral intake (MI; mg/kg EBW/d), according to the model: RM = β_0 + β_1*MI. All parameters were tested using the mixed procedure (SAS 9.2). The β_0 values found were −103.41 (P = 0.0147); −13.52 (P = 0.2999); −0.829 (P = 0.7241); −5.595 (P = 0.1382); −0.738 (P = 0.2381) for Ca, P, Na, K and Mg, respectively. These values can be used as the maintenance requirements (mg/kg EBW/d), being the mineral loss when intake as equal to zero. The β_1 values were 0.804 (P = 0.0087); 0.419 (P = 0.0005); 0.216 (P = 0.0009); 0.119 (P = 0.0047); 0.0455 (P = 0.0025) for Ca, P, Na, K and Mg, respectively. Significance of all β_1 parameters suggests that the models use accurate minerals retention efficiency. Highest β_1 for Ca and P may be correlated with the high skeletal growth. The requirements for maintenance (mg/kg EBW/d) can be calculated as the module of β_0. Supported by CNPq/FAPEMIG/INCT CA/FUNARBE/CAPES/EMBRAPA.

Key Words: calcium, calf, phosphorus

W46 In vitro study on the effects of sodium-calcium malate and live yeast on ruminal fermentation and methane production. J. Alcañiz*[1], A. Ortiz[1], M. D. Carro[3], M. J. Ranilla[2], and J. J. Mallo[1], *[1]NOREL S.A., Madrid, Spain, [2]Universidad de León, León, Spain, [3]Universidad Politécnica de Madrid, Madrid, Spain.*

The objective of this study was to analyze the effects of sodium-calcium malate (MS), live yeast (LY) and their combination on in vitro ruminal fermentation and methane production (MP). A system of batch cultures of mixed ruminal microorganisms (BCRM) was used. Experimental treatments were control (no additives), sodium-calcium malate (MS), Live yeast (LY) and combination of both (MSLY). Bottles (120 mL) including 300 mg of a diet (40% forage: 60% concentrate) and 30 mL of a mix solution 1:4 of rumen fluid and buffer solution described by Goering and Van Soest (1970) were used for the incubation. Additives were added at dose of 9 mg MS/BCMR and 1.5 mg LY/BCMR. Bottles were incubated at 39°C for 16 h. At the end of the incubation period, total gas production was measured in each bottle using a pressure transducer and a calibrated syringe. A gas sample was removed from each bottle and stored in a hemoguard vacutainer before analysis for methane by gas chromatography. Bottles were uncapped, the pH was measured immediately, and samples were taken for volatile fatty acids, lactate and ammonia-N analyses. Incubations were replicated 4 times to allow statistical analysis. Data were analyzed using Proc Mixed of SAS. No differences were found between treatments on acetic, butyric, lactic, valeric acid (VA) and MP. PH was similar for all treatments. MS increased propionate (PR) compared with control (319 vs. 287 mmol, $P < 0.01$), reduced VA production (17.3 vs. 19.5, $P < 0.01$) and acetic:propionic ratio (A:P) (2.85 vs. 3.13, $P < 0.05$). LY reduced VA production compared with control (17.1 vs. 19.5, $P < 0.001$). MSLY increased PR (329 vs. 289, $P < 0.001$) isobutiric (17.5 vs. 12.3, $P < 0.001$), isovaleric acid (22.1 vs. 19.8, $P < 0.01$) and total production of volatile fatty acids (1570 vs. 1449, $P < 0.05$) compared with control. MSLY increased also the total ammonia production (229 vs. 202, $P < 0.001$) and reduced gas production (2851 vs. 2923, $P < 0.01$). With this experiment we concluded that combination of additives was the most effective treatment affecting a higher number of parameters. LY only affected VA and MS was the most effective treatment to reduce A:P ratio.

Key Words: malate, live yeast

W47 Yeast supplementation of lactating dairy cows during summer. G. G. S. Salvati[1], N. N. Morais Junior[1], F. F. Cardoso[1], A. C. S. Melo[1], M. Aronovich[3], R. A. N. Pereira[2], and M. N. Pereira*[1], *[1]Universidade Federal de Lavras, Lavras, MG, Brazil, [2]Empresa de Pesquisa Agropecuária de Minas Gerais, Lavras, MG, Brazil, [3]Empresa de Pesquisa Agropecuária do Estado do Rio de Janeiro, Niterói, RJ, Brazil.*

Dairy cows subjected to heat stress have reduced feed intake and increased reliance on glucose, making feeding strategies capable of improving diet digestibility plausible for improving post rumen nutrient flow and performance. The effect of yeast on digestion and performance of lactating cows during the warm summer months of southeast Brazil was evaluated. Cows were individually fed in tie stalls, THI was above 68 for 75.6% of the time. Twenty-eight Holsteins (207 ± 87 DIM) received a standardization diet for 14 d and then a treatment for 70 d, in a covariate adjusted randomized block design with repeated measures over time. Treatments were: Yeast (*Saccharomyces cerevisiae*, strain NCYC 996; Procreatin7, Lesaffre) or Control. Capsules of 10 g were orally dosed to each cow daily, equivalent to 25 × 10^{10} cfu of live cells and 5 × 10^{10} cfu of dead cells. The diet contained corn silage (37.7%), Tifton (7.1%), raw soybeans (4.1%), soybean meal (16.5%), corn (20.7%), citrus pulp (11.9%), 18.3% CP, 37.5% NDF,

and 26.7% starch. Yeast increased the yield of milk (26.7 vs. 25.4kg/d, $P = 0.03$) and solids, especially lactose ($P = 0.03$). Response in milk yield was consistent over time and started on d 5. The daily intake of digestible OM, total tract digestibility of nutrients, urinary allantoin excretion, ruminal pH and protozoa content, chewing pattern along the day, and DMI did not respond to Yeast ($P > 0.21$). There was a trend for increased plasma glucose on Yeast (62.9 vs. 57.3mg/dL, $P = 0.09$), coupled to lowered respiratory frequency (48 vs. 56 breaths/min, $P = 0.02$), at similar rectal temperature ($P > 0.51$). On d 71 to 73, citrus pulp was abruptly replaced by the same amount of corn to induce acidosis. The increased load of starch increased DMI from 7AM to 1PM, and jugular blood pCO_2, HCO_3^-, and base excess, and decreased blood pH ($P < 0.01$). Yeast increased blood pH from 7.32 to 7.34 ($P = 0.02$). Yeast supplementation improved milk yield of cows under heat stress, the mechanism apparently involved regulation of body homeothermia and glucose availability to the mammary gland, but not diet digestibility.

Key Words: *Saccharomyces cerevisiae*, probiotic, yeast

W48 Strategies to modify the biohydrogenation pathways of polyunsaturated fatty acids in the rumen. A. Siurana[1], A. Ferret[1], M. Rodriguez[1], V. Fievez[2], D. Bravo[3], and S. Calsamiglia*[1], *[1]Autonomous University of Barcelona, Spain, [2]Ghent University, Ghent, Belgium, [3]Pancosma, Geneva, Switzerland.*

Two experiments were conducted to determine the effects of lipases and essential oils on rumen fermentation and apparent biohydrogenation of linoleic (LA) and linolenic (LNA) acids. In experiment 1, a 50:50 forage:concentrate diet containing linseed oil (8.3% of DM) was incubated in a batch culture of rumen fluid at 2 pH levels (6.4 and 5.6) in 2 replicated periods. Treatments were: control; lipase 1 and 2 (0.4 and 4 μL/g DM); a lipase inhibitor (0.4 and 2 mg/g DM); Oxy-propyl-thiosulfate (PTSO) (60 and 120 mg/L); Eugenol (EUG) (150 and 500 mL/L) and Cinnamaldehyde (CIN) (150 and 500 mL/L). Samples were collected to analyze ammonia-N, volatile fatty acids (VFA) and the fatty acid (FA) profile. In experiment 2, 8 continuous culture fermenters (1,320 mL) were used in 3 replicated periods (5 d of adaptation and 3 d of sampling). Fermenters were fed 95 g/d of DM of a 60:40 forage:concentrate diet containing 5% DM of linseed oil. Treatments were control, lipase 1 (4 μL/L), PTSO (90 mg/L) and CIN (250 mg/L), and 2 pH levels (6.4 and 5.6). During the last 3 d of each period, samples were taken to analyze VFA, ammonia-N and the FA profile. Lipase 1 increased the apparent biohydrogenation of LNA and reduced the efficiency of intermediary steps of biohydrogenation of LA and LNA in experiment 1, but these results were not observed in experiment 2. The PTSO inhibited the apparent biohydrogenation of LA and LNA and decreased total VFA concentrations. The low pH inhibited the biohydrogenation of LA, increased the t10 C18:1, and decreased total VFA concentrations. Results indicated that effects of lipase 1 observed in the batch culture were not observed in long-term dual flow continuous culture fermentations. Reducing the pH inhibited the ruminal fermentation and increased the alternative pathway of ruminal biohydrogenation. The PTSO modified the pathways of fatty acid biohydrogenation, but the magnitude of the effect was pH-dependent.

Key Words: polyunsaturated fatty acid biohydrogenation, lipase, essential oil

W49 Effect of rumen-protected choline top-dressed during the transition period on milk yield and composition in Holstein dairy cows on two commercial dairies. M. C. Amundson*[1], P. D. Carvalho[1], R. W. Bender[1], R. R. Grummer[1,2], R. D. Shaver[1], and P. M. Fricke[1], *[1]University of Wisconsin-Madison, Madison, [2]Balchem Corporation, New Hampton, NY.*

Pregnant Holstein cows and heifers on 2 commercial farms were blocked by parity and randomly assigned to 2 treatments. Cows (n = 925) in the first treatment were supplemented rumen-protected choline (RPC; Reashure, Balchem Corp., New Hampton, NY) during the transition period, whereas cows (n = 952) in the second treatment were not supplemented (control; CON). All cows were housed together in transition pens, and RPC cows were individually top-dressed 60 g/d RPC while restrained in feedline headlocks from 21 d before to 21 d after calving. Daily milk yield collected by the parlor system and downloaded as a weekly average which was analyzed for the first 14 wk of lactation within parity using PROC MIXED of SAS with treatment, farm, week, and all 2- and 3-way interactions as fixed effects and cow within treatment within farm as a random effect. Milk yield did not differ between RPC vs. CON cows in first (30.5 vs. 30.7, n = 990) or second (41.4 vs. 41.4, n = 440) lactation, whereas third and greater lactation RPC cows tended ($P = 0.06$) to have greater milk yield than CON cows (45.5 vs. 44.3, n = 515). Data from DHI records for monthly milk testing including milk yield, fat, protein, and SCC were analyzed using PROC MIXED of SAS with treatment, lactation, farm, DIM, month, and treatment by lactation, and treatment by farm interactions as fixed effects and cow within treatment within farm within lactation as a random effect. Milk yield did not differ between RPC vs. CON cows in first (30.9 vs. 31.1 kg/d, n = 963) or second (39.2 vs. 39.6 kg/d, n = 427) lactation, whereas third and greater lactation RPC cows had greater ($P < 0.05$) milk yield than CON cows (43.0 vs. 41.4 kg/d, n = 487). Milk fat and protein did not differ between RPC and CON cows (3.78% vs. 3.81% and 3.05% vs. 3.06%, respectively; n = 1,877), whereas RPC cows had a lower ($P = 0.02$) linear SCC compared with CON cows (4.0 vs. 4.1; n = 1,877). We conclude that supplementing RPC during the transition period did not affect milk components but increased milk yield for older cows during and beyond the postfresh supplementation period.

