collected at 46 and 60 (± 7) DIM for progesterone (P4) analysis. Anestrus was defined as P4 < 1ng/ml in both de-fatted milk samples. Data were available from 550 cattle in 18 herds from February through October 2004, and were analyzed with contingency tables and logistic regression. Overall, the prevalence of anestrus was 24.4% (95% confidence interval = 20.8 to 27.9%). The estimated herd specific prevalence varied from 9% to 56%. The prevalence of anestrus was not different among parities (27%, 28%, and 23% in parity 1 (34.2% of animals), 2 (32.3%), and ≥ 3 (33.4%), respectively). Anestrus was 1.7 times more likely in animals calving in March through May than in animals calving in June through August. In a representative subset of 321 animals, milk β-hydroxybutyrate (BHBA) was measured once in each of the first two weeks after calving. Among these, 33% had subclinical ketosis (≥ 100 mmol/ml BHBA) in the first week (range among herds, 6 to 80%) and 28% (range, 8 to 52%) in week 2 of lactation. Cattle with ketosis in week one were 1.4 times more likely (P=0.06) than non-ketotic animals to be classified as anestrus, but ketosis in the second week of lactation was not associated with anestrus. Accounting for season, parity and ketosis in week 1, anestrus tended to be less likely in animals with first DHI test projected 305ME > 10,000 kg than in animals projected to produce < 10,000 kg (odds ratio =0.65, 95% CI 0.4 - 1.1, P = 0.13). Time to first insemination was not significantly different between cycling and non-cycling animals (mean ± SD, 73 ± 20 vs. 78 ± 23 DIM); approximately half the cows in the study received timed AI for first insemination. The probability of pregnancy at first service was 30% and 20% (P = .04) in cyclic and anestrus cattle, respectively. The prevalence of anestrus varies considerably among dairy herds and has a negative effect on the probability of pregnancy at first insemination.

Key Words: Reproduction, Estrus Cycle, Anestrus

79 Endometrial thickness affects ovulation rate and conception rate in lactating Holstein cows. A. H. Souza*, A. Gümen, E. P. B. Silva, A. P. Cunha, J. N. Guenther, D. Z. Caraviello, and M. C. Wiltbank, *University of Wisconsin, Madison*.

The objective of this study was to test the association of endometrial thickness (ET) with ovulation rate (OR) and conception rate (CR) in dairy cows. Holstein cows (n=726) underwent a modified Ovsynch protocol: GnRH on d 0, PGF2α on d 7, GnRH 58 h later, and timed AI (TAI) 16 h after the 2nd GnRH. Half of the cows received 1 mg of estradiol-17β (E2) at 8 h before the second GnRH injection. Endometrial thickness was measured with ultrasound at about one inch after the uterine bifurcation 48h after the PGF2α injection. Ovulation was confirmed by ultrasonography 7 d after TAI. Data were analyzed with the Generalized Linear Mixed Effects Models with dependent variables assumed to follow binomial distribution and cow treated as a random effect. Primiparous had smaller mean ET (9.5mm±1.9 vs. 10.1mm±2.0; P<0.05). Although parity did not alter OR (95%, primiparous n=267 vs. 94%, multiparous n=459; P>0.10), primiparous cows had greater CR (44% vs. 38%; P<0.01). Regardless of parity, cows with ET ≤ 7mm had lower (P<0.01) OR (74%, n=82) than cows with ET>7mm (98%, n=644). Similarly, CR were lower (15%, n=80 vs. 43%, n=644; P<0.01) for cows with ET ≤ 7mm compared to cows with greater ET, respectively. The logistic regression model indicated that CR increased as ET increased up to 10 mm and this effect was independent of E2 treatment. Uterine tone grade (scale 1-min to 5-max) was highly associated with mean ET within each class of uterine tone (r=0.94; P<0.01) and CR increased as uterine tone increased from 1 to 3, remaining constant when uterine tone was > 3. No interaction between BCS and ET was found (P>0.10). A single uterine ultrasound evaluation of ET in Holstein cows 48 h after PGF administration in a TAI program was a surprisingly good predictor of ovulation failures (ET ≤7 mm) and pregnancy success (ET >10 mm).

