type (TYPE) were investigated using British, Continental crossbred, and Brahman crossbred calf-fed steers (n = 420). Steers were weighed at re-implantation and sorted into seven weight blocks, each block consisting of two pens (ten steers per pen) per TYPE. Pens within a block × TYPE subclass were randomly assigned to one of two RAC treatments (0 mg·hd^{-1}·d^{-1} vs. 200 mg·hd^{-1}·d^{-1}) fed during the final 28 days of the finishing period. The TYPE × RAC interaction did not affect ($P > 0.05$) any of the growth performance and carcass traits evaluated in this study. Feeding RAC improved ($P < 0.001$) ADG (1.50 vs. 1.73 ± 0.03 kg) and G:F (0.142 vs. 0.167 ± 0.003), but did not impact ($P > 0.05$) DMI of steers. Dressing percentage, adjusted fat thickness, KPH fat percentage, and yield grade were not affected by RAC supplementation. Carcasses of steers fed RAC had heavier ($P < 0.05$) hot carcass weights (359 vs. 365 ± 1.4 kg), larger ($P < 0.05$) LM areas (81.9 vs. 83.9 ± 0.71 cm^2), and tended ($P = 0.07$) to have lower mean marbling scores (Slight^{87} vs. Slight^{77} ± 3.5) than carcasses of control steers. Brahman crossbred cattle had the lowest DMI and produced carcasses that were the lightest and had the lowest mean marbling score ($P < 0.05$). British cattle produced carcasses with the highest ($P < 0.05$) mean marbling score. Continental crossbred steers had the heaviest live weights, highest dressing percentages, and produced the heaviest carcasses with the largest LM areas ($P < 0.05$). Results from this study suggest that, despite inherent differences in growth performance and carcass characteristics of steers differing in biological type, diverse biological types would be expected to respond similarly to supplementation of ractopamine hydrochloride at 200 mg·hd^{-1}·d^{-1}.

Key Words: Beef, Ractopamine, Breed

426 Effects of ractopamine hydrochloride (Optaflexx) on feedlot heifers. M. Quinn*, J. Drouillard, E. Loe, B. Depenbusch, A. Webb, and M. Corrigan, *Kansas State University*, *Manhattan*.

An experiment was conducted to determine the effects of ractopamine HCl (Optaflexx) on live performance, carcass quality, and meat characteristics when fed to heifers (n = 302, 479±3 kg initial BW) during the final 28 days of feedlot finishing. Heifers were fed diets (dry basis) consisting of steam flaked corn (79.6%), ground alfalfa hay (6%), corn steep liquor (6.2%), dry supplement (6%), and a premix (2.2%) that provided 300 mg monensin, 90 mg tylosin, and 0.5 mg melengesterol acetate per heifer daily. Cattle were blocked by weight and assigned to dirt surfaced pens (12 to 13 heifers/pen, 12 pens/treatment). Treatments consisted of 0 or 200 mg per heifer daily of ractopamine HCl. After finishing, heifers were shipped to a commercial abattoir and carcass data were collected following a 24-h chill. Loins were obtained from three animals randomly selected from each pen for determination of Warner-Bratzler shear force values, fatty acid profile, weight loss during cooking, purge loss during retail display, and L*, a*, and b* color measurements. Average daily gain and DMI for the Optaflexx and control cattle were not different (P>0.17), but heifers fed Optaflexx tended (P=0.06) to be more efficient (G:F = 0.183 and 0.167 for Optaflexx and Control groups, respectively). Live weight gain for the Optaflexx heifers was 56.8 kg compared to 54.1 kg during the 28-d period (P=0.09). Treatments did not differ with respect to slaughter weight, hot carcass weight, dressing percent, longissimus muscle area, fat thickness, marbling score, USDA yield grade, or USDA quality grade (P>0.19). Warner-Bratzler shear force values, weight loss during cooking, purge loss during retail display, and fatty acid profiles were similar for the two treatments (P>0.2). Feeding Optaflexx to finishing heifers resulted in modest improvements in live weight gain and gain efficiency, but did not affect carcass characteristics or meat quality.

Key Words: Ractopamine, Heifers, Finishing

Ruminant Nutrition: Dairy—Fiber and Digestion

427 Validation of propionate challenge test methodology. B. J. Bradford*, A. D. O'Toole, A. S. Nash, and M. S. Allen, *Michigan State University*, *East Lansing*.