Key Words: choline, milk component, milk yield

W50 Effects of a commercial feed additive on production losses during acute heat stress conditions in Holstein dairy cows. K. A. Davison*[1], R. O. Rodrigues[1], J. A. Davidson[2], N. M. Barkley[1], A. L. Kenny[1], E. C. Adkins[1], and M. R. Waldron[1], *[1]University of Missouri, Columbia, [2]Purina Animal Nutrition Center, Gray Summit, MO.*

The objective of this study was to assess the effects of a commercial carbohydrate-based feed additive on dry matter intake (DMI), milk yield, milk composition, and plasma metabolites during an acute period of heat stress. Forty-eight mid-lactation Holstein dairy cows were blocked according to milk yield, days in milk, and parity and then randomly assigned to one of 2 dietary treatments within block. Treatments were calculated to provide 100g (as fed) daily of either sucrose (control; CTL) or a commercial feed additive (Rally, Purina Animal Nutrition, Shoreview, MN; RAL) administered as part of the total mixed ration (TMR). Cows were individually fed the TMR in 2 daily allotments for a total of 39d; 27.25 ± 0.3 d during thermoneutral (TN) conditions, followed by 11.75 ± 0.3 d during heat stress (HS) conditions (daily cyclical temperatures ranging from 23.8°C to 30.2°C, temperature-humidity index of 69.2 to 75.5) in temperature-controlled environmental chambers. Daily DMI was determined using feed issue and refusal records. Milk yield was recorded daily and milk components were assessed weekly. Blood was sampled twice weekly and analyzed for concentrations of plasma glucose, β-hydroxybutyrate, and nonesterified fatty acids (NEFA). All variables were analyzed using the SAS mixed model ANOVA procedure with repeated measures. There was no significant treatment difference during the TN period for any

of the variables measured. During HS, RAL cows displayed increased DMI (treatment by time, $P < 0.05$) and milk yield (treatment by time, $P = 0.05$) relative to CTL cows. Milk fat percentage tended to decrease to a greater extent in cows fed RAL (treatment by time, $P < 0.07$), but milk fat yield was not different between treatments ($P > 0.20$). Plasma NEFA concentrations of RAL cows were lower (treatment, $P < 0.03$) than those of CTL cows during HS. Feeding RAL before and during a period of acute cyclical HS increased DMI and milk yield, and appeared to favor improved energy balance of mid-lactation dairy cows during HS.

Key Words: Rally, heat stress, dairy

W51 Effect of dietary and metabolizable protein in early lactation on the lactational performance and metabolism of dairy cows. H. M. Dann*[1], P. Ji[1], K. W. Cotanch[1], H. M. Gauthier[1], M. P. Carter[1], S. Y. Morrison[1], J. Darrah[1], Y. Koba[2], and R. J. Grant[1], *[1]William H. Miner Agricultural Research Institute, Chazy, NY, [2]ZEN-NOH National Federation of Agricultural Cooperative Associations, Tokyo, Japan.*

Multiparous Holstein cows (n = 84) were used to evaluate the effect of crude protein (CP) and metabolizable protein (MP) in corn silage-based diets fed during the fresh and early lactation periods on performance and blood metabolites. Treatments were (1) a low-protein diet (L; 15.3% CP, 35.6% NDR, 24.2% starch) for 1 to 91 d in milk (DIM; LL), (2) a high-protein diet (H; 17.0% CP, 33.3% NDR, 24.6% starch) for 1 to 21 DIM and a L diet for 22 to 91 DIM (HL), and (3) a H diet for 1 to 21 DIM and a moderate-protein diet (M; 16.2% CP, 34.4% NDR, 24.5% starch) for 22 to 91 DIM (HM). Diets contained 40% corn silage, 12% haylage, and 48% concentrates. The MP supply at 19.1 kg dry matter intake (DMI) was estimated (NDS v3) to be 1798, 1895, and 1999 g/d for L, M, and H, respectively. Cows were housed in sand bedded freestalls, fed in a Calan Broadbent feeding system, and milked 3× daily. Dry matter intake and milk yield were measured daily. Milk composition was measured weekly starting at wk 2. Serum was collected at 1, 3, 5, 7 10, 13, 16, and 19 DIM and analyzed for blood urea N (BUN) and nonesterified fatty acids (NEFA). After 21 DIM, serum was collected weekly and analyzed for BUN. Data were analyzed as a completely randomized design by ANOVA with the MIXED procedure of SAS using treatment and time as fixed factors and cow within treatment as a random factor. Through the first 91 DIM, treatment did not affect DMI, milk yield, fat content, or protein content. As expected, protein intake and concentrations of milk urea N (MUN) and BUN were highest for HM. Serum NEFA was not affected by treatment (549 ± 36 μEq/L; $P = 0.99$). Milk N efficiency was higher for LL than HM. Diets containing lower crude protein can be fed successfully to cows in early lactation as long as the metabolizable protein supply is adequate.

Table 1.

Item	LL	HL	HM	SE
DMI, kg/d	26.2	26.2	26.5	0.4
CP intake, kg/d	3.9[b]	4.0[b]	4.4[a]	0.1
Milk, kg/d	51.2	50.2	52.4	1.2
Fat, %	3.51	3.58	3.58	0.09
True protein, %	2.82	2.86	2.89	0.04
MUN, mg/dL	8.3[b]	9.0[b]	11.8[a]	0.2
BUN, mg/dL	8[c]	10[b]	12[a]	<1
SCM/DMI	1.90	1.91	1.98	0.04
Milk N efficiency, %	39.8[a]	38.6[ab]	36.9[b]	0.5

[abc]$P \leq 0.05$.

Key Words: cow, early lactation, metabolizable protein

W52 Influence of an antioxidant supplementation on production and health status of dairy cows. J. McNamara[1], S. Shields*[1], and E. von Hemiendahl[2], *[1]Washington State University, Pullman, [2]Lohmann Animal Health GmbH, Cuxhaven, Germany.*

Vitamin E allows for optimum immune and inflammatory state of dairy cattle, however, it can be a significant cost. Antioxidants scavenge the reactive oxygen species in feed and may be able to spare vitamin E to supply higher amounts to the cow for the endogenous radical defense system. Therefore, our objective was to test the effect of inclusion of Loxidan in a dairy ration to reduce the effective amount of vitamin E necessary to maintain production and health of lactating dairy cattle. The study was a randomized complete block, and cows were individually fed a TMR ad libitum to requirements from 14 to 84 d postpartum. Twenty cows each were allotted to 3 treatments; a control ration to supply 1000 IU per cow per d of vitamin E; the same ration with 150 mg/kg diet of antioxidant blend (Loxidan, Lohmann Animal Health, Cuxhaven, Germany); or a ration to supply 3000 IU per cow per d Vitamin E. There was no effect of treatment on DMI in any parity group. Milk production was the same in multiparous cows on all treatments (35.0 ± 1.2 (SEM) kg/d); however, in 1st lactation animals milk production was greatest ($P < 0.01$) in animals on the high vitamin E, least on lower vitamin E and intermediate on Loxidan. Serum vitamin E was similar between control and Loxidan, and higher on the higher vitamin E treatment. There were no effects on milk composition, body weight or serum glucose, NEFA, or BHBA. A serum indicator of stress, advanced oxidation protein products (AOPP), was lower in animals fed the Loxidan-supplemented or higher vitamin E diet compared with controls, especially in multiparous animals (Treatment × DIM × parity $P < 0.05$). The SCC of these cows was low (58,000) and there was no treatment effect; but there was a treatment × parity interaction ($P < 0.001$) in that SCC in control 2nd lactation animals was 112,000 and in Loxidan treatment 8,000; high vitamin E was 24,000. The results indicate that a lower inclusion rate of vitamin E can be fed if the diet is additionally protected with antioxidants to achieve similar results to a higher rate of vitamin E feeding, and in 1st parity animals a slight increase in milk production.

Key Words: vitamin E, antioxidant, Loxidan

W53 Verifying consistent bioavailability values in rumen-protected lysine. M. R. Culbertson*[1], M. J. Poss[1], F. D. Valdez[1], and D. A. Sapienza[2], *[1]Kemin Industries Inc., Des Moines, IA, [2]Sapienza Analytica LLC, Slater, IA.*

To characterize and predict the release rate and pattern of a rumen-protected amino acid (LysiPEARL, Kemin Industries, Des Moines, IA), an analytical test method was developed and validated. This dissolution test method, adopted from the United States Pharmacopeia (USP), can be used to ensure consistent product performance by characterizing batch-to-batch manufacturing uniformity and corroborate reliable intestinal digestibility of lysine through in vitro bioavailability model correlation. In validating this time release method linearity, repeatability, and accuracy were demonstrated. The use of conductivity as a test method for quantitating lysine dissolution was assessed and accepted in both multifactorial ANOVA ($P > 0.05$) and fit factor ($f_1 \leq 5$ and $f_2 \geq 50 \leq 100$) analyses, as well as by comparing samples using a validated orthogonal test method, high-performance liquid chromatography (HPLC). The method was challenged to detect changes in product resulting in significant dissolution differences in both PEARL size distribution ($P < 0.01$) and coating ($P < 0.01$). Three batches of rumen-protected lysine were manufactured and then characterized by both dissolution and rumen

in vitro by-pass kinetic modeling. The kinetic modeling, based on a combination of rumen degradation and intestinal release information, offered lysine release results consistent with the laboratory validated dissolution method in all product batches cross-examined in this study with an $r^2 = 0.94$. The laboratory dissolution method is an accurate tool to evaluate manufacturing conditions and ensure reproducible intestinal bioavailability when balancing rations with rumen-protected amino acids.

Key Words: bioavailability, dissolution, rumen-protected lysine

W54 Effect of supplying limiting amino acids in diets with reduced CP on milk and protein yield. M. A. C. Danes*[1], G. A. Broderick[1], and C. Parys[2], *[1]University of Wisconsin, Madison, [2]Evonik Industries AG, Hanau, Germany.*

Supplying limiting essential amino acids (EAA) to dairy cows may allow reducing dietary CP without loss of milk and protein yield, thereby increasing N efficiency. This strategy was evaluated by infusing limiting EAA into the abomasum of cows fed diets with reduced CP concentration. Ten Holstein cows were blocked by DIM into 2 5x5 Latin squares with 5 treatments: (1) positive control (16% CP), formulated to meet metabolizable protein (MP) requirements; 14.9% CP with (2) or without (3) EAA infusion; or 13.5% CP diet with (4) or without (5) EAA infusion. All diets contained alfalfa silage, corn silage, high moisture corn, canola meal, soybean meal and soybean hulls. The EAA solutions were prepared according to AminoCow to provide all limiting EAA in each treatment. Data from the last 4 d of each 14-d period were analyzed using Proc Mixed of SAS. Contrasts and LSM are reported in the table. Cows yielded on average 10 kg less milk than expected, making the 14.9% CP diet not MP limiting according to AminoCow, which may explain why no effect was detected on that diet (contrast 3). The 13.5% CP diet did not differ from the positive control (contrast 2) but the predicted balance of EAA indicated that methionine, lysine and histidine were limiting. Infusion of EAA on this diet overcame the deficiency, which increased ECM and tended to increase milk and protein yield (contrast 4). The NRC (2001) model underestimated MP-allowable milk by, respectively, 2.5, 4.2 and 8.2 kg for the 16, 14.9 and 13.5% CP diets. The number of cows used limited statistical power. However, results suggested that the lowest CP diet with supplemental EAA infusion was the best treatment, indicating the advantage of balancing dairy rations for amino acids.