Key Words: Endometrial Thickness, Ovulation Rate, Conception Rate

Ruminant Nutrition: Dairy—Protein and Amino Acids

80 A review of the 2001 dairy cattle NRC protein and amino acid model - A European perspective. P. Huhtanen*, *MTT Agrifood Research, Finland.*

NRC 2001 protein and amino acid model was tested using data from eight production experiments with dairy cows conducted using change-over designs. The experiments included a total of 72 selected to represent a wide range in feed intake, milk production and strategies to manipulate metabolizable protein (MP) intake (e.g. forage to concentrate ratio, level and type of CP supplementation). Grass silage, rolled barley and rapeseed feeds were the most typical forage, energy and protein supplements; i.e. the test data consisted of diets not typically used in the USA. The other protein systems evaluated were INRA, AFRC (1992), German and two versions [Danish (DK) and Finnish (FIN)] of the Scandinavian AAT/PBV system. The supply of MP was estimated according to different systems. For the NRC 2001 system EAA supply was also computed. A mixed model regression analysis with a random study effect was used to investigate the relationship between estimated MP or AA supply and milk protein yield (MPY). Scandinavian systems predicted MPY more accurately compared with NRC 2001 (RSME for adjusted for random study effect 16.9, 18.6 and 28.0 g/d for the FIN, DK and NRC 2001). Prediction accuracy of the NRC 2001 model was markedly increased, when a bivariate model with MP from microbial CP and RUP were used as independent variables (RSME 21.8 g/d). The slope was much higher for microbial MP compared to MP derived from RUP suggesting that NRC 2001 overestimates the range in RUP supply. Digestible Lys and Met in MP were not significantly associated to MPY supporting the conclusions from infusion studies that these AA are not limiting in dairy cows fed grass silage-based diets. However, MPY increased significantly (P<0.001) with increased digestible His in MP confirming the findings from infusion studies that His is the first limiting AA with these diets. It is concluded that the NRC 2001 amino acid model is a significant step forward in achieving a more precise feeding for N. Methodological aspects in determination parameters used to estimate MP supply will be discussed.

Key Words: Protein Evaluation, Metabolizable Protein, Dairy Cow

81 Use of NRC (2001) to examine the relationships between predicted supplies of metabolizable protein (MP), MP-methionine (MP-Met), and MP-lysine (MP-Lys) and actual yields of milk and milk protein. R. Ordway*, N. Whitehouse, and C. Schwab, *University of New Hampshire, Durham.*

The NRC (2001) predicts passage of MP-amino acid (AA) flows to the small intestine, but does not predict responses to changes in supplies of individual AA. To determine if milk and milk protein yields can be predicted more accurately from predicted supplies of MP-Met and MP-Lys than MP, results from over 300 diets published in the Journal of Dairy Science were entered into the NRC (2001) model. Results from the Summary and Duodenal Amino Acid Supply Reports were used to generate plots of measured milk and milk protein yields vs. predicted supplies of MP, MP-Met, and MP-Lys. Plots derived from predicted supplies of MP were restricted to include diets in which NE-allowable milk was greater than MP-allowable milk and NE-allowable milk was within ±6 kg of measured milk yield to ensure that MP was more limiting than NE and that factors other than MP or NE were not limiting performance, respectively. To generate plots of measured yields of milk and milk protein vs. predicted supplies of MP-Met and MP-Lys, diets were restricted to those in which MP balance was within -250 and +100 g/d of zero. To generate plots from predicted MP-Met supplies, diets were restricted to those having a Lys/Met ratio in MP greater than 3.0/1. To generate plots from predicted MP-Lys flows, diets were restricted to those having a Lys/Met ratio in MP less than 3.25/1. The following regression equations describe the relationship between measured milk yields and MP, MP-Met and MP-Lys supplies, respectively: MP (n=146): $y=-0.000004x^2+0.034x-20.56$, $R^2=0.65$; MP-Met (n=98): $y=-0.0226x^2+2.7383x-40.796$, $R^2=0.76$; and MP-Lys (n=28): $y=-0.0013x^2+0.6174x-26.37$, $R^2=0.90$ and between milk protein yields and MP, MP-Met and MP-Lys, respectively: MP (n=146): $y=0.4524x-62.063$, $R^2=0.74$; MP-Met (n=98): $y=-0.3497x^2+55.631x-732.68$, $R^2=0.81$; MP-Lys (n=98): $y=-0.0195x^2+13.098x-457.31$, $R^2=0.92$. Results indicate that yields of milk and milk protein are more accurately predicted by supplies of the first limiting AA rather than by supplies of MP.

