

Ruminant Nutrition: Protein, Energy and By-Products Supplementation II

W107 Improvements in feed efficiency via rumen-protected amino acid supplementation limited by ration formulation software. T. R. McGill* and M. D. Hanigan, *Virginia Polytechnic Institution and State University, Blacksburg.*

To avoid nutrient limitations, MP requirements are often overestimated in the formulation of dairy cow rations. Overfeeding of N results in increased expenses for producers and increased N excretion to the environment. Thus, improvements in the efficiency of dairy cow feeding provide economic and environmental incentives. Previous improvements in feed efficiency have come via the dilution of maintenance through increased production. To achieve further improvements, it is necessary to explore approaches such as supplementation of limiting AA's in rumen protected (RP) form to diets low in MP. The goal of this study was to better illustrate the mechanism of lactation response to RPAA, and to evaluate the effect of RPAA products on milk yield. Four diets were fed to 36 multiparous Holstein dairy cows in a 4×4 Latin square design. Diets were (1) positive control diet with 17.1%CP (+Con), (2) negative control diet containing 15.4%CP (-Con), (3) -Con diet supplemented with 20 g/d/cow of RP methionine (RPM), and (4) -Con diet supplemented with 20 g/d/cow of RP methionine and 60 g/d/cow of RP lysine (RP M/L). Data were analyzed using the MIXED procedure in SAS 9.2. Milk yield was not significantly different between groups, suggesting that protein was not sufficiently limiting to affect production. Concentrations of MUN from cows fed -Con, RPM and RP M/L diets were significantly lower than that of cows fed +Con diet ($P < 0.0001$), suggesting improved efficiency of N metabolism in cows fed diets low in MP. The 2001 NRC formulation software was used to formulate diets. The predicted metabolizable protein balance of the -Con diet was -262 g/d, and predicted a 17.5% decrease in MP Allowable Milk compared with the +Con. This inaccuracy illustrates the need for improvement in dairy nutrition models. Model inaccuracies contribute greatly to inefficiencies in dairy cow feeding, and must be evaluated in the effort to improve dairy cow feed efficiency. Such improvements could act synergistically with RPAA supplementation to more closely match nutrient composition in feed to nutrient requirements of dairy cows.

Key Words: rumen-protected amino acid, feed efficiency, NRC

W108 The effect of a two ration feeding regimen on feed intake, milk production and composition, and plasma hormones and metabolites in dairy cows. M. Niu*, Y. Ying, P. A. Bartell, and K. J. Harvatine, *Penn State University, University Park.*

There is a circadian pattern of feed intake, milk synthesis, and plasma metabolites in dairy cows consuming a single TMR fed once a day. The object of this study was to determine if feeding multiple rations over a day that compliment these rhythms would improve milk production. Twelve Holstein cows were used in a replicated 3×3 Latin square design with 21 d periods in an automated feed observation system that recorded feed weight every 10 s. Diets were control (Con; 32% NDF, 25% starch), a low forage and high fermentable starch diet (L; 28% NDF, 32% starch, 56% corn silage and 14% steamflaked corn), and a high fiber diet (H; 33.5% NDF, 22% starch, 43% corn silage and no steamflaked corn). The L and H diets were balanced to provide the same composition as the control diet when combined in a 1:3 ratio of L:H. Con was fed control diet at 0700 h, the high/low treatment (HL) was fed H at 0700 h and L at 2200 h, and the low/high (LH) treatment was fed L at 0700 h and H at 1100 h. Daily variables were analyzed by a

mixed model and the contrasts were Con vs. HL and HL vs. LH. Time course data were analyzed using repeated measures and the contrasts were tested at each time point. DMI was decreased by 1.3 kg/d by HL compared with LH ($P < 0.05$). There was no difference between Con and HL for milk yield and composition, but milk fat percent was higher in HL compared with LH ($P < 0.05$, 3.61 vs. 3.44%) and HL tended to increase milk fat yield compared with LH ($P < 0.10$). Milk yield was 1.8 kg higher and fat percent was 0.38 units lower at the 0500 h milking compared with the 1700 h milking, but milk fat yield did not differ. Blood samples were collected from the tail vein at 8 times to represent the course of a day at the last 3 d of each period. There was no effect of treatment on plasma NEFA and BUN concentration, but plasma glucose was decreased 2.5 mg/dL by HL compared with Con ($P < 0.05$). Feeding HL reduced DMI and increased milk fat yield compare with the LH, but feeding multiple rations over the day had little effect on DMI or milk yield and components compared with a single TMR.