Table 1.

	Treatment					Contrasts[1]			
Variable	16% CP	14.9% CP + EAA	14.9% CP	13.5% CP + EAA	13.5% CP	1	2	3	4
DMI, kg/d	23.2	22.6	23.7	23.8	23.0	NS	NS	NS	NS
Milk, kg/d	35.6	34.5	35.7	36.7	34.6	NS	NS	NS	<0.10
ECM, kg/d	34.5	33.4	34.9	37.1	33.8	NS	NS	NS	<0.05
Fat, kg/d	1.24	1.19	1.27	1.38	1.22	NS	NS	NS	<0.05
Protein, kg/d	1.00	0.98	1.00	1.05	0.98	NS	NS	NS	<0.10
MUN, mg/dL	12.4	10.5	11.4	9.0	8.9	<0.1	<0.01	NS	NS
EUN (%)	26.3	28.8	27.5	32.1	30.8	NS	<0.01	NS	NS

[1]Contrasts: 1 = 16 vs. 14.9; 2 = 16 vs. 13.5; 3 = 14.9 vs. 14.9 + EAA; 4 = 13.5 vs. 13.5 + EAA.

Key Words: amino acid, nitrogen

W55 Baseline bovine plasma concentrations of free amino acids during lactation. T. A. Burnett*[1], A. M. L. Madureira[1], G. Wu[2], J. R. Thompson[1], and R. L. A. Cerri[1], *[1]University of British Columbia, Vancouver, BC, Canada, [2]Texas A&M University, College Station.*

Amino acids play nutritional and regulatory roles in lactation. At present, little is known about changes in their concentrations in the plasma of lactating cows during the entire lactation period. This study was conducted to fill in this gap of knowledge. Eighty-nine lactating Holstein (40 primiparous and 49 multiparous) cows were used throughout the first 9 mo of lactation. Cows were maintained in free stall barns and fed a TMR diet (CP = 17.8%, MP = 48.3g/DM) twice a day through the entire experiment, this ration was maintained for a minimum of 200 d in lactation. Information on health episodes, reproductive status, age of gestation and milk production was recorded. Blood samples were collected using sodium-heparin vacutainers on 9 different days in milk 0, 3, 7, 15, 30, 60, 90, 180 and 270. Samples were taken in 9 cohorts consisting of different cows at the same stage of lactation. Plasma was analyzed quantitatively for 24 amino acids using HPLC methods involving derivatization with o-phthaldialdehyde. Data were analyzed by ANOVA for repeated measures using Proc MIXED of SAS. GLN, THR, CIT, β-ALA, TAU, ALA, and ORN were not affected by days in milk, milk production or reproductive status ($P > 0.10$). There was an effect of days of lactation on concentrations of ASP, ARG, TYP, TRP, MET, VAL, PHE, ILE, PRO and LYS in plasma ($P < 0.01$). Correlations between free amino acids and days of lactation were all negative ($r^2 = 0.09$ to 0.20; $P < 0.01$) with a major decrease in free amino acids occurring between d 60 and 90 of lactation. Changes in ASN, SER, and GLY depended on both days of lactation ($P < 0.01$) and yield of milk production ($P < 0.01$), but no interactions were found. There were negative correlations ($r^2 = 0.10$ to 0.17; $P < 0.05$) between age of gestation and the following amino acids: TAU, TYR, MET, and PHE. In conclusion, concentrations of specific amino acids in plasma decreased after 60 d in milk, independent of milk production. Stage of gestation also affected the concentrations of TAU, TYR, MET, and PHE. Taken together, these results suggest a basis to develop possible new strategies for improving health, lactation and reproduction of cows.

Key Words: amino acid, dairy cattle, reproduction

W56 An evaluation of amino acid utilization in lactating dairy cows consuming DDGS and different levels of fat. H. A. Paz* and P. J. Kononoff, *University of Nebraska-Lincoln, Lincoln.*

Eight multiparous Holstein cows were used in a replicated 4 × 4 Latin square to determine the lactation response and AA utilization when dairy cows were fed either conventional (12% fat) or low-fat (6.6% fat) distillers dried grains with solubles (DDGS). Dietary treatments were 1) Control (CON), no DDGS, 2) 29% conventional DDGS (DG), 3) 29% low-fat DDGS (LF), and 4) 29% low-fat DDGS plus rumen inert fat (LF+RIF). Diets were formulated to be isonitrogenous (18.5% CP) but not isocaloric. Net energy of lactation was estimated to be 1.59, 1.61, and 1.68 Mcal/kg of DM for the LF, CON and LF+RIF, and DG diets, respectively. Periods lasted 21 d with the last 3 d for data collection. Compared with cows fed the CON diet, cows fed diets with DDGS had a greater ($P = 0.03$) DMI (22.7 vs. 26.6 ± 1.14 kg/d) and similar ($P = 0.26$) milk yield (31.8 ± 3.0 kg/d). Milk protein percentage was greater in cows fed diets with DDGS ($P = 0.01$) compared with those fed the CON diet (3.22 vs. 3.09 ± 0.08%) and milk fat percentage was lower ($P = 0.01$) in cows fed the DG diet compared with those fed the other diets (3.14 vs. 3.74 ± 0.18%). Arterial concentration of Lys was similar (11.7 ± 0.96 μg/mL; $P = 0.83$) across diets and concentrations of Leu (38.8 ± 2.62; $P < 0.01$), Met (3.77 ± 0.21 μg/mL; $P < 0.01$), and

Phe (10.9 ± 0.49; $P = 0.03$) increased in diets with DDGS compared with the CON diet (27.9 ± 2.62, 2.96 ± 0.21, and 9.61 ± 0.49 µg/mL, respectively). Arteriovenous differences of essential AA were similar ($P \geq 0.19$) across diets. Extraction efficiencies of Lys and Met did not differ across diets and averaged 59.8 ± 4.84% ($P = 0.54$) and 57.3 ± 0.36% ($P = 0.36$), respectively. For cows fed the CON diet, Met was ranked as the first limiting AA followed by Lys and the opposite was observed for cows fed diets with DDGS. Across diets, Arg was the third limiting AA. Low-fat DDGS can be included at high levels without negative effects on milk yield and milk fat percentage. Despite the fact that diets containing DDGS resulted in a lower supply of lysine, physiological indicators of lysine utilization were not affected.

Key Words: dairy cow, distillers dried grains with solubles, extraction efficiencies

W57 Estimation of the metabolizable methionine contribution of four rumen-protected products using the AUC methodology. L. Faivre[1], Y. Mercier[1], E. Devillard[1], and B. K. Sloan*[2], *[1]Adisseo France, Commentry, France, [2]Adisseo North and Central America, Alpharetta, GA.*

Methionine is one of the most limiting amino acids (AA) for milk protein synthesis and is critical achieving a well-balanced ration for AA. Because the required dietary metabolizable methionine (MMet) concentrations cannot be reached by using conventional feedstuffs, various rumen protected methionine (RPM) sources have been developed. To be effectively used, these RPM sources need to be well characterized for their real contribution of MMet. The aim of the present study was to measure the MMet contribution of 4 RPM products MetaSmart (Adisseo, France), AminoShure-M (Balchem, USA), Pro-Met (Bioscreen, Italy) or a prototype product (Adisseo, France), using the Area Under the Curve (AUC) methodology described by Graulet et al. (2005). Eight nonlactating rumen cannulated Holstein cows fed 75% hay and 25% concentrate were used in a replicated incomplete Latin Square design with 4 periods of one week. They received a spot dose of 50g equivalent methionine via the rumen cannula. Blood samples for methionine concentration assessment were obtained from 8 h before and until 72 h after the spot dose. The AUCs were used to estimate the percentage of MMet. An ANOVA with repeated measures was performed using PROC MIXED of SAS/ STAT software (SAS 9.1.3; SAS Institute Inc., Cary, NC). The proportion of methionine reaching the blood stream was calculated at 54.1 ± 5.9% for MetaSmart, which was consistent with previous data (52.3 ± 3.4%, Graulet et al., 2005). AminoShure-M was statistically lower ($P < 0.001$) than Metasmart and evaluated at 42.4 ± 6.5%. Pro-Met measured at 12.2 ± 4.7% was also significantly lower than AminoShure-M. As for the bioavailability of the prototype product, it was not statistically different from MetaSmart bioavailability and was calculated at 57.4 ± 4.3%. This study suggests that MMet contribution of different RPM can be very variable, and products need to be characterized by approved methodologies to determine their real MMet contribution for an optimal usage.

Key Words: metabolizable methionine, rumen-protected amino-acids, area under the curve

W58 A controlled on farm evaluation of methionine for lactating dairy cows. N. N. Morais Junior[1], G. G. S. Salvati[1], R. C. Oliveira[1], R. A. N. Pereira[2], and M. N. Pereira*[1], *[1]Universidade Federal de Lavras, Lavras, MG, Brazil, [2]Empresa de Pesquisa Agropecuária de Minas Gerais, Lavras, MG, Brazil.*

Controlled on farm trials allows for large number of experimental units. We evaluated the response to the isopropyl ester of 2-hydroxy-4-(methylthio) butanoic acid (HMBi, MetaSmart, Adisseo). Cows were paired blocked and randomly assigned to 2 pens of primiparous and 2 of multiparous, in free stalls. The final data set had 234 Holsteins (215 ± 105 DIM at d 26), 96 primiparous and 138 multiparous. Within parity, a pen received HMBi (30g/d) added to a Control diet. Soybean meal and heated soybeans were the major protein sources. HMBi was manually mixed to the first daily feed delivery by 4 researchers housed at the farm along the experiment. The same batch of TMR was fed to all pens. Cows were fed and milked 3x/d. Milk yield on 3 consecutive days was used for blocking and as covariate in the statistical model. Treatments were offered for 28d and response was evaluated on d 24 to 28. Diets were sampled at each feeding in 5 locations of the feed bunk. Composite TMR samples were frozen. Feed refusals were measured, sampled and frozen. Data was analyzed with Mixed as a randomized block design and intake data used pen as replicate and sampling day as repeated measures over time. The CP of the consumed diet was 17.1% of DM ($P = 0.71$), orts 5.3% of offered ($P = 0.64$), and DMI 19.3 kg/d ($P = 0.59$). Cows had similar BCS and girth perimeter ($P > 0.21$). Milk yield before treatment allocation was 34.6 kg/d ($P = 0.95$) and 34.7 on d 24 to 28 ($P = 0.83$). HMBi increased protein yield (1.096 vs.1.049 kg/d, $P = 0.05$) and content (3.18 vs. 3.07%, $P = 0.03$). PUN was reduced by HMBi (13.9 vs.15.6 mg/dL, $P = 0.02$), but MUN did not respond (15.7 vs.16.4 mg/dL, $P = 0.20$). The urinary allantoin to creatinine ratio was increased by HMBi ($P = 0.03$). HMBi increase the plasma content of 11 amino acids at $P < 0.01$, 2 at $P < 0.07$, and cysteine ($P = 0.60$) and lysine ($P = 0.18$) had non-statistical increases. The total of plasma amino acids was increased by 10.4% of Control ($P < 0.01$), methionine increased by 30.8% ($P < 0.01$), and the increase in other amino acids ranged from 4.4 to 19.2%. HMBi decreased PUN, and increased microbial yield, plasma amino acids, and milk protein yield and content.