Key Words: Methionine, Lysine, Metabolizable Protein

82 Effect of lysine (Lys) supply on its utilization by the mammary gland (MG). H. Lapierre*[1], L. Doepel[2], E. Milne[3], and G. E. Lobley[3], [1]*Agriculture and Agri-Food Canada*, *Lennoxville, Quebec, Canada*, [2]*University of Alberta*, *Edmonton, Alberta, Canada*, [3]*Rowett Research Institute*, *Aberdeen, UK*.

The uptake to output ratio of Lys across the MG is usually greater than 1, allowing for synthesis of non-essential (NE) amino acids (AA) from Lys-N in the MG (Lapierre et al., 2003- EAAP No.109). Six lactating dairy cows were used to determine if the contribution of Lys-N to NEAA synthesis was affected by Lys supply. Cows received a basal diet (12.0%CP) in twelve equal meals per day plus an abomasal infusion of AA (560 g/d, casein profile) with or without Lys (50.3 g/d), in a cross-over design with 7-d periods. On d 7, all cows received a 7.5-h jugular infusion of [2-^{15}N]Lys (0.8 mmol/h), preceded by a priming dose (0.8 mmol). The cows were milked at 6 and 7 h using oxytocin injection, and arterial blood was sampled at 7h. The isotopic enrichment (IE: atom percent excess (ape)) of AA in the arterial free pool and in 7-h milk casein (after 18h hydrolysis in 6M HCl) was determined by GC-combustion isotope ratio MS. Protein yield (P = 0.02; 1.01 vs 1.13 ± 0.039 kg/d) but not milk yield (P = 0.33; 34.8 vs 36.6 ± 1.12 kg/d) increased with Lys infusion. More Lys-N was used across the MG for the synthesis of NEAA (Ala, Glu, and Ser) when Lys was not limiting (trt*site interaction). Transfer of Lys-N to the branched-chain AA across the MG also increased with Lys supply. Uptake of Lys by the MG in excess of needs for milk protein output is not obligate and mammary metabolism responds to changes in Lys supply.

IE (ape x 1000) of AA

Trt Site	Control Artery	Control Casein	Lysine Artery	Lysine Casein	SEM	Effect Trt	P Site	value Trt*site
His	6.3	3.6	7.8	3.0	0.70	0.55	0.001	0.18
Leu	1.8	2.4	4.8	8.4	0.40	0.001	0.001	0.005
Lys	948	574	611	431	38.7	0.001	0.001	0.04
Phe	3.2	6.8	5.3	6.7	1.53	0.52	0.10	0.44
Thr	3.0	4.7	3.0	4.8	0.87	0.91	0.07	0.93
Val	1.3	1.8	3.2	5.7	0.34	0.001	0.001	0.02
Ala	2.5	4.7	9.5	16.8	0.68	0.001	0.001	0.003
Glu	3.9	7.3	5.0	28.2	1.18	0.001	0.001	0.001
Gly	1.1	2.2	2.8	3.3	0.46	0.02	0.12	0.50
Pro	0.4	1.0	3.1	3.8	1.52	0.04	0.67	0.96
Ser	3.4	6.7	8.4	20.4	0.92	0.001	0.001	0.001
Tyr	2.9	3.7	6.6	3.4	1.34	0.35	0.37	0.12

Acknowledgements: Thanks to Ajinomoto for supplying the AA.

Key Words: Dairy Cow, Lysine, Mammary Gland

83 Ruminal outflow of soluble amino acid fractions in lactating dairy cows. S. M. Reynal*[1], I. R. Ipharraguerre[2], M. Lineiro[2], A. F. Brito[1], G. A. Broderick[3], and J. H. Clark[2], [1]*University of Wisconsin*, *Madison*, [2]*University of Illinois*, *Urbana*, [3]*US Dairy Forage Research Center*, *Madison, WI*.