Key Words: dairy cows, milk production, multiple rations per day

W110 Developing techniques to determine the metabolizable methionine content of ruminant products. R. S. Ordway*¹, C. G. Schwab^{2,3}, B. K. Sloan⁴, and N. L. Whitehouse², 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.*

Several methods have been used to determine the effectiveness of ruminant Met supplements in providing metabolizable Met (MP-Met) to dairy cows. Measuring differences in the slope of changes in milk protein or plasma free Met concentrations to increasing intakes of a Met supplement are 2 of the most promising. A randomized split plot 5×5 Latin square using 20 lactating cows in a $2 \times 2 \times 5$ factorial arrangement of treatments was employed using 10 d periods with the last 4 d used for milk and blood sampling. Main effects were Met adequacy of basal diet (1.8 or 2.3 MP-Met as a % of MP), Met supplement [Smartamine M (S) or dry MetaSmart (M)] and level of Met supplementation (0, 3, 6, 9 and 12 g/d MP-Met). Basal diets met NRC (2001) requirements and contained 6.8% Lys in MP. Additional S was used to achieve the high MP-Met basal diet. S and M were estimated to supply 600 and 222 g of MP-Met/kg of product, respectively. The response criteria evaluated were milk protein content (MPC), milk protein yield (MPY), plasma Met (PM) and total plasma sulfur AA (TPSAA). Three blood samples were taken from the tail vein daily at 2-h intervals after the am feeding on d 7-10 of each experimental period. Plasma samples were centrifuged, deproteinized and composited within and across days and analyzed in duplicate for AA content. For each response parameter, linear regression equations were derived for each product at each level of Met adequacy. On the limiting MP-Met basal diet, both Met supplements increased MPC 0.009 units/g MP-Met with a SE of 0.002; a precision of $\pm 20\%$. Both M and S improved MPY 9 and 6 g per g of MP-Met, respectively, with SE of >2.6 and an imprecision of $>40\%$. For S, irrespective of level of MP-Met adequacy, both PM and TSAA increased in a linear fashion ($r^2 > 0.78$) with a precision of $\pm 10\%$; however, the predictability was poor for M ($r^2 < 0.33$). It appears PM or TPSAA are the most appropriate response parameters to use to predict the MP-Met contribution of rumen protected DL-Met sources, but they are unsuitable for products where the analog rather than DL-Met is absorbed.

Key Words: amino acid methodologies, encapsulated methionine, methionine analogue

W111 The effect of various dietary metabolizable proteins to metabolizable energy ratios on ovarian follicular activities in prepubertal Holstein heifers. H. R. Motalebei, M. Dehghan-Banadaky*, K. Rezayazdi, and H. Kohram, *Department of Animal Science, University of Tehran, Karaj, Tehran, Iran.*

The objective of the present study was to evaluate the effects of various metabolizable protein (MP) to metabolizable energy (ME) ratios on ovarian follicular dynamics in prepubertal Holstein heifers. Twenty-four Holstein heifers, weighing 217 kg, 210 ± 28 d old, were used in the trial. Heifers were randomly assigned to 3 rations of MP per day: (1) control, MP based on NRC (34.57 g), (2) 10% MP less than NRC (31.14 g), (3) 10% MP more than NRC (38 g). Metabolizable energy in all rations was based on NRC requirements (14 Mcal per day). Rations were formulated by NRC (2001) software. After 70 d of feeding, the estrous synchronization were done using 2 IM injection of PGF2 α (Vetalyse, Dinoprost, Aburaihan, Iran), 11 d apart and ovarian ultrasonography (Pie medical, Falco 100, 8 MHz) was performed once daily over 10 d period from the day of estrus. The ovarian follicles were counted and classified as: class 1 (total, \geq 2 mm), class 2 (small, 4–6 mm), class 3 (medium, 7–9 mm), class 4 (large, \geq 10 mm) and class 5 (medium and large \geq 7 mm). The results showed that there were no differences ($P > 0.05$) between rations in classes 1 to 4, but class 5 follicles were higher ($P < 0.05$) in ration 1 than rations 2 and 3. It is concluded that 10% MP less than NRC rations may had the beneficial effect on the ovarian activity in prepubertal heifers.