Key Words: amino acid, methionine, protein

W59 Forages fertilized with selenium as a way to supplement lactating dairy cows. R. Seboussi*[1], G. F. Tremblay[2], P. Y. Chouinard[1], Y. Chorfi[3], G. Bélanger[2], Y. Couture[3], V. Ouellet[1], and E. Charbonneau[1], *[1]Université Laval, Québec, QC, Canada, [2]Agriculture and Agri-Food Canada, Québec, QC, Canada, [3]Université de Montréal, St-Hyacinthe, QC, Canada.*

Fertilization with Se improves the forage Se concentration, but no data on its impact on lactating cows are available. This study aimed to determine the effect of forages fertilized with Se on the performance of lactating dairy cows. A high Se grass and legume silages (1.5 ppm Se) were produced by fertilizing one fourth of forage fields with 2.5 kg/ha of Selcote Ultra (1% Se wt/wt). The low Se silages (0.06 ppm) were harvested from the remaining area. Thirty-three mid- to late-lactation primiparous Holstein cows were used in an unbalanced randomized block design. Each block of cows entered the experiment when enough animals with similar DIM were available and an average 77-d period of Se-depletion was performed. Cows were then randomly assigned for 42 d to one of the 4 experimental TMR fed ad libitum with diets based as follows: CTRL = low Se silages; ISe = low Se silages supplemented with inorganic Se (sodium selenite); OSe = low Se silages supplemented with organic Se (Sel-Plex); FSe = high Se silages. Pre-planned contrasts were tested: (1) CTRL vs. Se-supplemented diets; (2) ISe vs. OSe and FSe; (3) OSe vs. FSe. The CTRL diet (0.12 ppm) had a lower ($P < 0.001$) Se concentration than ISe (0.70 ppm), OSe (0.79 ppm) and FSe (0.80 ppm) diets, which did not differ statistically in Se concentration. No treatment effects were observed on DMI, milk yield, ECM, FCM and

milk fat and lactose concentrations. Cows fed the ISe diet had lower (P = 0.01) milk protein concentration (3.44%) than cows fed OSe (3.58%) and FSe (3.51%) diets but their milk protein yields were similar. Higher SCC were observed for cows fed CTRL than Se supplemented diet (P = 0.05) but the form of Se supplement had no significant effect. Blood glutathione peroxidase was similar between treatments. Apparent Se digestibility was similar in cows fed CTRL (42.5% of intake) and Se-supplemented diets but it was lower (P = 0.04) in cows fed the ISe diet (38.6%) than OSe (42.2%) and FSe (49.8%) diets. Apparent Se digestibility tended (P = 0.07) to be greater in cows fed the FSe than the OSe diet. Forages fertilized with Se are therefore an effective way to provide adequate levels of dietary Se to dairy cows.

Key Words: lactating cow, selenium, forage

W60 Effect of feeding various dosages of *Saccharomyces cerevisiae* fermentation product on serum markers of the innate and adaptive immune system of multiparous dairy cows. C. M. Shriver-Munsch[1], E. M. Zaworski[1], A. N. Fadden[1], W. K. Sanchez[2], I. Yoon[2], and G. Bobe*[1,3], *[1]Oregon State University, Corvallis, [2]Diamond V Mills, Cedar Rapids, IA, [3]Linus Pauling Institute, Corvallis, OR.*

We previously documented that feeding 56 or 112 g/d of *Saccharomyces cerevisiae* fermentation product (SCFP; Original XP) to transition dairy cows resulted in lower somatic cell counts in milk and lower incidence of clinical mastitis. The objective of this study was to examine how feeding SCFP may improve mammary gland health in transition dairy cows on a commercial dairy farm. Multiparous Holstein cows were given individually a supplement containing either 0 (control: n = 14), 56 (n = 15), or 112 g (n = 13) of SCFP daily during morning lock-up as a top dressing to their total mixed ration. The supplement consisted of 0, 56, or 112 g of XP mixed with 84 g of molasses and 168, 112, or 56 g of corn meal, respectively. Supplement feeding began 28 d before predicted calving date (at least 14 d prepartum) and ended 28 d postpartum. Blood samples were collected weekly and more often around calving to measure serum concentrations of markers of innate (haptoglobin and serum amyloid A) and adaptive immunity (IgG, IgM, and IgA). Feeding SCFP (112 or 56 versus 0 g/d) tended to decrease serum concentrations of serum amyloid A in the last week before calving (13.9 versus 23.4 mg/L; P = 0.06) and increased it in the first week after calving (180 versus 82 mg/L; P = 0.02). Doubling feeding rates of SCFP (112 versus 56 g/d) decreased serum haptoglobin concentrations prepartum (3.4 versus 4.5 mg/L; P = 0.03). Feeding SCFP (112 or 56 versus 0 g/d) tended to decrease serum concentrations of IgM (2.38 ± 0.17 g/L versus 2.93 ± 0.25 g/L; P = 0.07). Our results suggest that feeding *Saccharomyces cerevisiae* fermentation product may alter immune function during the transition period.

Key Words: acute phase protein, immunoglobulin, yeast culture

W61 Effect of feeding various dosages of *Saccharomyces cerevisiae* fermentation product on serum concentrations of macrominerals of multiparous dairy cows. A. N. Fadden[1], E. M. Zaworski[1], C. M. Shriver-Munsch[1], W. K. Sanchez[2], I. Yoon[2], and G. Bobe*[1,3], *[1]Oregon State University, Corvallis, [2]Diamond V Mills, Cedar Rapids, IA, [3]Linus Pauling Institute, Corvallis, OR.*

Feeding 56 g/d of *Saccharomyces cerevisiae* fermentation product (SCFP; Original XP) to transition dairy cows has been reported to promote feed consumption around calving. We hypothesized that greater feed intake may be reflected in improved macromineral status. To test this hypothesis, multiparous Holstein cows were given individually a supplement containing either 0 (control: n = 14), 56 (n = 15), or 112 g (n = 13) of SCFP daily during morning lock-up as a top dressing to their total mixed ration. The supplement consisted of 0, 56, or 112 g of XP mixed with 84 g of molasses and 168, 112, or 56 g of corn meal, respectively. Supplement feeding began 28 d before predicted calving date (at least 14 d prepartum) and ended 28 d postpartum. Blood samples were collected at days −21, −14, −7, −3, −1, −1, 0, 1, 3, 7, 14, 21, and 28 postpartum to measure serum concentrations of calcium, magnesium, and phosphorus. Feeding SCFP (112 or 56 vs. 0 g/d) increased serum concentrations of phosphorus during the supplementation period (6.43 ± 0.11 mg/dL vs. 6.09 ± 0.14 mg/dL; P = 0.03) and calcium in the 48 h around calving (8.26 ± 0.19 mg/dL vs. 7.88 ± 0.18 mg/dL; P = 0.04). Whereas, feeding SCFP (112 or 56 versus 0 g/d) decreased serum concentrations of magnesium (2.49 ± 0.04 mg/dL versus 2.65 ± 0.05 mg/dL; P = 0.005) without reaching levels that may influence feed intake. Doubling feeding rates of SCFP (112 versus 56 g/d) did not significantly alter serum concentrations of calcium, magnesium, and phosphorus (P > 0.10). Our results suggest that feeding *Saccharomyces cerevisiae* fermentation product may be beneficial during the transition period to support the macromineral status of dairy cows.

Key Words: dairy, macromineral, yeast culture

W62 Effect of feeding various dosages of *Saccharomyces cerevisiae* fermentation product on serum indicators of feed intake of multiparous dairy cows. E. M. Zaworski[1], A. N. Fadden[1], C. M. Shriver-Munsch[1], W. K. Sanchez[2], I. Yoon[2], and G. Bobe*[1,3], *[1]Oregon State University, Corvallis, [2]Diamond V Mills, Cedar Rapids, IA, [3]Linus Pauling Institute, Corvallis, OR.*

We previously documented that feeding 56 or 112 g/d of *Saccharomyces cerevisiae* fermentation product (SCFP; Original XP) to transition dairy cows improved SCFP consumption on the day of calving. The objective of this study was to examine how feeding SCFP may improve feed consumption in transition dairy cows. On a commercial farm, multiparous Holstein cows were given individually a supplement containing either 0 (control: n = 14), 56 (n = 15), or 112 g (n = 13) of SCFP daily during morning lock-up as a top dressing to their total mixed ration. The supplement consisted of 0, 56, or 112 g of XP mixed with 84 g of molasses and 168, 112, or 56 g of corn meal, respectively. Supplement feeding began 28 d before predicted calving date (at least 14 d prepartum) and ended 28 d postpartum. Blood samples were collected at days −7, −3, −1, −1, 0, 1, 3, and 7 postpartum to measure serum concentrations of markers of stress (cortisol), inflammation (haptoglobin and serum amyloid A), hunger (visfatin), and energy status (insulin, glucose, BHBA, and NEFA). Feeding SCFP (112 or 56 versus 0 g/d) decreased serum concentrations of cortisol (1.2 vs. 1.9 µg/L; P = 0.007). Feeding SCFP tended to decrease serum concentrations of serum amyloid A before calving (12.6 vs. 20.8 mg/L; P = 0.09) and increased it after calving (162 vs. 75 mg/L; P = 0.04). Doubling feeding rates of SCFP (112 vs. 56 g/d) tended to decrease serum haptoglobin concentrations (7.8 vs. 11.2 mg/L; P = 0.09). No significant effects at $P \leq 0.10$ were observed for serum concentrations of visfatin, insulin, glucose, BHBA, and NEFA. Our results suggest that feeding *Saccharomyces cerevisiae* fermentation product may improve feed intake around calving in part by decreasing cortisol secretion.

Key Words: cortisol, feed intake, yeast culture

W63 Effect of applying a bacterial inoculant to corn silage on the performance of lactating dairy cows. O. C. M. Queiroz[1], F. C. Basso[2], R. Daetz[1], A. Schlaefli[1], J. J. Romero[1], J. H. Shin[1], F. H. Kamada[2], U. Carneiro[2], and A. T. Adesogan*[1], *[1]Department of Animal*

Sciences, IFAS University of Florida, Gainesville, [2]Department of Animal Sciences, UNESP, Jaboticabal, Sao Paulo, Brazil.