Two experiments were designed to validate methods used to investigate physiological responses to propionate during propionate challenge tests (PCT). In experiment 1, the dose-reponse to jugular propionate infusion was assessed in a duplicated 4 x 4 Latin square experiment with 8 lactating dairy cows. Sodium propionate (4.5 M, pH 7.4) was infused in an intrajugular bolus at 0 (saline), 50, 100, or 150 mg/kg bodyweight, and jugular blood was sampled over the following 2 hours. Data for both experiments were analyzed by mixed effects models using autoregressive covariance structures for repeated measures. Peak propionate concentration increased quadratically at an increasing rate as propionate dose increased, while area under the curve (AUC) for plasma glucose increased linearly with increasing propionate dose. Plasma NEFA concentration was elevated by all propionate treatments at 20 and 30 min post-infusion (P < 0.05), which may have been caused by a stress response; infusion of 150 mg/kg propionate tended to increase plasma norepinephrine concentration by 53% (P = 0.09) relative to pre-infusion values. Experiment 2 was designed to study the impact of short-term fasting on responses to propionate infusion. Eight lactating dairy cows were included in a duplicated 4 x 4 Latin square design with a 2 x 2 factorial arrangement of treatments. Sodium propionate (100 mg/kg bodyweight) or saline was infused either prior to feeding (900) or 2 h after feeding (1300). Fed cows consumed 4.4 ± 1.4 kg DM prior to the PCT. While fed cows had significantly higher plasma propionate concentration, fed state did not influence post-infusion changes in plasma propionate, glucose, insulin, glucagon, or NEFA concentrations. Liver glycogen concentration decreased significantly after propionate, but not saline, infusion (P < 0.001). Short-term differences in fed state do not significantly alter physiological responses to PCT. However, insulin and glucagon release following jugular administration of propionate are likely super-physiological, and post-infusion lipolysis suggests that stress responses may alter PCT measurements.

Key Words: Propionate Challenge, Dairy Cow, Stress

428 Effects of dietary forage and non-fiber carbohydrate content on B-vitamin intake, duodenal flow, and apparent synthesis in dairy cows. E. Schwab*[1], R. Shaver[1], C. Girard[3], C. Schwab[2], D. Putnam[4], and N. Whitehouse[2], [1]*University of Wisconsin*, *Madison*, [2]*University New Hampshire*, *Durham*, [3]*Dairy and Swine R&D Center*, *AAC, QC, Canada*, [4]*Balchem Encapsulates*, *New Hampton, NY*.

Eight Holstein cows fitted with ruminal and duodenal cannulae were used in a replicated 4×4 Latin square design with a 2×2 factorial treatment arrangement to evaluate effects of dietary forage (F) and NFC concentrations on intake, duodenal flow, and apparent synthesis (AS) of B-vitamins in lactating cows. Each square contained two multiparous and two primiparous cows and periods were 21 d in length. Diets with 35 or 60% (DM basis) F (corn silage, alfalfa hay, and grass hay) were formulated to contain 30 or 40% NFC (DM basis). Dietary concentrates were composed of varying proportions of ground shelled corn, rolled barley, soybean hulls, beet pulp, soybean meal, blood meal, Smartamine-M®, minerals, and vitamins. B-vitamin AS was estimated as the difference between duodenal vitamin flow and vitamin intake. This estimate does not account for potential microbial use or destruction, or ruminal absorption of the vitamins. Increased dietary F increased riboflavin intake and decreased DMI, niacin intake and flow, and biotin intake. Increased dietary NFC increased DMI, niacin AS, and biotin flow and decreased niacin intake. For biotin AS, negative least square means and a SEM of about 75% of means averaged across diets indicate that ruminal microbial synthesis of biotin is minimal and highly variable.