Table 1. The effects of various ratios of MP to ME on ovarian follicular activities (no. and class of follicles) in prepubertal heifers

No. of follicles	MP/ME (g/Mcal)			P-value	SEM
	34.57	31.14	38		
Class 1 (total, \geq 2 mm)	13.67	13.58	14.08	NS	0.525
Class 2 (small, 4-6 mm)	9.64	8.30	9.10	NS	0.503
Class 3 (medium, 7-9 mm)	0.64	0.94	0.61	NS	0.131
Class 4 (large, \geq 10 mm)	0.50	0.43	0.32	NS	0.930
Class 5 (medium and large, \geq 7 mm)	1.09	1.79	0.94	0.03	0.243

Key Words: metabolizable protein, metabolizable energy, ovarian follicle

W112 Ruminal fermentation profile of cows fed diets containing dried distillers grains with solubles associated with risk factors for milk fat depression. H. A. Ramirez Ramirez* and P. J. Kononoff, *University of Nebraska-Lincoln, Lincoln.*

Four ruminally-cannulated Holstein cows, averaging (\pm SD) 114 ± 14 DIM and 662 ± 52 kg BW were used in a 4 × 4 Latin Square to test the effects of high dietary oil and starch as risk factors associated with milk fat depression (MFD) on ruminal fermentation when feeding of a diet containing dried distillers grains with solubles (DDGS). Formulation of the experimental diets included corn oil and ground corn to increase crude fat (CF) and starch levels. In each of the 21-d periods cows were assigned to one of 4 dietary treatments (values expressed on a DM basis): control ration containing 20% DDGS but no risk factors associated with MFD (CON; CF 5.4%, starch 20%); CON with added oil (OIL; CF 6.4%, starch 20%); CON with added starch (STARCH; CF 5.6%, starch 26%); and CON with added oil and starch (COMBO; CF 6.5%, starch 25%). There was a significant effect ($P < 0.01$) of diet on milk fat concentration (MF%) (3.19, 2.75, 2.88 and 2.21 ± 0.18% for CON, OIL, STARCH and COMBO, respectively). Ruminal pH and

NH₄ were not affected by treatment (averaging 5.97 ± 0.08 and 14.5 mg/dL across treatments). Total concentration of VFA was similar for CON, OIL and STARCH (119 ± 3.64 mmol/L) whereas COMBO was lower ($P < 0.01$; 111 ± 3.64 mmol/L). Molar proportion of acetate (Ac) was affected by treatment ($P < 0.01$) being higher for CON compared with OIL, STARCH and COMBO (64.6 versus 61.9 ± 1.44 mol/100 mol). Treatment also had a significant effect ($P < 0.01$) on propionate (Pr) which was highest for COMBO, followed by OIL and STARCH; and lowest for CON (25.3, 24.5 and 22.0 ± 1.53 mol/100 mol). Concomitant with these changes Ac:Pr tended ($P = 0.12$) to decrease with the addition of risk factors (2.97, 2.64, 2.62 and 2.45 ± 0.21 for CON, OIL, STARCH and COMBO, respectively). Feeding a diet with 20% DDGS resulted in higher concentration of Ac and low Pr; by adding high levels of oil and starch to such diet these parameters were inverted resulting in a tendency to decrease Ac:Pr and reduced MF% possibly due to shifts in ruminal environment which may affect microbial metabolism and milk fat synthesis.