The objective was to determine the effect of applying a bacterial inoculant to corn silage on the performance of dairy cows. Corn silage was harvested at 35% DM, treated with or without 150,000 cfu/g of fresh forage of an inoculant containing *Lactococcus lactis* SR 3.54, *Lactobacillus plantarum* CHCC6072, and *Enterococcus faecium* M74 (Chr. Hansen, Denmark) and ensiled in 2 3.7-m wide plastic bags for 186 d. Sixty lactating dairy cows (20 ± 4 DIM) were blocked by parity and milk production and randomly assigned to treatments. Cows were fed a common diet for a 10-d covariate period followed by a 90-d experimental period when a TMR consisting of 35% corn silage, 11% alfalfa hay and 54% of a concentrate was fed. Milk production and DMI of individual cows were recorded daily. Milk and feed ingredients were sampled weekly and chemically characterized. Cows were dosed with chromic oxide for 10 d and fecal samples were collected in the last 5 d to estimate in vivo apparent digestibility. The data was analyzed as a randomized complete block design and the statistical model included treatment, time (repeated), parity, and the interactions. Compared with cows fed silage without inoculant, cows fed inoculated silage had greater yields of milk (38.4 vs. 37.4 kg/d; SEM = 0.23), FCM (38.2 vs. 37.3 kg/d; SEM = 0.22), fat (1.33 vs. 1.30 kg/d; SEM = 0.01) and lactose (1.91 vs. 1.82 kg/d; SEM = 0.01) and greater FCM:DMI ratio (1.72 vs. 1.54 kg/d; SEM = 0.02). Daily DMI (23.2 vs. 25.3 kg/d; SEM = 0.14) and concentrations of milk fat (3.43 vs.3.48%; SEM = 0.01) and protein (2.82 vs. 2.93%; SEM = 0.005) were lower in cows fed the inoculated silage versus the no inoculated silage diet. However, DM (70.7 vs. 71.6%; SEM = 0.92) and NDF digestibility (56.9 vs. 58.6%; SEM = 1.1) were unaffected by treatment. In conclusion, applying the inoculant to corn silage increased milk production and efficiency of feed utilization by lactating dairy cows.

Key Words: silage inoculant, milk yield, *Lactococcus*

W64 Use of virginiamycin and rumen-protect fat, and its association in the diet of crossbred dairy cows grazing tropical pastures. R. C. Silva[1], B. Pessim[3], L. A. Souza[3], J. A. Alves Neto[1], J. M. B. Benatti*[1], A. D. Moreira[1], A. F. Campos[1], P. H. Gonçalves[3], R. D. Signoretti[2], and G. R. Siqueira[2], *[1]Universidade Estadual Paulista – FCAV, Jaboticabal, São Paulo, Brazil, [2]Agencia Paulista de Tecnologia dos Agronegócios - Alta Mogiana, Colina, Sâo Paulo, Brazil, [3]Centro Universitário de Barretos, Barretos, São Paulo, Brazil.*

The study aimed to evaluate virginiamycin (VM), rumen-protected fat (RPF) and its association in the production of dairy cows supplemented and maintained on pasture under rotational stocking Tanzania. A total of 16 crossbred Holstein × Zebu cows (predominantly 3/4 grade of Holstein blood), average live weight of 500 kg, with production at the beginning of the experiment 20 kg / day were distributed in 4 4 × 4 Latin square. The experimental area was 24 paddocks with 1.750 m^2 (total of 4.2 ha) formed with *Panicum maximum* 'Tanzania', irrigated and managed grazing system in flash. The supplement was made up of citrus pulp (79.8 g/kg), soybean hulls (21.7 g/kg), corn germ (256.5 g/kg), peanut meal (30.2 g/kg) refinazil (114.0 g/kg), corn (430.0 g/kg) and mineral core doped Factor Premium (Premix, Patrocinio Paulista-SP) (67.8 g/kg). Treatments consisted of control; VM (35 mg/kg of concentrate) RPF protected fat soybean oil (1% DM of concentrate) and VM (35 mg/kg of concentrate) associated with RPF (1% DM of concentrate), the experimental unit was the animal. The variables were analyzed using the SAS software (version 9.0) using the PROC MIXED considering significant difference $P < 0.10$. There was no interaction for any of the variables ($P > 0.10$). The inclusion of RPF did not affect milk production ($P = 0.155$), with an average of 17.17 kg/d, the VM has increased from 16.92 to 17.42 kg/d ($P = 0.087$). In milk yield corrected for 4% of fat, the use VM increased milk production at 0.66 kg/d ($P = 0.034$) and RPF decreased by inclusion of 0.75 kg/d ($P = 0.017$). The inclusion of RPF decreased ($P < 0.10$) percentages of total solids, lactose and nonfat dry extract and did not alter the percentages of fat, protein and milk urea nitrogen. The VM reduced the protein ($P = 0.098$) and did not alter the other characteristics of milk. The virginiamycin supplementation in dairy cows grazing grass Tanzania increases milk production while maintaining quality. The use of RPF reduced milk production correct for 4% of fat.

Key Words: fodder, milk additive, supplement

W65 Influence of an antioxidant supplementation on adipose and liver transcriptome in early lactation dairy cattle. J. McNamara*[1], S. Shields[1], J. Thomson[2], and E. von Heimendahl[3], *[1]Washington State University, Pullman, [2]Montana State University, Bozeman, [3]Lohmann Animal Health GmbH, Cuxhaven, Germany.*

Vitamin E supplementation to dairy cattle can support a stronger immune and inflammatory system, but is expensive and can itself be oxidized. Antioxidants scavenge the reactive oxygen species in feed and could spare vitamin E in the ration. Therefore, greater amounts of vitamin E are absorbed and are available for the endogenous radical defense system. Our objective was to test the effect of inclusion of an antioxidant added to the feed to reduce the vitamin E necessary to maintain production and health of lactating dairy cattle. In addition we were interested to know if vitamin E could alter the expression of key immune or inflammatory functional genes in adipose and liver. The study was a randomized complete block, and cows were fed a TMR ad libitum to requirements from 14 to 84 d postpartum. Twenty cows each were allotted to 3 treatments; a control ration containing 1000 IU/kg vitamin E; the same ration with 150 mg antioxidant (Loxidan, Lohmann Animal Health, Cuxhaven) per kg DM or a ration with 3000 IU/kg vitamin E. Adipose and liver samples were taken at 7 and 28 DIM, RNA was prepared and samples were analyzed on the Affymetrix Bovine gene array chip, with the data analyzed using Genesifter by Geospiza. Plasma Vitamin E was higher ($P < 0.01$) in higher vitamin E compared with control with or without Loxidan. In primiparous animals, milk production was highest ($P < 0.01$) in animals on the high vitamin E, intermediate on low vitamin E with Loxidan and lowest on control. In the adipose transcriptome showed 27 genes improving response to stress that increased in animals fed Loxidan; in the liver 18 genes controlling antioxidant activity increased in animals fed Loxidan ($P < 0.05$ for all). Higher vitamin E feeding showed 5 genes controlling immune processes increased compared with control. The advanced oxidation protein products were lower ($P < 0.05$) in higher vitamin E or Loxidan-Low vitamin E compared with controls. A lower inclusion rate of vitamin E can be fed if the diet is additionally protected with antioxidants to maintain production and may improve immune and inflammatory status.

Key Words: vitamin E, lactation, antioxidant

W66 Effect of *Saccharomyces cerevisiae* live cells on milk yield and digestibility of buffalo cows. F. Masucci[1], G. De Rosa[1], CMA Barone[1], P. Parente[1], ML Varricchio[1], A. Di Francia[1], and E. Chevaux*[2], *[1]Università di Napoli Federico II, Dipartimento di Agraria, Portici (NA), Italy, [2]Lallemand SAS, Blagnac, France.*

The effects of *Saccharomyces cerevisiae* strain CNCM I-1077 dietary supplementation were examined in lactating buffalo cows. On a farm

in Caserta province, 44 buffalo cows were divided into Control and Saccharomyces groups balanced for age (on average, 52.7 ± 2.1 mo), days in milk (120 ± 64 d) and milk production (9.2 ± 1.37 kg/head/d). The groups were fed the same total mixed ration (TMR) that was supplemented, in Saccharomyces group, with 50 g/day of yeast supplement (Levucell SC), corresponding to 10×10^9 cfu/day live cells. The experimental period lasted 16 weeks. At the beginning and at the end of this period, each cow was weighted and scored for BCS. Every 2 weeks milk yield of each cow was measured and sampled; DMI was also evaluated on pen basis. At the end of experimental period, total tract in vivo digestibility was evaluated by using acid insoluble ash as indigestible marker. Milk traits and estimated mozzarella cheese yield were analyzed by a linear mixed model for repeated measures including the effects of diet, time and the interaction diet*time. The effect of diet on DMI, BCS and digestibility coefficients were analyzed by one-way ANOVA. No differences ($P > 0.05$) were found between the dietary groups for live weight (663.0 vs. 689.6 kg, respectively for Control and Saccharomyces group, SEM 11.8) and BCS (6.33 vs. 6.11 SEM 0.39). Saccharomyces supplemented cows presented higher ($P < 0.05$) TMR-DMI (16.1 vs. 16.5 kg/d, SEM 0.11) and milk yield (7.6 vs. 8.3 kg/head/d, SEM 0.251). Although milk fat (9.10 vs. 9.64%, SEM 0.254) and milk protein (5.39 vs. 5.34%, SEM 0.10) were not influenced by the treatment ($P > 0.05$), Saccharomyces group had greater ($P < 0.01$) estimated mozzarella yield (2.17 vs. 2.45 kg/d SEM 0.075). Total tract in vivo digestibility coefficients of dry matter, organic matter, crude protein and NDF were significantly higher in Saccharomyces compared with Control group. Overall, live yeast supplementation to lactating buffaloes significantly increased milk production, without decreasing milk quality, live weight and BCS.