Item	Dietary F,NFC				SEM	Effect		
	35,30	35,40	60,30	60,40		F	NFC	F´NFC
DMI, kg/d	21	22	18	20	1	†	†	NS
Riboflavin, mg/d								
Intake	98	95	111	116	7	†	NS	NS
Flow	344	351	320	358	24	NS	NS	NS
AS	245	256	209	242	19	NS	NS	NS
Niacin, mg/d								
Intake	2027	1330	1190	581	83	†	†	NS
Flow	2447	2910	1981	1946	209	†	NS	NS
AS	398	1580	812	1365	186	NS	†	NS
Biotin, mg/d								
Intake	134	140	121	132	9	†	NS	NS
Flow	121	133	109	131	8	NS	†	NS
AS	-14	-7	-11	-0.4	6	NS	NS	NS

† = (P£0.05), NS = not signficant

Key Words: B-Vitamin, Duodenal, Cow

429 Impact of alfalfa hay neutral detergent fiber concentration and digestibility on Holstein dairy cow performance: I. Hay analyses and lactation performance – USDFRC. D. R. Mertens*[1], H. G. Jung[2,3], M. L. Raeth-Knight[3], and J. G. Linn[3], [1]*US Dairy Forage Research Center*, *Madison, WI*, [2]*USDA Agricultural Research Service*, *St. Paul, MN*, [3]*University of Minnesota*, *St. Paul*.

Our objective was to evaluate the impact of amylase-treated NDF (aNDF) and 48-h in vitro NDF disappearance (NDFD) of alfalfa hay on milk production when fed as 15% or 30% of ration DM at the Univ. of Minnesota (UMN) and US Dairy Forage Research Center (DFRC), respectively. Samples of 22 commercial hays were evaluated to identify four alfalfa hays that differed in aNDF and NDFD based on chemical, in vitro and NIRS analyses. After delivery, core samples were taken at each location and analyzed for aNDF and NDFD at the DRFC. Composite hay samples were made for each location during lactation trials. Sixty-eight cows were assigned to one of four TMR, each containing one of the hays. Ration DM consisted of 30% alfalfa hay, 16.1% corn silage, 25.3% ground corn, 2.7% molasses, 5% roasted soybeans, and 20.9% concentrate mixture, which contained soybean meal, soybean hulls, distiller's grains, minerals and vitamins. Cows averaged 46.5 kg milk/d and 86 days in lactation at the beginning of the trial. Cows were fed a covariate diet for two weeks, followed by experimental diets for 12 weeks. Production trial means were analyzed with covariance using Proc GLM in SAS. Initial samples indicated the aNDF of hays low in fiber and high in digestibility (LFHD), low in fiber and digestibility (LFLD), high in fiber and digestibility (HFHD) and high in fiber and low in digestibility (HFLD) were 37.2, 36.4, 41.7 and 40.8%, respectively. The NDFD of initial samples were 41.3, 37.9, 44.6 and 41.1% of NDF for LFHD, LFLD, HFHD and HFLD, respectively. The 4 to 5 %-unit difference between high and low aNDF and NDFD was similar between locations and among bale core and experimental composite samples. However, variation was observed between laboratories and methods in aNDF and NDFD determinations. Least-squared means for milk production were 43.8, 45.0, 46.9 and 45.4 for LFHD, LFLD, HFHD and HFLD, respectively (P = 0.07). We concluded that small differences in aNDF and NDFD among the alfalfa hays have limited impact on milk production when included as 30% of the diet DM.

Key Words: NDF, Digestibility, Alfalfa Hay

430 Impact of alfalfa hay neutral detergent fiber concentration and digestibility on Holstein dairy cow performance: II. Lactation performance ~ St. Paul. M. L. Raeth-Knight*[1], J. G. Linn[1], H. G. Jung[1,2], D. R. Mertens[3], and P. R. Peterson[1], [1]*University of Minnesota*, *St. Paul*, [2]*USDA Agricultural Research Service*, [3]*US Dairy Research Center*, *Madison, WI*.

Sixty multiparous lactating Holstein cows were fed one of four diets, containing alfalfa hays selected for low (L) and high (H) neutral detergent fiber concentration (NDF) and low (l) or high (h) 48-h in vitro NDF digestibility (IVNDFD) within NDF levels. Diets, fed as a TMR, contained 14.8% alfalfa hay, 35.0% corn silage, 26.5% grain mix, 15.5% corn, 5.2% roasted soybeans and 3.0% molasses (DM basis). Cows were blocked by calving date and randomly assigned to diets following calving. Data was collected during the first 133 days in milk and analyzed as weekly averages using PROC MIXED. Alfalfa hay NDF and IVNDFD did not significantly impact dry matter intake, milk production or energy corrected milk (ECM) production. Milk true protein percentage was significantly lower for the Lh treatment (2.7 %) as compared to the Hl treatment (3.0 %); however, fat, protein and lactose yields were not affected by hay NDF or IVNDFD. Feed efficiency (FE) was similar across treatments, averaging 1.7 kg of 4% fat-corrected milk (FCM) per kg of DM intake. Fiber concentration and in vitro digestibility of alfalfa hay did not have a significant impact on the lactation performance of Holstein cows when included at 15% of the diet dry matter.