Three multiparous Holstein cows cannulated in the rumen and duodenum and averaging 154 DIM were used in an unbalanced 4x4 Latin square with 14-d periods to study the effects of CP source on ruminal outflow of amino acids (AA) as solutes. On DM basis, diets contained 35% corn silage, 25% alfalfa silage, 34.8 to 28.6% corn grain, and either 2.3% urea (NPN), 5.2% solvent extracted soybean meal (SSBM), 4.6% lignosulfonate-treated soybean meal (LSBM), or 8.5% corn gluten meal (CGM). DM intake averaged 19.7 kg/d overall and was 4.5 kg/d higher for cows fed LSBM than for cows fed CGM. Soluble AA (SAA) in omasal digesta were fractionated based on molecular weight by ultrafiltration into proteins (> 10 kDa), oligopeptides (3 to 10 kDa), peptides (< 3 kDa), and free AA. In each fraction, proportions of SAA of microbial and dietary origin were estimated using ^{15}N. Ruminal outflow of total SAA was not altered by treatments (P > 0.05) and ranged from 254 (NPN) to 377 g/d (CGM) and accounted for 9.2 (LSBM) to 15.9% (CGM) of total AA outflow. Averaged across diets, omasal flow of SAA in proteins, oligopeptides, peptides, and free AA were, respectively, 29.2, 216.7, 50.4, and 4.9 g/d and accounted for 10.3, 70.6, 17.5, and 1.6% of total SAA outflow. On average, SAA of feed origin contributed 27, 75, 93, and 93% of total SAA that passed to the omasum in proteins, oligopeptides, peptides, and free AA, respectively. Ruminal outflow of Met, Val, and total AA in soluble peptides was higher for SSBM than for LSBM (1.2 vs. 0.2; 4.9 vs. 3.4; and 59.6 vs. 45.5 g/d, respectively), whereas that of AA in soluble peptides was higher for CGM than for LSBM (49.1 vs. 45.5 g/d). Results indicate that 1) a substantial proportion of AA of feed origin escapes ruminal degradation as solutes, mainly in oligopeptides, and 2) ruminal concentrations and outflows of small peptides might be overestimated when measured in acid-deproteinized digesta.

Key Words: Omasal Flow, Soluble AA Fractions, Dairy Cows

84 Supplementing rumen-protected methionine to reduce dietary crude protein in dairy cows. G. A. Broderick*[1], M. J. Stevenson[2], R. A. Patton[3], N. E. Lobos[4], and J. J. Olmos Colmenero[4], [1]*U.S. Dairy Forage Research Center*, *Madison, WI*, [2]*Degussa Corp.*, *Kennesaw, GA*, [3]*Nittany Dairy Nutrition, Inc.*, *Mifflinburg, PA*, [4]*University of Wisconsin*, *Madison*.

Over-feeding of crude protein (CP) adds expense and can cause environmental pollution from excess N excretion. Met has been reported to be the amino acid limiting milk and protein yield in dairy cows. Supplementing rumen-protected Met (RPM) may allow feeding less CP without loss of production but with reduced urinary N excretion. A lactation trial was conducted in which dietary CP was reduced in steps of 1.3 percentage units by replacing soybean meal with high moisture shelled corn; RPM (as Mepron®) was increased with each reduction in CP. Twenty-four multiparous Holstein cows averaging 598 kg BW were blocked by DIM into 6 groups and randomly assigned to 4x4 Latin square sequences and fed TMR containing (DM basis): 18.6% CP, 0% Mepron; 17.3% CP, 0.035% Mepron; 16.1% CP, 0.07% Mepron; 14.8% CP, 0.105% Mepron. All diets contained (DM basis) 21% alfalfa silage, 28% corn silage, 4.5% roasted soybeans, 5.8% soyhulls, 0.6% sodium bicarbonate, 0.5% vitamins and minerals, and 27% NDF. Periods were 4-wk long; production data were summarized from the last 2-wk. The statistical model included square, period, cow(square), diet, and diet*period. Probability was set at 0.10; least square means are reported. There were no effects of diet on intake and gain and on yield of protein, lactose and SNF. However, there were significant effects (P ≤ 0.08) on milk/DM intake and on yield of milk, 3.5% FCM and fat. Production was greater at 17.3% CP plus 8.2 g/d of RPM and 16.1% CP plus 16.6 g/d of RPM, than on the other 2 diets. Apparent N efficiency (milk N/N-intake) was greatest (P < 0.01) on the lowest CP diet containing the most RPM. Typical large reductions (P < 0.01) in MUN were observed with reduced dietary CP. Under the conditions of this trial, feeding lower CP diets supplemented with RPM as Mepron resulted in improved N-efficiency.