Key Words: ethanol by-products, ruminal pH, VFA

W113 The protein binding capacity of protein-precipitable phenolics from 10 warm-season perennial forage legumes. H. D. Naumann*^{1,2}, J. P. Muir², B. D. Lambert^{2,3}, A. E. Hagerman⁴, and L. O. Tedeschi¹, ¹Texas A&M University, College Station, ²Texas A&M AgriLife Research, Stephenville, ³Tarleton State University, Stephenville, TX, ⁴Miami University, Oxford, OH.

Condensed tannins (CT) are protein-precipitable phenolic compounds (PPP) that bind to proteins and potentially reduce ruminal protein breakdown. Ruminants consuming forages containing biologically active CT could experience an increase in ruminal-bypass protein. The objectives of this study were to determine the PPP concentration and amount of protein bound (PB) by PPP, as well as the protein binding capacity of PPP produced by warm-season perennial legumes commonly consumed by ruminants. Ten warm-season perennial legumes: *Leucaena retusa*, *Desmanthus illinoensis*, *Lespedeza stuevei*, *Mimosa strigillosa*, *Neptunia lutea*, *Desmodium paniculatum*, *Arachis glabrata*, *Lespedeza cuneata* and 2 ecotypes of *Acacia angustissima* var. *hirta* were evaluated. Protein-precipitable phenolics were determined by reacting crude plant extracts with bovine serum albumin. The amount of PB was determined by nitrogen analysis of the protein-phenolic residues. The PB to PPP ratio (PB:PPP) was used to evaluate the difference in protein binding capacity among the forage legumes surveyed. *Arachis glabrata*, included as a negative control, contained no PPP. *Desmodium paniculatum* had the greatest PPP concentration (193.9 g/kg DM; $P < 0.0001$). The greatest amounts of PB ($P < 0.0001$) were measured in *L. stuevei* and *M. strigillosa* (74.8 and 74.6 g/kg DM, respectively). The least amount of PB was demonstrated by *L. retusa*. The greatest protein binding capacities ($P < 0.05$) were demonstrated by PPP from *L. cuneata*, *D. illinoensis* and *M. strigillosa*, which had PB:PPP of 0.74, 0.67 and 0.61, respectively. Protein-precipitable phenolics from *D. paniculatum*, *L. retusa* and 2 ecotypes of *A. angustissima* demonstrated the least ($P < 0.05$) protein-binding capacities (PB:PPP = 0.17, 0.38, 0.36, and 0.31, respectively). The protein binding capacity of PPP from *L. cuneata* was more than 4 times greater than that of *D. paniculatum*, which had a PPP concentration almost 4 times greater than *L. cuneata*. Differences in protein binding capacity of PPP could translate into differences in biological value of forages consumed by ruminants, especially as it relates to ruminal escape protein.

Key Words: bypass protein, legume

W114 Ruminant degradability in vitro by sub-products of the biodiesel industry. A. L. Silva, M. I. Marcondes*, F. C. Sousa, L. S. Knupp, C. M. Velloso, C. S. Cunha, and J. P. P. Rodrigues, *Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil.*