Treatment	**Lh**	**Ll**	**Hh**	**Hl**		
NDF, % DM	37.2	36.4	41.7	40.8		
IVNDFD, % of NDF	41.3	37.9	44.6	41.1		
Item					**P-Value**	**SE**
DMI, kg/d	22.8	21.7	22.1	22.8	.77	.80
ECM, kg/d	34.2	35.4	36.3	36.3	.48	1.2
Fat, kg/d	1.3	1.4	1.5	1.4	.44	.06
Protein, kg/d	1.1	1.1	1.1	1.2	.18	.03
Lactose, kg/d	1.9	1.8	1.9	1.9	.89	.06
FE	1.6	1.8	1.7	1.7	.52	.09

Key Words: NDF, NDF Digestibility, Alfalfa Hay

431 Impact of alfalfa hay neutral detergent fiber concentration and digestibility on Holstein dairy cow performance: III. Diet digestibility ~ St. Paul. M. L. Raeth-Knight*[1], J. G. Linn[1], H. G. Jung[1,2], D. R. Mertens[3], and P. R. Peterson[1], [1]*University of Minnesota*, *St. Paul*, [2]*USDA Agricultural Research Service*, [3]*US Dairy Forage Research Center*, *Madison, WI*.

Multiparous Holstein cows were fed 1 of 4 treatment diets, containing alfalfa hay varying in neutral detergent fiber concentration (NDF) and 48-h in vitro NDF digestibility (IVNDFD). In study 1, 60 early lactation cows were randomly assigned to treatments; containing approximately 15% alfalfa hay (DM basis). Diet composition was detailed in Part II (lactation performance). In study 2, 20 late lactation cows were randomly assigned to treatments; containing 95.8% alfalfa hay and 4.2% molasses (DM basis). Apparent total tract DM and fiber digestibility were measured using the acid insoluble ash technique. In study 1, alfalfa hay NDF and IVNDFD did not result in any difference in apparent total tract DM digestibility (DMD) or NDF digestibility (NDFD). However, within low NDF hays, there was a trend for lower IVNDFD to increase DMD; and within the high NDFD hays, high NDF hay increased DMD. In study 2, cows fed hay with higher IVNDFD had increased DMD within low NDF hays and decreased DMD within high NDF hays. Alfalfa hay IVNDFD did not impact apparent total tract NDFD in high NDF hays. However, in low NDF hays, higher hay IVNDFD increased apparent total tract NDFD. Alfalfa hay NDF and IVNDFD did not affect diet in vivo DMD or NDFD when included at 15% of the diet DM. Alfalfa hays included at 96% of the diet dry matter resulted in an interaction between hay NDF and IVNDFD for in vivo digestibility.

Treatment[1]	Lh	Ll	Hh	Hl		
NDF, % DM	37.2	36.4	41.7	40.8		
IVNDFD, % of NDF	41.3	37.9	44.6	41.1		
Study 1					**P-Value**	**SE**
DMI, kg/d	20.6	19.2	20.3	20.6	.90	1.5
DMD, %	65.5	72.1	68.6	65.9	.10	2.1
NDFD, %	49.3	56.3	52.0	51.9	.23	2.5
Study 2						
DMI, kg/d	17.4[ab]	22.2[a]	19.6[a]	13.1[b]	.03	2.0
DMD, %	80.8[a]	66.1[b]	65.8[b]	76.9[a]	<.01	2.4
NDFD, %	74.2[a]	55.8[b]	65.0[c]	71.1[ac]	<.01	2.7

[1]low NDF, high IVNDFD (LH); low NDF, low IVNDFD (LL); high NDF, high IVNDFD (HH); high NDF, low IVNDFD (HL)

Key Words: NDF, NDF Digestibility, Alfalfa Hay

432 Effects of the number of cycles at suboptimal pH on rumen bacterial fermentation in a dual flow continuous culture system. M. Cerrato*, S. Calsamiglia, and A. Ferret, *Universitat Autonoma de Barcelona*, *Bellaterra, Spain*.