Key Words: buffalo cow, live yeast, milk production

W67 Effects of arginine concentration on the in vitro expression of casein and mTOR pathway related genes in mammary epithelial cells from dairy cattle. M. Z. Wang[1,2], B. L. Xu[1], D. P. Bu[2], J. Q. Wang[2], and J. J. Loor*[3], *[1]Yangzhou University, Yangzhou, China, [2]State Key Laboratory of Animal Nutrition, Beijing, China, [3]University of Illinois, Urbana.*

Arginine is a conditionally-essential amino acid that is taken up by bovine mammary gland in excess of its output in milk. In this study we evaluated the effects of arginine level on the expression of casein and signaling pathway-related genes in mammary epithelial cells. The treatments (applied for 24 h) were designed to be devoid of Arg 0X (control; 0.00 mg/L), resemble the profile of Arg in casein (Arg 1X; 278.00 mg/L), be deficient, Arg 0.25X; 69.50 mg/L) and Arg 0.5X (139.00 mg/L), or be in excess of the amount in casein, Arg 2X (556.00 mg/L), Arg 4X (1,112 mg/L), and Arg 8X (2,224 mg/L). Cultures were run in triplicate for each treatment. An ANOVA with Arg level as fixed effect and replicate as random effect was used for statistical analysis. Treatment means were separated using Fisher's least significant difference pair-wise comparisons. The expression of CSN1S, CSN3 and mTOR in the experimental groups was higher than those of the control group ($P < 0.05$). Except for Arg 0.25X and Arg 8X ($P > 0.05$), the expression of CSN1S2, CSN2 and JAK2 in other experimental groups was higher ($P < 0.05$) than those in the control group. Except for Arg 8X ($P > 0.05$), the expression of STAT5 in the other experimental groups was higher than those of the control group ($P < 0.05$). It was also observed that, except for Arg 0.5X, S6K expression was higher in other experimental groups than the control group ($P < 0.05$). In contrast, except for Arg 0.25X, the other experimental groups resulted in lower 4EBP1 expression than the control group ($P < 0.05$). Among groups, the expression of CSN1S1, CSN1S2, CSN2, CSN3, JAK2, STAT5, mTOR and S6K gene was highest with Arg 2X ($P < 0.05$); the reverse was true for 4EBP1 gene, with the lowest expression in this group ($P < 0.05$). Taken together, arginine appears to play an important role in the transcriptional regulation of casein genes and mTOR related genes in bovine mammary epithelial cells.

Key Words: mammary, milk protein, nutrition

W68 Essential amino acid signal on translation regulation pathways in mammary tissue. S. I. Arriola Apelo*[1], L. M. Singer[1], X. Lin[2], and M. D. Hanigan[1], *[1]Department of Dairy Science, Virginia Polytechnic Institute and State University, Blacksburg, [2]Animal Science and Technology College, Shandong Agriculture University, Shandong Province, China.*

Signaling pathways regulate rate of protein translation in the mammary gland. The quantitative effects of Ile, Leu, Met, and Thr on mammalian target of rapamycin (mTOR) and eukaryotic initiation factor (eIF) 2 pathways were studied with a central composite design consisting of 4 central runs, 2 axial runs per AA, and a complete 2^4 factorial. The central run was set to 35% of the concentration of Dulbecco's Modified Eagle Medium (DMEM) for each of the above AA. Axial runs were set to 0 and 100% of DMEM. Factorial runs were set at 20 and 50% of DMEM. Mammary tissue slices (0.12 ± 0.02 g) from 5 lactating dairy cows were incubated 4 h at 37°C in 5 mL of treatment media enriched with [$^2H_5$] Phe. Western immunoblotting was performed to identify total and site-specific phosphorylated mTOR (Ser2448), eukaryotic elongation factor (eEF) 2 (Thr56), ribosomal protein (rp) S6 (Ser235/236), and eIF2a (Ser51). The statistical model included individual AA linear and quadratic effects and one-way interactions as fixed continuous effects, and cow as a random effect. Neither linear and quadratic amino acid effects nor interactions among them were significant for eIF2a (Ser51) phosphorylation. In the mTOR pathway, AA did not affect mTOR phosphorylation. However, phosphorylation of eIF2 and mTOR were negatively correlated (−0.28, $P < 0.001$) as expected. Downstream of mTOR, Leu ($P = 0.027$) inhibited eEF2 phosphorylation, which is known to stimulate translation elongation. The effect of Leu tended to be affected by concentrations of Ile (Leu*Ile, $P = 0.058$) and Thr (Leu*Thr, $P = 0.093$). Phosphorylation of mTOR was negatively correlated with that of eEF2 (0.31, $P < 0.001$). Interestingly, rpS6 phosphorylation was linearly affected by concentrations of Ile (Ile, $P = 0.013$), but not of Leu, and this response was affected by Thr (Ile*Thr, $P = 0.007$). Phosphorylation of rpS6 and eEF2 were negatively correlated (0.38, $P < 0.001$), and the former tended to be correlated with mTOR phosphorylation (0.15, $P < 0.086$). These results are in agreement with previous ones where independent effects of Leu and Ile on translation regulation were observed.

Key Words: essential AA, mTOR pathway, protein translation

W69 Effects of two different ruminant methionine technologies on milk and milk component production across a range of metabolizable methionine adequacy. R. S. Ordway*[1], C. G. Schwab[2,3], B. K. Sloan[4], and N. L. Whitehouse[2], *[1]Balchem Corporation, New Hampton, NY, [2]University of New Hampshire, Durham, [3]Schwab Consulting LLC, Boscobel, WI, [4]Adisseo North and Central America, Alpharetta, GA.*

Methionine is often considered the first limiting AA in dairy cow diets and providing more metabolizable Met (MP-Met) in diets in the form of ruminant Met products may have positive consequences on lactational performance and the efficiency of utilization of metabolizable protein

(MP). Ruminant Met products can only be used effectively in ration formulation if they are well characterized in terms of the quantity of MP-Met they provide per unit of product and it is reasonable to assume that diets adequate in MP-Met would not elicit a milk or milk component response to additional MP-Met. Forty multiparous lactating Holstein dairy cows were used in a replicated randomized complete block split plot 5 × 5 Latin square design with a 2 × 2 × 5 factorial arrangement of treatments. The main effects were (1) 2 levels of dietary Met adequacy [Limiting (L) or Adequate (A)]; (2) 2 forms of dietary Met (encapsulated DL-Met, Smartamine M (S), or the dry isopropyl ester of the Met analog, MetaSmart (M); and (3) 5 incremental levels (0, 3, 6, 9, or 12 g/d) of supplementary estimated MP-Met. The basal diets were formulated to meet NRC (2001) requirements for energy and nutrients and were identical except for predicted Met in MP (L: 1.81% and A: 2.31%). The Lys to Met ratios in MP for the L and A diets were 3.73:1 and 2.94:1, respectively. Smartamine M was used to make the basal diet adequate in MP-Met and significance was declared at $P < 0.05$. There were no differences in DM intake, milk fat yield, or milk urea N across treatments. There was a linear decrease in milk yield, protein yield, and lactose yield and a linear increase in fat concentration for AS. There was a linear increase in milk protein concentration for both LS and LM and a linear increase in milk protein yield for LM only. The results of this research indicate that the Met status of the basal diet and the source of supplemental dietary Met affect the response in milk and milk component production differently and also provide evidence that Met analogs are metabolized differently than DL-Met.

Key Words: methionine, methionine analogue, amino acids

W70 Performance and health of Holstein dairy calves fed Peptide Powder 80 or hydrolyzed wheat protein as alternative protein sources in milk replacers. H. Chester-Jones*[1], D. Dean[2], D. Ziegler[1], K. Halpin[2], M. Raeth-Knight[3], and D. Carlson[4], *[1]University of Minnesota Southern Research and Outreach Center, Waseca, [2]International Ingredient Corporation, St. Louis, MO, [3]University of Minnesota, St. Paul, [4]Milk Products, Chilton, WI.*

One-hundred twelve (2–4 d old) individually fed Holstein heifer calves (39.7 ± 0.7 kg) were randomly assigned to 1 of 4 treatments in January, 2012 to evaluate pre- (d 1 to 42) and post-weaning (d 43 to 56) calf performance and health when partially replacing milk protein in milk replacers (MR) with Peptide Powder 80 or hydrolyzed wheat protein. Peptide Powder 80 (International Ingredient Corp., St. Louis, MO) is a novel protein source designed for MR made up of hydrolyzed vegetable proteins and yeast (80% CP, % DM). All calves were fed a non-medicated 20% protein:20% fat MR at 0.284 kg in 1.99 L water (12.5% solids) 2× daily for the first 35 d and 1× daily from d 36 to weaning at d 42. Calf starter (CS; 18% CP, as-fed) and water were offered free choice d 1 to 56. Day 1 to 14, 1:1 neomycin:oxytetracycline was added to the MR solution to provide 22 mg/kg BW/d. Lysine and total sulfur amino acid concentrations in MR were balanced across all treatments with the use of synthetic AA. Treatments (TRT) were (1) Control all milk MR; (2) MR with 33% of the CP replaced by hydrolyzed wheat protein; (3) MR with 33% of the CP replaced by Peptide Powder 80; and (4) MR with 33% of the CP replaced by Peptide Powder 80 and additional Thr and Trp to be equivalent to TRT 1. There were no pre- or post-weaning ADG, CS, DMI and hip height (HH) differences ($P > 0.05$). Overall 56 d total BW gain, CSI, DMI and HH gain averaged 36.9 kg, 47.2 kg, 68.4 kg and 10.25 cm, respectively. Gain:feed (d 1 to 56) was higher ($P < 0.05$) for calves on TRT 2 (0.56) vs. those fed TRT 3 and 4 (0.53), but G:F did not differ between TRT 1 calves (0.54) and calves fed TRT 3 or 4. There were no TRT differences in scouring d and treatment costs. Under the conditions of this study, partially replacing milk protein in MR with Peptide Powder 80 or hydrolyzed wheat protein resulted in similar calf performance.

Key Words: Holstein calves, milk replacer protein sources, performance

W71 Effects of feeding LysiPEARL and rumen-protected lysine sources on plasma lysine concentration in lactating dairy cows. W. D. Weich*[1], K. F. Kalscheur[1], F. R. Valdez[2], and C. A. Macgregor Jr.[3], *[1]South Dakota State University, Brookings, [2]Kemin Industries, Inc., Des Moines, IA [3]Soy Best, West Point, NE.*

A common method to balance for metabolizable protein lysine in lactating dairy cows is to feed commercial sources of rumen-protected (RP) lysine. The objective of these experiments was to evaluate the effects of feeding a source of RP-lysine on plasma lysine. In the first experiment, 40 Holstein cows were fed a common diet randomly assigned to one of 5 topdress treatments: (1) Control, (2) Lysine HCl, (3) Aminoshure-L (Balchem Inc., New Hampton, NY), (4) LysiPEARL (Kemin Industries Inc., Des Moines, IA), and (5) USA Lysine (Kemin Industries Inc.). Each lysine treatment provided 150 g/h/d of lysine HCl and were blended into 900 g of ground corn and fed so treatments were consumed before availability of the daily TMR. Jugular blood samples were taken at 2 h intervals starting at feeding and analyzed for plasma amino acid (AA) concentration. Responses of plasma lysine concentrations compared with control were summed for each plasma collection to demonstrate overall change. Cows fed LysiPEARL (171 mg/dL) and USA LYSINE (256 mg/dL) had greater ($P < 0.10$) lysine concentrations, while cows fed Aminoshure-L (40 mg/dL) and Lysine HCl (86 mg/dL) were not different ($P > 0.10$) from cows fed Control. In the second experiment, LysiPEARL was added to fresh soy gums which were then added to mechanical extracted soybean meal (MES) (Soy Best; West Point, NE). Eight Holstein dairy cows were randomly assigned to one of 2 treatments. The first treatment diet contained 2.27 kg MES fortified with LysiPEARL (TRT), while the second treatment contained 2.27 kg MES without the LysiPEARL addition (CON). Diets were fed for 8 d and jugular blood samples were collected at 0.5 h before feeding and at 2 h intervals for 20 h on d −1 and d 8. Plasma AA data were summarized and expressed as a change from baseline determined on d −1. Plasma lysine for cows fed TRT (33.3 mg/dL) was greater ($P < 0.10$) compared with cows fed CON (21.4 mg/dL). In conclusion, results demonstrate LysiPEARL products are effective in increasing plasma lysine concentration when fed alone or when inserted into gums and combined with MES.