The in vitro gas production technique is capable of simulating the ruminal environment, reflecting the rate and extent at which the components are fermented by the rumen microorganisms. The objective was to study the rumen fermentation kinetics of 18 by-products from the biodiesel industry, with potential for use for feeding ruminants, using in vitro gas production technique. The feeds studied were: cottonseed (*Gossypium* spp. L.) meal and cake; babassu (*Orbignya speciosa*) cake; canudo de pito (*Mabea fistulifera* Mart) meal; crambe (*Crambe abyssinica*) meal and cake; palm kernel (*Elaeis guineensis*) cake; sunflower (*Helianthus annuus*) meal and cake; licuri nut (*Syagrus coronata*) cake; macauba fruit (*Acrocomia aculeata*) cake; castor seed (*Ricinus communis*) meal detoxified with lime; forage radish (*Raphanus sativus*) cake; 2 jatropha (*Jatropha curcas*) cakes; 2 peanut (*Arachis hypogaea*) cakes; and soybean (*Glycine max*) meal. Feeds were grouped, according to the rumen fermentation kinetic parameters, in 6 different groups. It was used multivariate analysis by Ward's minimum-variance method, and adopted an R^2 of 0.8. Soybean meal was used as control treatment. Parameters evaluated were: gas production from fibrous carbohydrates (VfFC), gas production from nonfibrous carbohydrates (VfNFC), degradation rate of fibrous carbohydrates (kdFC), degradation rate of nonfibrous carbohydrates (kdNFC) and lag time (lag). The VfNFC varied from 16.72 to 200.07 mL for the macauba fruit cake and peanut cake II, respectively. While the VfFC varied from 53.09 to 242.12 mL for the palm kernel cake and macauba fruit cake, respectively. Mean kdFC values varied from 0.002 to 0.039%/h for the licuri nut cake and forage radish cake, respectively. The kdNFC for palm kernel cake and macauba fruit cake varied from 0.022 to 0.430%/h, respectively. Mean lag values varied from 0.0001 to 5.2029 h for the cottonseed cake and palm kernel cake, respectively. The sub-products forage radish cake and cottonseed, crambe and sunflower meals, contained in the group 1, showed similar quality to soybean meal. Thus, these feeds have potential to replace soybean meal in ruminant rations.

Key Words: carbohydrate, degradation rate, ruminants

W115 Urinary and blood characteristics in cattle fed low-quality tropical forage in response to infrequent nitrogen supplementation. L. M. A. Rufino*, E. Detmann, J. P. P. Rodrigues, L. H. R. Silva, S. C. Valadares Filho, M. F. Paulino, and M. O. Franco, *Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil.*

The effects of supplementation with rumen degradable protein (RDP) using 2 frequencies of supplementation on urinary and blood characteristics were evaluated in cattle fed low-quality tropical forage. Five crossbred steers, with average BW of 257 ± 18 kg, were used in a 5×5 Latin square design. Five treatments were evaluated: 1. control (without supplementation); 2. daily supplementation supplying 30% of the daily RDP requirements (30/D); 3. daily supplementation supplying 60% of the daily RDP requirements (60/D); 4. supplementation every 3 d supplying 30% of 3 d based requirements of RDP (30/I); and 5. supplementation every 3 d supplying 60% of 3 d based requirements of RDP (30/I). The animals were fed ad libitum with Tifton 85 hay (4.5% of crude protein). The supplement was composed of 85% casein and 15% urea: ammonium sulfate (9:1). The experimental periods lasted 24 d, being 9 d for adaptation to the treatments. The total urine collection was performed from d 16 to 18 and the excretions of urea nitrogen (UN) and 3-methylhistidine (3MH) were evaluated. Blood samples were taken from d19 to 21 via the jugular vein every 6 h (6 h, 12 h, 18 h, and 24 h) and composed on

a daily basis. The concentrations of serum urea nitrogen (SUN) and plasma amino acids (PAA) were evaluated. The different collection days were considered as repeated measures. The treatments did not affect ($P > 0.10$) 3MH and PAA. The supplementation increased ($P < 0.01$) the UN and SUN. Among supplements, only a difference between amounts of RDP was detected ($P < 0.01$) for these variables, being the greatest values observed when 60% of RDP requirements were supplied. Moreover, there was a day \times treatment interaction ($P < 0.01$) for both SUN and UN. There were variations among days ($P < 0.01$) only for treatments 30/I and 60/I. In both treatments, there was an increase in SUN on d 2 of collection with return on 3rd day at concentrations similar to those observed on d 1. Infrequent nitrogen supplementation changes the nitrogen metabolism of cattle fed low-quality tropical forage.