Item	CP, % RPM, g/d	18.6 0	17.3 8.2	16.1 16.6	14.8 25.0	SE	P > F
DMI, kg/d		23.4	23.4	23.8	23.7	0.5	0.88
Milk, kg/d		39.7^{ab}	41.6^{a}	41.7^{a}	39.7^{b}	0.7	0.06
Milk/DMI		1.72^{ab}	1.80^{a}	1.77^{ab}	1.69^{b}	0.03	0.06
3.5% FCM, kg/d		38.9^{b}	42.0^{a}	41.2^{ab}	38.6^{b}	1.0	0.04
Fat, kg/d		1.37^{ab}	1.49^{a}	1.43^{ab}	1.32^{b}	0.05	0.08
Protein, kg/d		1.15	1.23	1.23	1.20	0.03	0.19
MUN, mg/dl		14.5^{a}	11.8^{b}	9.4^{c}	7.9^{d}	0.3	< 0.01
Milk N/N-intake		0.26^{c}	0.30^{b}	0.32^{b}	0.34^{a}	0.01	< 0.01

^{a,b,c,d}Means in rows with different superscripts differ (P < 0.05)

Key Words: Mepron, Rumen-Protected Methionine, Milk Yield

85 Determination of ruminal escape and metabolizable methionine values of 2-hydroxy-4 (methylthio) butanoic acid (HMB) as a function of dose and mode of supply. J. C. Robert*, C. Richard, and B. Graulet, *Adisseo France SAS*, *Antony, France*.

The aim of this trial was to explain discrepancies between experimental results about the value of metabolizable Met (or bioavailable Met) of HMB for cows. Three non-lactating rumen-cannulated Holstein cows were randomly assigned in a factorial design based on 3 doses of HMB (25, 50 and 100 g Met equivalent as Rhodimet™ AT88, Adisseo) and 2 modes of rumen supply (spot-dose at T0 or 12-h infusion). Rumen HMB by-pass measurements were achieved using Cr-EDTA as a marker to estimate the rumen liquid out-flow. For this purpose, HMB and Cr were dosed in samples of rumen juice collected at T0 and 1, 3, 6, 10, 14 and 24h. At the same time, metabolizable Met supply to cows from HMB was determined using a blood kinetics test based on area under the curve (AUC) calculations from plasma Met concentrations, as previously described (Robert et al, 2001). HMB rumen by-pass and corresponding blood plasma Met bioavailability were significantly higher with spot doses vs staggered doses and also increased with HMB doses whatever the mode of supply. However, between 50 and 100 g Met equivalent, bioavailability remained constant suggesting a steady-state. In practical conditions (25 g of HMB supply per day per cow), the metabolizable Met supply as HMB would be insufficient to meet the requirements of a high producing dairy cow fed a Met-deficient ration.

Mode of rumen supply	Infusion			Spot			P value	
Dose(g Met eq.)	25	50	100	25	50	100	dose	mode
HMB outflow (g)	0.73±0.19c	3.43±0.61c	10.83±1.90b	2.84±0.39c	7.90±1.07b	18.52±2.15a	0.001	0.001
HMB by-pass (%)	2.56±0.65d	6.04±1.06cd	9.53±1.67bc	10.0±1.36bc	13.90±1.88ab	16.30±1.89a	0.001	0.001
AUC (plasma Met)	1.2±0.3b	5.1±4.3b	11.3±1.5b	2.4±0.6b	9.1±4.8b	31.4±11.0a	0.001	0.019
metab. Met (g)	1.6±0.4c	6.3±5.3bc	12.6±0.5b	3.3±0.8bc	10.6±4.0bc	23.5±4.9a	0.001	0.008
Met bio availability (%)	6.4 ±1.5c	12.7±10.6bc	12.6±0.5b	13.2±3.4bc	21.2±8.0bc	23.5±4.9a	0.048	0.005

Key Words: Ruminant, Methionine Analog, Metabolism

86 Effects of soy gum application to soybean meal on protein degradation by ruminal microbes and intestinal protein digestion. M. D. Stern*[1], T. K. Miller-Webster[2], W. H. Hoover[2], M. Ruiz Moreno[1], and C. A. Macgregor[3], [1]*University of Minnesota*, *St. Paul*, [2]*Rumen Fermentation Profiling Laboratory, West Virginia University*, *Morgantown, WV*, [3]*Grain States Soya, Inc.*, *West Point, NE*.