Key Words: rumen-protected lysine, mechanical extracted soybean meal

W72 Impact of fiber and monensin in texturized calf starters when fed in the nursery phase on calf health and performance in both the nursery and grower phases. D. Ziegler*[1], B. Ziegler[2], H. Chester-Jones[1], D. Schimek[2], and M. Raeth-Knight[3], *[1]University of Minnesota Southern Research and Outreach Center, Waseca, [2]Hubbard Feeds Inc., Mankato, MN, [3]University of Minnesota, St. Paul.*

One-hundred four (2–4 d old) individually fed Holstein heifer calves (41.2 ± 0.72 kg BW) were randomly assigned in a 2 × 2 factorial design to evaluate calf performance and health when fed texturized calf starters (CS) with varying fiber levels with and without monensin (M).The effect of the nursery diets on later calf performance were observed in group pens (7 heifers/pen) when fed a common diet from 9 to 25 wk of age. All nursery calves were fed a non- medicated 20% protein:20% fat milk replacer (MR) at 0.284 kg in 1.99 L water (12.5% solids) 2x daily

for the first 35 d and 1x daily from d 36 to weaning at 42 d. Calf starter (CS; 18% CP, as-fed) and water were fed free choice d 1 to 56. Day 1 to 14, 1:1 neomycin:oxytetracycline was added to the MR solution to provide 22 mg/kg BW/d. Treatments were 1), Lower fiber (LF) CS with 0 mg/kg M; 2), LF CS with 49.5 mg/kg M; 3), Higher fiber(HF) CS with 0 mg/kg M and 4), HF CS with 49.5 mg/kg M. LF CS avg. 8.5% ADF and 16.4% NDF. HF CS avg 12.3% ADF and 18.3% NDF. Over 56 d in the nursery phase, calves fed CS with M had lower gains ($P = 0.007$) total CS and total DMI ($P = 0.02$) regardless of fiber level. There were no treatment health costs, gain/feed or hip height (HH) gain differences ($P > 0.05$). In the grower phase, heifers were limit-fed a common 16% CP grain mix daily (2.73 kg/heifer, d 1 to 56 and 2.27 kg/heifer, d 57 to 112) with free choice hay. There were CS × M treatment interactions ($P = 0.05$) for gain over the 112 d grower phase. There were no differences ($P > 0.05$) in HH for the grower period but CS × M interactions ($P = 0.04$) for HH were observed for the combined study periods. Under the conditions of the nursery phase, through 56 d, calves fed M had lower intakes and gains. Fiber level had no gain affects. There were indications of compensatory growth over the 112 d grower period from calves fed CS with M in the nursery phase.

Key Words: calf performance, calf starter, monensin and fiber levels

W73 Manual manipulation of calf starter for calves fed milk replacer: Effects on growth, starter intake, and weaning. N. E. Guindon, R. G. Cabral*, N. T. Antaya, N. L. Whitehouse, and P. S. Erickson, *University of New Hampshire, Durham.*

Thirty-six Holstein heifer calves were assigned at birth to 1 of 4 treatments in a 2 × 2 factorial arrangement of treatments in a randomized complete block. The objectives of this study were to determine if manually stirring calf starter resulted in increased dry matter intake (DMI), growth and improved weaning in calves fed a high protein milk replacer (HPMR). Treatments were (1) conventional MR (CMR)+ calf starter with no stirs, (2) CMR+ calf starter with stirs at 1030 and 1400 h, (3) HPMR + calf starter, and (4) HPMR + calf starter with stirs at 1030 and 1400 h. All calves had free-choice water. Milk replacer was fed twice daily. Calves were on treatment for 6 wk and weaned at wk 7 (fed MR once daily) and tracked for 1 wk until d 56. Stirs/no stirs continued until d 56. Water intake ($P < 0.001$), average daily gain (ADG) ($P < 0.0001$), DMI ($P < 0.0001$), and feed efficiency (ADG/DMI, $P < 0.01$) were increased in HPMR-fed calves compared with calves fed CMR preweaning (2.24 L/d vs. 0.97 L/d; 0.60 kg/d vs. 0.28 kg/d; 1.23 kg/d vs. 0.79 kg/d; 0.48 vs. 0.30, respectively). Calves fed HPMR had greater wither height gain ($P < 0.001$), and hip height gain ($P < 0.02$) compared with calves fed CMR preweaning (0.21 cm/d vs. 0.15 cm/d, respectively, for hip and wither height gains). Calves that had starter stirred ate less DM ($P < 0.05$) and tended to eat less starter ($P < 0.1$) compared with calves that did not have starter stirred (0.97 kg/d vs. 1.05 kg/d; 0.23 kg/d vs. 0.3 kg/d, respectively). During wk 7, calves formerly fed HPMR ate less ($P < 0.0001$) starter than calves fed CMR (0.50 vs.1.18 kg/d, respectively), but more ($P < 0.0001$) MR (1.13 kg/d vs. 0.45 kg/d). Calves that had their starter stirred tended ($P < 0.10$) to eat less starter and DM than calves that did not have their starter stirred (823 g/d vs. 979 g/d; 1.61 kg/d vs. 1.77 kg/d respectively). Postweaning, calves formally fed HPMR ate less starter ($P < 0.01$) than calves fed CMR (1.22 kg/d vs. 1.69 kg/d respectively). Manual manipulation of starter did not improve growth or DMI preweaning, weaning and postweaning phases in calves fed either HPMR or CMR.

Key Words: calf, milk replacer, starter

W74 Effect of 2-hydroxy-4-methylthio-butanoic acid (HMTBa) on ruminal fermentation, digestibility, and performance of lactating dairy cows. C. Lee[1], J. Oh*[1], A. N. Hristov[1], and G. I. Zanton[2], *[1]Department of Animal Science, The Pennsylvania State University, University Park, [2]Novus International Inc., St. Charles, MO.*

HMTBa has been shown to stimulate microbial protein production in continuous culture and also has methionine-sparing effect in vivo. The objective of this experiment was to test the effect of HMTBa on ruminal fermentation and microbial protein synthesis, nutrient digestibility and urinary N losses, and performance of dairy cows. Eight multiparous lactating Holstein dairy cows (51 DIM, SD = 3.9) were assigned to 4 treatments in a replicated 4 × 4 Latin square trial. The basal diet was formulated to meet or exceed NRC (2001) recommendations and contained corn silage, grass hay, ground corn grain, whole heated soybeans, soybean meal, canola meal, cottonseed hulls, and other minor ingredients (DM basis: 15.9% CP and 33% NDF). Treatments were 4 levels of HMTBa, fed through the mineral/vitamin premix: 0 (control), 0.05, 0.10, and 0.15% (DM basis). Each experimental period was 28 d, including 21 d for adaptation. Ruminal ammonia and microbial N were labeled through a 6-d intraruminal infusion of $^{15}NH_4Cl$. Treatment had no effect on DM intake (28.4 to 28.9 kg/d; $P \geq 0.64$), milk yield (44.6 to 45.0 kg/d; $P \geq 0.46$), and feed efficiency and milk composition ($P \geq 0.12$). Total tract apparent digestibility of nutrients was also not affected ($P \geq 0.08$) by treatment, except digestibility of CP decreased quadratically ($P = 0.01$) with HMTBa supplementation. Fecal, but not urinary, and total excreta N losses were increased ($P = 0.004$ to 0.05; quadratic responses) by HMTBa. Ruminal pH and ammonia concentration were not affected by treatment ($P \geq 0.21$). Concentrations of acetate and propionate were not affected by treatment ($P \geq 0.08$), but butyrate concentration was decreased linearly ($P = 0.03$) by HMTBa. Concentration of microbial N in reticular small and large particulate phases and whole digesta tended to be numerically increased ($P \leq 0.17$) by HMTBa. In conclusion, HMTBa had no effect on intake and performance, decreased dietary CP digestibility, and tended to increase the concentration of microbial N in reticular digesta in the conditions of this crossover trial.

Key Words: dairy cow, rumen microbial protein, 2-hydroxy-4-methylthio-butanoic acid

W75 Yeast-derived microbial protein supplementation of dairy calves. V. A. Silveira[1], K. P. Freire[1], A. V. Siqueira[1], P. A. M. Barros Junior[1], I. M. Lima[2], M. S. Zoni[3], W. Giardini[4], R. Almeida*[2], and M. N. Pereira[1], *[1]Universidade Federal de Lavras, Lavras, MG, Brazil, [2]Universidade Federal do Paraná, Curitiba, PR, Brazil, [3]Milkonsult, Castro, PR, Brazil, [4]Alltech do Brasil, Araucária, PR, Brazil.*

Yeast-derived microbial protein (YMP) is a source of high quality protein and peptides. The supplementation of YMP to dairy calves before and after the weaning phase was evaluated. Fifty-eight Holstein calves, 32 milk-fed and 26 weaned, were paired blocked within rearing stage by body weight, and were randomly assigned to YMP (Demp, Alltech) or Control for 21d. Calves were forced fed 250mL of milk or water once per day, added or not of 40g/d of YMP. Calves were group fed by automatic feeders (DeLaval calf feeder CF150X) with whole pasteurized cow milk (20L) added of milk and milk replacer powder (1kg). A calf starter concentrate was offered ad libitum to all calves, and weaned calves also had access to ryegrass hay and haylage. Body weight was obtained at 7-d intervals at 2PM, rectal temperature was measured daily at 2PM, fecal (1 = normal, 4 = watery) and activity (1 = active, 4 = recumbent) scores daily, as well as the cost of medications. Data obtained over time was analyzed with Mixed of SAS with a model containing the fixed effects of rearing stage, block within rearing stage,

treatment, interaction of treatment and rearing stage, time, and its 2 and 3 term interactions. The mean square for calf within treatment tested the treatment effect. Mean age at experimental d1 for milk-fed calves was 50.7 ± 21.9 for Control and 49.9 ± 21.7 for YMP, and for the weaned calves it was 113.0 ± 16.9 and 115.0 ± 17.8, respectively. The mean BW of milk-fed calves was 98kg and of weaned calves 163kg. The intake of fluid diet by milk-fed calves was 7.4 and 7.5L/d for Control and YMP, respectively ($P = 0.53$). There was an interaction of treatment, time and rearing stage for daily gain ($P < 0.01$). Calves during the milk-fed phase gained 1.186g/d for Control and 1.211g/d for YMP, and for the weaned phase it was 1.212g/d and 1.421g/d, respectively (SEM = 0.055). There was no detectable effect on the cost of medications ($P > 0.28$) or rectal temperature ($P > 0.35$), and treatment did not affect the frequency of fecal or activity scores ($P > 0.53$, Chi-Square). The supplementation of YMP after weaning increased the daily gain of calves raised on an accelerated early nutrition program.