Key Words: metabolism, nitrogen, recycling

W116 Small intestinal digestion of raw cornstarch in cattle is increased by duodenal infusion of non-essential amino acids or casein. D. W. Brake*, E. C. Titgemeyer, E. A. Bailey, and D. E. Anderson, *Kansas State University, Manhattan.*

Previous research demonstrated that small intestinal starch digestion (SISD) in cattle may be increased by postprandial infusion of casein, but reports on effects of amino acids (AA) are limited. We evaluated effects of AA on SISD in cattle. Five duodenally and ileally cannulated steers (initial BW = 259 kg) were used in a 5×5 Latin square with 6-d periods. All cattle were fed 4.8 kg DM/d of a soybean hull-based diet and received continuous duodenal infusions of raw cornstarch (1.5 kg/d) and Cr-EDTA in 12.6 L/d volumes. Treatments were infused duodenally and included (1) control, (2) 424 g/d casein, (3) 393 g/d AA mimicking casein (CASAA), (4) 192 g/d AA mimicking the essential AA in casein (EAA), and (5) 200 g/d AA mimicking the non-essential AA in casein (NEAA). On d 6 of each period, 6 spot samples of ileal digesta and feces were composited and subsequently analyzed. Flow of starch to the ileum tended ($P = 0.08$) to be less when cattle received casein, CASAA, or NEAA. Additionally, SISD was greatest ($P \leq 0.05$) with CASAA and least with control. When cattle were infused with EAA, SISD did not differ from control, and SISD was intermediate to control and CASAA when cattle received casein or NEAA. Flows of ethanol-soluble oligosaccharides to the ileum were greatest ($P = 0.01$) with EAA and casein, least for control and NEAA, and intermediate for CASAA. Glucose flows to the ileum averaged 61 g/d and were not affected ($P = 0.26$) by treatment. Large intestinal starch digestion tended ($P = 0.06$) to be less and starch flow to the feces was greater ($P = 0.04$) for control and NEAA than for CASAA and casein. Postprandial starch digestion was least ($P = 0.03$) for control and NEAA. Apparently, SISD in cattle receiving continuous infusion of raw cornstarch is improved by AA similar to casein, and this response was mimicked by NEAA but not EAA.

Key Words: amino acid, cattle, small intestinal starch digestion

W117 Relationships between malt characteristics and feed value of malt barley grain. S. Ding*^{1,2}, M. Oba², M. L. Swift³, W. Z. Yang¹, and T. A. McAllister¹, ¹Lethbridge Research Center, Agriculture and Agri-Food Canada, Lethbridge, AB, Canada, ²Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada, ³Alberta Agriculture and Food, Lacombe, AB, Canada.

Grain producers in western Canada prefer to grow malt barley over feed barley as malt barley is more economically attractive. However, less half of the malt barley produced qualifies as malt grade with the

remainder used as feed grain. Feed value of malt barley is rarely considered by grain growers and as such, there is a paucity of information available. The objective of this study was to examine the relationship of malt characteristics with chemical composition and DM digestibility (DMD). Five-hundred and 60 malt barley samples were collected across western Canada in 2007. Five malting characteristics including fine malt extract (FEXT), diastatic power (DP), α -amylase (ALPH), β -glucan (GLU) and friability (FRI) were selected due to a potential correlation to nutrient content and DMD of malt barley. Digestibility of DM was evaluated by grinding the samples through 6-mm and incubated for 24 h in batch culture. Samples were ground to 1-mm for determination of CP, NDF and starch. Correlation coefficient was analyzed using CORR procedure of SAS. FEXT (%), DP ($^{\circ}$ L), ALPH (D.U.), GLU (ppm), and FRI (%) ranged from 74 to 85, 110 to 220, 57 to 97, 51 to 580 and 34 to 110, respectively. The concentrations (% DM) of CP, starch and NDF ranged from 8.1 to 16.5, 55.6 to 67.4, and 17.2 to 21.2, respectively. Digestibility of DM (%) averaged 39.5 and ranged from 26.8 to 56.6. Protein concentration of malt barley was negatively correlated ($P < 0.01$) with FEXT ($r = -0.89$) and FRI ($r = -0.70$), but positively correlated with DP ($r = 0.63$). The starch concentration was negatively correlated ($P < 0.01$) with DP and ALPH ($r = -0.56$ and $r = -0.57$, respectively). Neither malt characteristics nor chemical composition of malt barley were correlated ($-0.24 < r < 0.28$) with DMD. These results indicate that some malt characteristics could be used as reliable criteria to select malt barley for use as feed barley. This work also demonstrates the substantial variation in chemical composition of commercially available malt barley and emphasizes the need to have an accurate and rapid means of quality assessment at the point of sale.