In a preliminary in situ study, mechanical-extracted (ME) soybean meal (SBM) #1 with fresh soy gums (MEC1G) was incubated for 16 h in the rumen of a cow that was 50 days in milk (DIM) and producing 36 kg milk. Rumen undegraded protein (RUP) was 73.3%. In a second in situ study, ME SBM #1 (MEC1) and MEC1G were incubated for 16 h in the rumen of a cow that was 200 DIM and producing 27.2 kg of milk. RUP was 58.0% for MEC1 and 62.1% for MEC1G, indicating that application of fresh soy gums to ME SBM increased RUP. Two subsequent experiments were conducted. In Experiment 1, eight diets containing 17% CP were examined in continuous culture fermenters to determine RUP. In each diet, 28% of the CP was provided by one of the following products: solvent-extracted (SE) SBM (SOL), ME SBM #1 (MEC1), ME SBM #1 with fresh soy gums (MEC1G), ME SBM #2 (MEC2), ME SBM #3 (MEC3), ME SBM extruded (MECE), SE SBM heat treated (SOLH), SE SBM nonenzymatically browned (SOLNEB). RUP was 30.9, 33.0, 37.6, 32.1, 30.1, 34.3, 32.0 and 31.5% for SOL, MEC1, MEC1G, MEC2, MEC3, MECE, SOLH and SOLNEB diets, respectively. Diet MEC1G had the numerically highest RUP and was different ($P < 0.10$) compared with the SOL, MEC2, MEC3, SOLH and SOLNEB diets. Results indicate that application of fresh soy gums onto ME SBM can increase RUP. In Experiment 2, a 3-step in situ/in vitro procedure was used to estimate intestinal CP digestion (ID) for seven SBM products. ID was 67.5, 83.8, 78.9, 75.7, 76.5, 65.4 and 57.7% for SOL, MEC1G, MEC2, MEC3, MECE, SOLH and SOLNEB, respectively. Intestinally absorbable dietary protein (IADP), calculated as RUP x ID was 15.7, 41.3, 33.2, 25.2, 29.3, 34.2 and 39.4% for SOL, MEC1G, MEC2, MEC3, MECE, SOLH and SOLNEB, respectively. ID ranged from 57.7 (SOLNEB) to 83.8% (MEC1G) indicating that processing can overprotect protein from digestion in the intestine.

Key Words: Soybean Meal, Protein, Gums

87 Effect of abomasal pectin infusion on digestion and nitrogen balance in dairy cows. T. F. Gressley* and L. E. Armentano, *University of Wisconsin*, *Madison*.

Dietary manipulation to shift nitrogen (N) excretion from urine to feces may reduce N volatilization from manure and improve air quality. In a previous study, abomasal infusion of 1 kg/d pectin tended to decrease urinary N by 25 g/d. We suggested that postruminal pectin fermentation stimulated bacterial growth in the large intestine and shifted some N excretion from urine to feces. However, voluntary DMI was reduced with pectin infusion and there was an apparent failure in the markers used to precisely predict urinary and fecal outputs, making data interpretation difficult. The present experiment was conducted to correct these problems. Six mulitparous lactating cows were assigned to a double reversal design with 4 21-d periods. All cows were fed the same basal diet (30.2% NDF) at 90% of ad-libitum intake. Cows received 30 L/d saline infused into the abomasum via a rumen fistula. Treatments were: 0 Pectin=saline only; 1 Pectin=saline plus 1.0 kg/d pectin. For the final 3 days of each period, total collection of urine and feces was conducted. Apparent total tract digestibility of OM including infused pectin was unaffected by treatment, however starch digestibility was reduced with 1 Pectin. Urinary N output decreased 27 g/d and fecal N increased 22 g/d with 1 Pectin. Fecal purine output increased 3 g/d with 1 Pectin, suggesting that approximately 60% of the increase in fecal N output was due to increased fecal bacteria output. Abomasal pectin tended to decrease rumen ammonia concentration and urinary purine derivative excretion, demonstrating that postruminal fermentation may reduce rumen ammonia available for microbial growth.