Suboptimal pH (5.5) has deleterious effects on ruminal fermentation. However, ruminal bacteria may resist short periods of time at low pH. Eight 1325-ml dual flow continuous culture fermenters were used in two consecutive periods to examine if the effects of prolonged periods (12 h) at pH 5.5 can be reduced by splitting it in 2 periods of 6 h or 3 periods of 4 h at pH 5.5. Temperature (39°C) and solid (5%/h) and liquid (10%/h) dilution rates were mantained constant. Fermenters were fed 96 g/d of a 60 to 40 forage to concentrate diet (18.9% CP, 31.0% NDF). Treatments were a constant pH 6.4 (CTR); 1 period of 12 h at pH 5.5 (P1x12); 2 periods of 6 h at pH 5.5 (P2x6); 3 periods of 4 h at pH 5.5 (P3x4). Data were analyzed using PROC GLM of SAS (1996) and differences declared at P<0.05 using the Dunnett's test. Differences were declared at P < 0.05. Compared to CTR, treatment P1x12 reduced neutral detergent fiber (21.5% vs 32.7 %) and acid detergent fiber digestion (25.7% vs 38.6 %), and increased branch-chained volatile fatty acids proportion (3.8 vs 1.9 mol/100 mol) and the acetate to propionate ratio (2.3 vs 4.6). There were no differences in these estimates between P1x12 vs P2x6 and P3x4. Treatment P2x6 reduced true dry matter (48.3% vs 57.9%) and true organic matter (44.1% vs 50.4%) digestion compared with P1x12. There was no difference in these estimates between P1x12 vs P2x6 and P3x4. There was no treatment effects on ammonia nitrogen concentration, crude protein degradation, microbial protein synthesis (gN/kg OM truly digested) and the flow of dietary, bacterial and nonammonia nitrogen. Results suggest that the negative effects of prolonged periods (12 h) at pH 5.5 on ruminal fermentation are dependent on the total amount of time (h) that ruminal pH is suboptimal, but were not reduced by splitting it into various cycles.

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Key Words: pH, Acidosis, Rumen Fermentation

433 Acidosis in dairy cows. E. Bramley[1], I. J. Lean*[2], N. D. Costa[3], and W. J. Fulkerson[1], [1]*University of Sydney*, *Camden, NSW, Australia*, [2]*Bovine Research Australasia*, *Camden, NSW, Australia*, [3]*Murdoch University*, *Murdoch, WA, Australia*.

A cross-sectional survey examined acidosis and rumen function in one hundred dairy herds selected from five areas of Australia. Rumen fluid was obtained by both rumenocentesis (RC) and stomach tube (ST) from eight fresh cows < 100 DIM; three primipars and five multipars; randomly selected from within each herd. Samples (RC) were tested for pH and ST rumen fluid samples were analysed for VFA, ammonia and D-lactate concentrations. Cows were allocated into three distinct groups containing 10.2%, 29.9% and 59.9% of cows (n = 797) using cluster analysis.

Table 1 shows F-values and significance of measures used in group definition and means for groups. Group 1 cows had higher valerate, propionate, D-lactate and lower pH and ammonia concentrations than groups 2 and 3. Group 1 cows were considered to be acidotic. Cows in category 2 had high ammonia concentrations and group 3 had lower VFA concentrations than other groups. Major determinants of differences between groups were valerate, propionate, whereas pH and D-lactate concentrations, while significant were not major determinants of groups.

Table 1

Measure (mM/L)-Mean±SD	Group1	Group2	Group3	F-ratio (P value)
Valerate	2.6(1.2)	1.3(0.4)	0.8(0.4)	332.6*
Propionate	34.2(10.2)	19.5(6.2)	14.4(4.9)	332.4*
Butyrate	9.1(3.5)	12.4(2.9)	6.9(2.3)	291.9*
Isobutyrate	0.7(0.2)	0.9(0.2)	0.5(0.2)	243.5*
Isovalerate	1.1(0.4)	1.4(0.5)	0.9(0.3)	130.6*
Acetate	52.5(12.4)	59.2(12)	39.2(10.7)	226.2*
Ammonia	2.5(2.0)	7.8(3.8)	3.6(2.0)	203.9*
Caproate	0.6(0.6)	0.3(0.2)	0.1(0.2)	116.6*
pH	5.7(0.5)	6.2(0.4)	6.3(0.4)	55.0†
D-lactate	0.3(0.9)	0.3(0.9)	0.1(0.5)	5.0 †

*P<0.0001; †P<0.05.