Key Words: calf feeding, calf, yeast-derived microbial protein

W76 Effect of supplementing vitamin E and β-carotene to prepartum Holstein cattle on health and reproductive responses. D. Wang[1], M. Garcia*[1], R. S. Bisinotto[1], N. Martinez[1], F. S. Lima[1], L. F. Greco[1], J. H. Shin[1], A. M. M. DiCalaça[1], A. L. Ranieri[1], B. L. Artiaga[1], E. K. Ganda[1], G. C. Gomes[1], L. F. V. Becker[1], S. C. Soares[1], V. S. Rezende[1], M. A. Engstrom[2], J. E. P. Santos[1], and C. R. Staples[1], *[1]University of Florida, Gainesville, [2]DSM, Parsippany, NJ.*

Objectives were to improve health and reproductive performance of Holstein cattle by drenching antioxidants during the periparturient period. At 23 d before the expected calving date, Holsteins were blocked by parity and randomly assigned to one of 4 treatments arranged in a 2 × 2 factorial design. Factors were drenching with vitamin E (VitE; 0 or 14,000 IU/drench) and β carotene (BC; 0 or 5 g/drench). Animals were drenched at approximately d −23, −12 and 0 relative to calving. Cows were monitored daily during the first 10 DIM for rectal temperature and vaginal discharge. Cows were presynchronized with 2 injections of $PGF_{2\alpha}$ at 46 ± 3 and 60 ± 3 DIM. Cows not inseminated in estrus after the second $PGF_{2\alpha}$ injection were enrolled in a 5-d timed AI protocol starting at 72 ± 3 DIM. The occurrence of retained fetal membranes (RFM) was included in the model to analyze for metritis (MT), puerperal metritis (PMT), and fever (≥39.5°C). The incidence of RFM was 7.3% (52/708). Drenching BC to animals with RFM reduced ($P \leq 0.04$) the incidence of PMT (31.0 vs. 65.2%) and fever (41.4 vs. 69.6%). Drenching VitE tended to reduce ($P = 0.08$) the incidence of MT (24.2 vs. 27.9%) and reduced ($P \leq 0.04$) the incidence of PMT (10.6 vs. 13.5%) and fever (32.7 vs. 36.7%). However, clinical endometritis (Metricheck) at 24 DIM was not affected by treatments. Drenching primiparous cows with BC reduced ($P = 0.04$) the incidence of mastitis (64.0 vs. 52.9%) but not multiparous cows (45.3 vs. 51.0%). Number of cases of mastitis and DIM at first mastitis were not affected by treatments. Eighty percent of cows had detectable corpus luteum by 63 DIM (n = 606) using ultrasound and was unaffected by treatment. Pregnancy at 60 d post AI (palpation) to first and second AI was not affected by treatments and averaged 27.8 and 33.5% for all inseminated cows, respectively. Pregnancy at 300 DIM was 73.8% for all cows (463/627) whereas proportion of culling was 33.2% with no effect of treatments. Drenching antioxidants prepartum and at calving improved some health measures but did not influence reproductive outcomes of Holstein cows.

Key Words: cow, antioxidant, reproduction

W77 Optimal lysine and methionine concentrations for milk protein production as determined with the latest versions of Dairy NRC (2001) and AMTS-Cattle. N. L. Whitehouse*[1], C. G. Schwab[1,2], T. Tylutki[3], and B. K. Sloan[4], *[1]University of New Hampshire, Durham, [2]Schwab Consulting LLC, Boscobel, WI, [3]Integrated Solutions for Sustainable Agriculture, Cortland, NY, [4]Adisseo North and Central America, Alpharetta, GA.*

We previously reported optimal concentrations for lysine (Lys) and methionine (Met) in metabolizable protein (MP) for NRC (2001), CPM (v.3.0.10), and AMTS (v.2.1.1) (Whitehouse et al., 2009; J. Dairy Sci. Vol. 92, E-Suppl.1). The indirect dose-response approach adopted by NRC (2001) was used to generate the dose-response plots, employing the same data set as used by NRC (2001). Since then, an updated version of NRC (v.1.1.9) and v.3.3.4 of AMTS have been released and are being used. The only change made to NRC (2001) affecting predicted nutrient supply was to fix the fractional passage rate (kp) equation for dry forages. Changes in AMTS affecting nutrient supply are the following changes in the feed library of CNCPS v. 6.1: changing protein pool A1 from NPN to ammonia N, assigning soluble true protein to protein pool A2, changing the fractional digestion rates (kd) for protein pools A1 and A2, and a refinement and standardization of the chemical composition of feeds in the feed library as described by Higgs et al. (2012; Cornell Nutrition Conference Proc.). This was done to better predict MP allowable milk. The objective of this work was to use the same trial data set as used previously to estimate the requirement values for Lys and Met in MP for the updated versions of NRC (2001) and AMTS. The dose-response plots were generated as described in NRC (2001). The resulting breakpoint estimates for the required concentrations of Lys and Met in MP for maximal content and yield of milk protein and the optimal Lys/Met ratios for both versions of each model are shown below.

Table 1.

	Original NRC	Revised NRC	AMTS v. 2.1.1	AMTS v.3.3.4
Protein content				
Lys	6.80	6.83	6.68	6.97
Met	2.29	2.28	2.40	2.53
Lys:Met ratio	2.97:1	3.00:1	2.78:1	2.75:1
Protein yield				
Lys	7.10	7.14	6.74	6.93
Met	2.52	2.37	2.31	2.34
Lys:Met ratio	2.82:1	3.01:1	2.92:1	2.96:1

Key Words: lysine requirement, methionine requirement, model

W78 Lactational and systemic response of lactating dairy cows to duodenal infusions of lysine, methionine, and branched-chain amino acids. S. C. Li*[1], D. P. Bu[2], Y. D. Zhang[2], and J. Q. Wang[2], *[1]University of Manitoba, Winnipeg, MB, Canada, [2]State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China.*

Four primiparous ruminal- and duodenal-fistulated Holstein dairy cows (BW 525 ± 14 kg, DIM 176 ± 18 d) were used to investigate the effects of duodenal infusion of lysine (Lys), methionine (Met), and branched-chain amino acids (BCAA) on lactational performance and plasma metabolites. Cows were fed a basal total mixed ration containing 8% alfalfa hay, 17% grass hay, 25% corn silage, and 50% concentrate (DM basis). After 10-d adaptation to the basal ration, 4 cows were randomly assigned in a 4 × 4 Latin square design with four 8-d continuous duodenal infusions

of the following amino acid mixtures: (1) 40 g/d of Lys, 19 g/d of Met and 75 g/d of BCAA consisted of 40% leucine (Leu), 40% isoleucine (Ile) and 20% valine (LMB); (2) LMB with BCAA removed (LM); (3) LMB with Met removed (LB); and (4) LMB with Lys removed (MB). Feed and milk samples were collected in the last 4 d of AA infusion, and jugular vein blood was sampled at the last day of the infusion. Dry matter intake (18.2 kg/d), milk yield (16.98 kg/d), milk concentration of fat (4.91%), lactose (4.57%), casein protein (2.80%), and whey protein (0.95%) were not affected by treatments. No effect of the treatments was observed on plasma Lys concentration (85.8 μ*M*). Plasma Met concentration was higher in LM cows compared with that in LMB, LB, and MB cows (102.9 vs. 65.6, 79.4, and 68.9 μ*M*, respectively; $P < 0.01$). Plasma Ile and Leu concentrations were higher ($P < 0.01$) in LMB and LB cows (147.8 and 100.6, 171.2 and 113.3 μ*M*, respectively) compared with that in LM and in MB cows (115.7 and 92.0, 126.0 and 96.9 μ*M*, respectively). Valine was not affected by the treatments (167.3 μ*M*). No treatment effect on blood glucose and insulin was observed (3.82 m*M* and 0.71 ng/mL, respectively). IGF-1 in plasma tended to be lower in MB cows than that in LMB, LM and LB cows (221.6 vs. 238.2, 252.5, and 249.0 ng/mL, respectively; $P = 0.07$). The results indicated that Lys was limited AA to the basal diet used in the study as plasma Lys was not affected by all treatments, as well as a tendency of lowered IGF-1 when Lys was not infused.

Key Words: branched-chain amino acid, dairy cow, lysine

W79 Influence of combination of *Salix babylonica* extract with mineral/vitamin mixture on in vitro gas production kinetics and dry matter degradability of total mixed ration. A. Z. M. Salem*[1], M. M. Y. Elghandour[1], H. Gado[2], L. M. Camacho[3], R. Rojo[4], and J. L. Borquez[1], *[1]Facultad de Medicina Veterinaria y Zootecnia, Universidad Autonoma del Estado de Mexico, Mexico, [2]Animal Production Department, Faculty of Agriculture, Ain Shams University, Qalubia, Egypt, [3]Facultad de Medicina Veterinaria y Zootecnia, Universidad Autonoma de Guerrero, MexicoCd. Altamirano, Guerrero, Mexico, [4]CU-UAEM Temascaltepec, Universidad Autonoma del Estado de Mexico, Mexico.*

The aim of this study was to determine effects of increasing doses of the Salix babylonica extract (SB) and mineral/vitamin mixture (MV) or their combination, as additives, on in vitro gas production and some ruminal fermentation parameters of a total mixed ration of concentrate with corn silage (TMR - 50:50 on DM basis). Four levels of SB extract (0, 0.6, 1.2 and 1.8 mL/g DM) and others of MV (0, 0.5, 1.5 and 2.5 g/100 g DM). Ruminal fluid was obtained from 2 Brown Swiss cows fitted with permanent rumen cannulas fed a TMR of a 50:50 commercial concentrate and alfalfa hay ad libitum. Samples of TMR were weighed into 120 mL serum bottles with appropriate addition of SB extract and then 10 mL of particle free ruminal fluid was added to each bottle followed by 40 mL of the buffer solution and finally, MV doses were added. The GP was recorded at 2, 4, 6, 8, 10, 12, 24, 48 and 72 h of incubation. After 72 h, the incubation was stopped and the pH of the mixture was determined and filtrate used to determine dry matter degradability (DMD), partitioning factor (PF_{72}), gas yield (GY_{24}), in vitro organic matter digestibility (OMD), metabolizable energy (ME), short chain fatty acids (SCFA), and microbial protein production (MCP). Individual addition of SB extract linearly and quadratically increased ($P < 0.05$) GP during all the incubation times, while the addition of MR was linearly increased ($P < 0.05$) GP produced at 48 and 72 h of incubations. The addition of MV was only quadratically increased asymptotic GP ($P = 0.038$). The SB × MR interaction increased ($P = 0.01$) lag time and GP ($P < 0.05$) during the first 36 h of incubation. Addition of SB linearly and quadratically increased ($P < 0.05$) all fermentation parameters except DMD and rumen pH. The addition of MV had only quadratically increased ($P < 0.05$) of pH, PF_{72}, GY_{24} and MCP. Combination of SB × MV increased ($P < 0.05$) DMD, OMD, ME, PF_{72} and SCFA. Combination of *Salix babylonica* extract with mineral/vitamin mixture could be affect positively on ruminal fermentation.

Key Words: gas production, minerals/vitamin, ruminal fermentation