	0 Pectin	1 Pectin	SED	P value
Milk, kg/d	29.4	28.9	0.8	0.56
Basal DM eaten, kg/d	22.2	22.2	0.1	0.45
Total DM input, kg/d	22.2	23.1	0.1	0.001
OM digestibility including pectin, %	66.3	66.0	0.5	0.49
Starch digestibility, %	86.3	84.1	0.5	0.001
MUN, mg/dl	11.9	11.2	0.56	0.29
Urine N, g/d	230	203	8	0.002
Fecal N, g/d	209	231	5	0.001
Fecal purines, g/d	15.4	18.5	0.4	0.001
Rumen ammonia, mM	6.9	6.0	0.4	0.06
Urine allantoin + uric acid, mmol/d	532	510	11	0.09

Key Words: Nitrogen, Pectin, Urine

88 Comparison among microbial markers for quantifying microbial protein flow from the rumen of lactating dairy cows. S. M. Reynal*[1], G. A. Broderick[2], and C. Bearzi[3], [1]*University of Wisconsin*, *Madison*, [2]*US Dairy Forage Research Center*, *Madison, WI*, [3]*Universidad de Buenos Aires*, *Buenos Aires, Argentina*.

Eight ruminally cannulated lactating cows were assigned to 4 x 4 Latin squares and fed diets with different levels of rumen-degraded protein (RDP) to compare ^{15}N, total purines (TP), and AA profiles as microbial markers for quantifying the flow of microbial protein at the omasal canal. Dietary RDP was gradually decreased from 13.2 to 10.6% of DM by replacing solvent soybean meal (SSBM) and urea with lignosulfonate-treated soybean meal (LSBM). Dietary RDP had significant effects on the chemical composition of isolated bacteria and protozoa. The guanine to adenine ratio of the fluid phase of omasal digesta was 4.6

times greater than that of fluid-associated bacteria, suggesting different degradation rates between purines. When estimated using TP, flows of microbial NAN did not change and flows of non-microbial NAN (NMNAN) decreased linearly (from 273 to 219 g/d; $P < 0.01$) when SSBM and urea were replaced in the diet with the less degradable LSBM. These results were in contradiction with published results and predicted responses to changes in the ruminal degradability of the protein source fed. However, as RDP decreased, microbial NAN flow decreased linearly ($P < 0.01$) when measured using ^{15}N (from 470 to 384 g/d), and AA profiles (from 392 to 311 g/d), while NMNAN flow (expressed as % of total NAN flow) increased linearly ($P < 0.01$) when estimated based on ^{15}N (from 30.4 to 37.8%) and AA profiles (from 44.5 to 52.0%). The regression ($P < 0.01$) of TP on ^{15}N for microbial NAN flow had a slope of 0.57 ($P < 0.01$) and an intercept of 195 ($P < 0.01$). Averaged across diets, microbial NAN flows estimated using ^{15}N, TP, and AA profiles were 429, 401, and 360 g/d, respectively, and were lowest for AA profiles and highest for ^{15}N and TP ($P < 0.01$). Microbial and dietary NAN flows from the rumen estimated using ^{15}N appeared to be more accurate and precise than flows estimated with the other markers.

Key Words: Microbial Markers, Omasum, Dairy Cows

89 Effects of daily variation in dietary protein concentration on milk production in mid-lactation cows. N. R. St-Pierre* and D. Gerstner, *The Ohio State University*, *Columbus*.