Key Words: Dairy Cows, Acidosis

434 Effects of graded levels of wheat-barley concentrate on subacute ruminal acidosis (SARA), lipopolysaccharide endotoxins (LPS) and acute phase proteins in steers. G. N. Gozho*, J. C. Plaizier, and D. O. Krause, *University of Manitoba*, *Winnipeg, MB, Canada*.

The objective was to determine if inducing SARA increases the concentrations of LPS in rumen fluid and of the acute phase proteins serum amyloid-A and haptoglobin in peripheral blood. This was achieved by feeding diets with increasing levels of concentrate to three rumen fistulated Jersey steers during a 5-wk experimental period using a time series design. Changes over time were tested for significance using the SAS mixed models procedure. Forage and concentrate consisted of chopped alfalfa hay and 50:50 wheat barley pellets, respectively. Forage to concentrate ratios in the diet were 100:0, 80:20, 60:40, 40:60 and 20:80, during wk 1 to wk 5, respectively. Animals were fed ad libitum during week 1 and feed intakes were measured to determine the level of feed intake for weeks 2 to 5. Rumen fluid and peripheral blood were collected every 3 hours for two days during each week. Rumen pH was monitored continuously using indwelling pH probes. Average dry matter intakes were 5.76, 5.72, 5.91, 5.98 and 5.38 kg DM/d for wk 1 to 5, respectively. Average daily pH decreased (P < 0.01) from 6.7 to 6.1 between wk 1 and wk 5. Time below pH 6 increased (P < 0.01) from 0 to 785 min/d between wk 1 and wk 5. Time below pH 5.6 increased numerically from 0 to 219 min/d between wk 1 and wk 5. This indicates that SARA was induced during wk 5. LPS in rumen fluid increased (P < 0.0001) from 6542 EU/mL during wk 1 to 32,275 EU/mL during wk 5. There was a diurnal variation in LPS. The highest concentration of LPS was detected 6 h after the initial morning meal. Serum amyloid-A increased (P < 0.0001) from 36.5 µg/mL during wk 1 to 131.3 µg/mL during wk 5. Haptoglobin concentration increased (P < 0.0002) from 0.54 mg/mL during wk 1 to 2.39 mg/mL during wk 4. Results show that inducing SARA was accompanied by increases in LPS endotoxin in rumen fluid and acute phase proteins in peripheral blood, suggesting that inducing SARA through grain feeding activates an inflammatory response.

Key Words: Subacute Ruminal Acidosis, LPS Endotoxin, Acute Phase Response

435 Method to measure feed particles by image analysis. G. Licitra[1,2], M. Caccamo*[1], I. Schadt[1], J. D. Ferguson[3], G. Gennuso[1], and G. Azzaro[1], [1]*CoRFiLaC, Regione Siciliana, Ragusa, Italy*, [2]*D.A.C.P.A., Catania University, Catania, Italy*, [3]*University of Pennsylvania, Philadelphia*.

A method to measure the surface area of single feed particles by "image analysis" was developed in order to determine a precise particle size distribution in TMR samples. Briefly, the sample was first processed through a 1.6 mm sieve. The particles retained on the sieve were treated with acetone, tert-butanol and NDF reagent in order to reduce particle adhesion. The sample was collected on a white cloth with 0.39*0.77mm pores through which reagents are passed and particles retained. The wet sample particles were distributed and separated into four quarters over a maximum total surface of about 58*41cm. This area was sufficient for samples of 10g. A digital camera was placed at a height of 51cm, a ruler was added to the quarters, and pictures of each quarter were taken. Particle sizes and distribution were calculated by image analysis using the Matlab® image processing module. In the image, 1 cm of the ruler was highlighted, and the number of pixels corresponding to 1 mm was calculated. The image was sub-divided into unities of different dimension in order to improve distinction of particles from the background. The distribution of pixel intensity, the mean and standard deviation was calculated for each unity and threshold was determined to binarize the image selection. The binarized image was processed to identify each particle, and corresponding to pixel number, particle surface area was calculated. Matlab® elaboration was tested on TMR samples of four different farms. Inside one randomly chosen quarter 15 particles were considered. The maximum distance of two points of the particles was measured by hand using a caliper, as well as calculated by Matlab®. Particles' dimension varied from 0.2 up to 18.6 cm. The mean difference between the two methods was 0.08 mm (std ± 0.07). The Matlab® method was not statistically different from the manual measurement (P = 0.98). Three replicates each of 10g, 20g, 40g and 80g of sample were processed to examine the influence of sample size on estimate of particle distribution. Image analysis can be used to evaluate more precisely the effect of feed particle size on cow performance and production.