Thirty lactating Holstein cows (18 primiparous, 12 multiparous) with an average body weight of 633 kg and averaging initially 38.2 kg of milk per day at 186 days in milk, were used in an incomplete, balanced cross-over design to assess the effects of fluctuating daily dietary crude protein (CP) on milk production and composition. Three dietary treatments consisting of three levels of daily variation in dietary CP were studied. Each cow was randomly assigned to a series of two dietary treatments that were administered in two consecutive periods of 21 days each. Treatment diets were based on 52% roughage on a DM basis (42% corn silage, 10% alfalfa hay), 8% cottonseed and 40% concentrate. All treatments averaged 15.5% CP but differed in level of day to day variation. Treatment 1 (small variance) consisted of a diet constant in theoretical CP content (15.5%). Treatment 3 (large variance) alternated on a daily basis the feeding of a 19.5% and 11.5% CP diet. Treatment 2 (medium variance) alternated between a 17.5% and a 13.5% CP diet. Two concentrates were used to prepare all 5 diets. Changes in CP were achieved through the substitution of corn for soybean meal in the concentrates. Treatments had no effect on milk yield (34.9, 34.9, 34.4 ± 0.90 kg/d), milk true protein content (2.97, 3.00, 3.00 ± 0.038 %), fat content (3.39, 3.30, 3.25 ± 0.136 %), lactose content (4.87, 4.86, 4.86 ± 0.046%), protein yields (1040, 1050, 1033 ± 30.5 g/d), fat yield (1171, 1146, 1123 ± 54.4 g/d), lactose yield (1708, 1699, 1674 ± 49.1 g/d), and milk urea N concentration (9.33, 9.14, 9.42 ± 0.36 mg/dL), for the small, medium and large variance treatments, respectively. Variation in daily dietary CP content does not affect milk production in mid lactation if the cycle of variation is over a period of two days.

Key Words: Dietary Variation, Milk Response, Crude Protein

90 Relationship between milk urea nitrogen (MUN) and days open in early lactation dairy cows. M. Nowrozi*, M. Raisianzadeh, and M. Abazari, *Agriculture and Natural Resources Research Center of Khorasan, IRAN*, *Mashhad, Khorasan, IRAN*.

Our objective was to evaluate the relationship between MUN and days open in Holstein dairy cows. Ten dairy farms in the countryside of Mashad, Iran were randomly selected, milk samples of postpartum cows (from calf birth to 3 months after parturition) were collected at monthly intervals, and reproduction data were compiled for three years. MUN content of 12,000 samples were measured by enzymatic method. The cows were categorized into four quartiles based on the MUN levels in these data: less than 12, between 12 and 16, between 16 and 18, and greater than 18 mg/dl. Data were analyzed by survival analysis and Cox model. The results show that the effect of mean milk yields in peak, herd, fat percentage, and season on model was not significant, but MUN had a significant effect on days open ($P < 0.0001$). The least days open were observed in cows with 16-18 mg/dl MUN and out of this range, days open were increased, significantly (134 vs. 148.6 and 150.29 d).

Acknowledgements: The authors would like to thank the Agriculture and Natural Resources Research Center of Khorasan IRAN for the technical support.

Key Words: Dairy Cows, MUN, Days Open

Swine Species: Effects of Maternal Nutrition on Offspring Performance

91 Consequences of birth weight for postnatal growth performance. C. Rehfeldt*, *Research Institute for the Biology of Farm Animals*, *Dummerstorf, Germany*.

In multiparous species such as the pig there is an intra-litter variation in birth weight and skeletal muscle fibre number. It is commonly recognized that low birth weight in piglets correlates with decreased survival and lower postnatal growth rates. So-called runts are usually excluded from rearing. In the majority of low birth weight piglets low numbers of muscle fibres differentiate during prenatal myogenesis, for genetic or maternal reasons, and only those low birth weight piglets with normal fibre numbers are able to exhibit postnatal catch-up growth. Pigs of low birth weight show the lowest growth performance and the lowest lean percentage at slaughter. In addition, they tend to develop extremely large muscle fibres (giant fibres) and poor meat quality, which, in part, results from the inverse correlation between fibre number and fibre size. Prenatal growth/myogenesis is under the control of various genetic and environmental factors, which can be targeted for growth manipulation. Prenatal development is mainly dependent on a close interrelation between nutritional supply/utilization and regulation by hormones and growth factors. In particular, the maternal somatotropic axis plays a significant role in the control of myogenesis. Thus, treatment of sows with growth hormone (GH) until mid gestation was able to increase birth weight and the number of muscle fibres in the progeny, which was most pronounced in small littermates disadvantaged by insufficient nutrient supply. GH treatment was associated with increased nutrient availability to the embryos and changes in regulatory proteins of the GH- IGF axis. Interactions between maternal nutrition and the somatotropic axis in determining prenatal growth and myogenesis are worthy of further investigation.

Key Words: Pig, Growth hormone, Muscle fiber