Key Words: Feed Particle Size, Image Analysis

436 Effect of replacing forage fiber with non-forage fiber in lactating dairy cow diets. J. Cyriac*, M. M. Abdelqader, K. F. Kalscheur, A. R. Hippen, and D. J. Schingoethe, *South Dakota State University*, *Brookings*.

Eight primiparous and eight multiparous lactating Holstein cows were used in a replicated 4 × 4 Latin square design to evaluate the effect of replacing forage fiber with non-forage fiber source on the performance of dairy cows. Four diets were formulated to replace corn silage with dried corn distillers grains with solubles (CDG) at 0, 7, 14, and 21% (DM basis). The control diet contained 40% corn silage, 15 % alfalfa hay, and 45 % concentrate (DM basis). Soybean meal was replaced with soybean hulls as the percentage of CDG increased in the diets. Alfalfa hay (15% DM) was equal for all diets. All dietary treatments were formulated to contain 16.8% CP, 30.7% NDF, and 4.8% fat. Results showed that dry matter intake increased linearly (P < 0.001) from 19.2 to 22.8 kg/d as CDG increased in the diet. Replacing forage with CDG did not affect (P > 0.10) milk yield (33.6 kg/d). However, milk protein percentage increased (P < 0.001) from 2.82 to 3.04% when the percentage of CDG increased in the diet. Consequently, milk protein yield increased (P < 0.007) from 0.93 to 1.03 kg/d as CDG increased in the diet. In contrast, there was a linear reduction (P < 0.001) in milk fat percentage (3.34, 3.25, 3.04, and 2.85) and milk fat yield (1.09, 1.09, 1.03, and 0.97 kg/d; P < 0.004) as the percentage of CDG increased in the diet. A linear increase (4.90, 4.90, 4.92, and 4.96%; P < 0.01) in milk lactose percentage was observed as CDG percentage increased in the diet. Energy-corrected milk and milk urea nitrogen were not altered due to diet. Feed efficiency (energy-corrected milk/DMI) decreased as CDG increased in the diet (1.67, 1.57, 1.49 and 1.37; P < 0.001). Increasing CDG in the diet resulted in a linear decrease (P< 0.001) in molar proportion of acetate (65.0, 63.6, 61.5, and 59.6) and a linear increase (P < 0.001) in propionate (21.9, 23.3, 25.0, and 27.3) in rumen fluid. Ruminal butyrate was not affected by diet. Milk production was not affected by the replacement of corn silage with CDG; however, milk fat percentage and yield were depressed indicating lack of effective fiber in the diet as CDG was increased.

Key Words: Corn Distillers Grains, Milk Fat Sepression, Replacement of Forage

437 Pretrial intake affects relative intake, digestion, and production responses of lactating cows to alfalfa and grass silages. J. A. Voelker Linton* and M. S. Allen, *Michigan State University*, *East Lansing*.

Effects of pretrial DMI on relative responses of DMI, digestion kinetics, and milk yield and composition to alfalfa silage versus grass silage were evaluated using 8 ruminally and duodenally cannulated Holstein cows in a crossover design experiment with a 14 d pretrial period and two 15 d experimental periods. Cows were 178 ± 111 (mean ± SD) DIM at the beginning of the pretrial period. During the 14 d pretrial period, milk yield ranged from 24.5 to 46.0 kg/d (mean = 37.0 kg/d) and pretrial DMI (pDMI) ranged from 11.4 to 21.0 kg/d (mean = 17.5 kg/d). Treatments were two diets with either alfalfa silage (diet AL) or grass silage (diet GR) as the sole forage. Alfalfa silage contained 43% NDF (DM basis) and grass silage contained 48% NDF; diets contained ~23% forage NDF and 27% total NDF, so forage:concentrate was 53:47 for AL and 49:51 for GR. Data were analyzed by a mixed-effects model. Digestibility of NDF was lower for AL in the rumen ($P < 0.0001$) and whole tract ($P < 0.0001$), and milk fat concentration was greater for GR than for AL ($P = 0.03$). Mean 3.5% fat-corrected milk yield (FCMY) and DMI were not different between AL and GR ($P > 0.15$), but individual FCMY and DMI responses to AL over GR ($Y_{AL} - Y_{GR}$) were positively related to individual pDMI values (FCMY: r = 0.84, $P = 0.02$; DMI: r = 0.87, $P < 0.01$). A more positive DMI response to AL over GR among high-pDMI cows was permitted by a more positive response in ruminal NDF turnover rate for AL over GR as pDMI increased (r = 0.72, $P < 0.05$). This response in NDF turnover rate was because of a differential response in rate of passage rather than digestion; indigestible NDF passage rate response ($Y_{AL} - Y_{GR}$) tended to increase with increasing pDMI (r = 0.69, $P = 0.06$), but NDF digestion rate response ($Y_{AL} - Y_{GR}$) did not change as pDMI increased ($P = 0.47$). Therefore, the effects of alfalfa and grass forages on intake, fiber digestion, and milk production are dependent on the extent to which fill limits intake in an individual animal.

Key Words: Grass vs. Legume, Digestion Kinetics, Feed Intake

438 Effects of dietary NDF concentration on milk yield, bacterial protein syntheses and endocrine-metabolic status in dairy sheep in late lactation. A. Cannas*, G. Bomboi, F. Boe, and B. Floris, *University of Sassari*, *Sassari, Italy*.

The effect of dietary NDF and non-fiber carbohydrates (NFC) on production and hormonal status was studied in ten high producing (mean milk yield 1995±353 g/d) Sarda ewes in the 5th month of lactation. The ewes were kept in individual metabolic cages and divided in two groups. One was fed a high NDF-low NFC diet (H-NDF diet = 46.2% NDF, 31.7% NFC, DM basis), the other received a low NDF-high NFC diet (L-NDF diet = 32.2% NDF, 45.9 NFC; DM basis). Both diets were fed ad libitum and included 57% of DM of chopped dehydrated alfalfa. The remaining part was composed mostly by soybean hulls (H-NDF diet) or cereal grains (L-NDF diet). Purine derivatives were used to estimate intestinal microbial protein absorption. At the end of the 30-d experimental period, the blood of the ewes was sampled every 30 minutes for 6 h, starting 30 min after the withdrawal of the diet. Compared to the preliminary period, when the ewes were fed a mix of the two experimental diets, during the experimental period DMI and NEL intake increased in the L-NDF group and decreased in the H-NDF group (variations for H-NDF and L-NDF, respectively: -287 vs. 27 g/d of DMI, P< 0.002; -0.60 vs. 0.19 Mcal of NEL/d, P< 0.002). Despite this, milk yield decreased less in the H-NDF compared to the L-NDF group (-202 vs. -370 g/d, P<0.01), while the BCS tended to increase more in the L-NDF group (0.10 vs. 0.25 units/30 d; NS). The H-NDF group synthetized more bacterial protein than the L-NDF group (150 g/d vs 99 g/d; P< 0.001). The ewes fed the H-NDF diet had higher hematic concentration of GH (1.43 vs. 1.23 ng/ml; P< 0.02), IGF-1 (71.8 vs. 66.4 ng/ml; P<0.01) and NEFA (109.4 vs. 74.0 μEq/ l; P<0.001) and lower concentration of insulin (17.6 vs. 27.0 μU/ ml; P<0.001) and glucose (68.9 vs. 71.2 mg/dl; P<0.013) than those of the L-NDF group. Leptin (2.37 vs. 2.28 ng/ml; P>0.37) and urea (44.2 vs. 45.5 mg/dl; P > 0.23) did not differ between the two groups. In conclusion, the H-NDF diet induced an endocrine and metablic status more suitable for milk production, as confirmed by the productive results, compared to the L-NDF diet.

Key Words: Sheep Milk, Dietary NDF, Hormones