Key Words: batch culture, chemical composition, malt barley

W118 Investigation of dietary fiber as a potential source of trace mineral antagonism in ruminants. G. I. Zanton* and P. Fisher, *Novus International Inc., St. Charles, MO.*

Dietary fiber has been implicated as a potential antagonist against trace mineral absorption in non-ruminants at fiber concentrations significantly lower than those which would be present in ruminant diets. The magnitude of the interaction between fibrous ingredients and trace minerals has not been characterized under ruminant relevant conditions. To address this question, fibrous feedstuffs were ground through a 1 mm screen and pre-incubated in 39°C distilled water under shaking for 2 h. Insoluble material was filtered and dried for 24 h. A quantity of dried, insoluble material was weighed into 15 mL centrifuge tubes to which 10 mL of solutions containing sulfate salts of Zn or Cu were added. Tubes were shaken for 24 h at 39°C, centrifuged for 15 min at 500 \times g, the supernatant was filtered (0.2 μ m), and analyzed for mineral concentration with ICP-OES. Percent mineral bound (%MB) to fiber was determined by the difference between final and initial concentration in solution. Several experiments were conducted with wheat straw (WS) as the fiber source to evaluate %MB and the effects of: pH (3.0 and 5.5–6.5) and Zn or Cu levels (15–1000 ppm); changing WS (12.5–100 g/L) and Zn or Cu (15–1000 ppm) levels; increasing levels of Ca (0.125–25 g/L) on Zn binding; and altering both Zn and Cu levels (16–250 ppm). In addition, the effect of rumen degradation (16 h) on Zn binding was evaluated with different fibrous feeds. Under all conditions evaluated, increasing level of Zn or Cu decreased %MB to the fiber. Lower pH reduced %MB whereas increasing the level of fiber increased %MB. Increasing the level of Ca or Cu in solution decreased the binding of Zn to the fiber, whereas increasing the level of Zn did not appreciably affect the binding of Cu. Incubation of the feeds in the rumen significantly

reduced the binding of Zn (78.9 vs 74.4% bound by fiber sources for $t = 0$ and 16, respectively; $P < 0.01$). Zn binding ranged from 56 to 92% for the feedstuffs evaluated with the following ranking: timothy hay < WS < alfalfa hay < wheat bran < oat bran. It is concluded that fiber can bind a significant percentage of Zn and Cu under ruminant relevant conditions.

Key Words: trace mineral, fiber, antagonisms

W119 Forage intake and digestibility by Katahdin ewes offered bermudagrass hay supplemented with apple cider vinegar. W. B. Smith*¹, E. A. Backes^{1,2}, J. D. Caldwell², K. P. Coffey¹, and A. N. Young¹, ¹*Department of Animal Science, University of Arkansas Division of Agriculture, Fayetteville,* ²*Department of Agriculture and Environmental Science, Lincoln University, Jefferson City, MO.*

Currently, some small ruminant producers are supplementing with apple cider vinegar (ACV) for increased fiber digestion and feed efficiency. However, no scientific data are available to justify this practice. Our objective was to determine intake and in vivo digestibility of bermudagrass hay by ewes supplemented with different levels of ACV. Sixteen non-pregnant, nonlactating Katahdin ewes (3 to 4 yr of age; 65.9 \pm 1.16 kg initial BW) were allocated randomly to 1 of 4 treatments: 0, 10, 20 or 30 mL ACV/d. Ewes were housed in individual 1.4 \times 4.3 m pens fitted with rubber mats. Each ewe was offered a 100 g mixture of cracked and ground corn at approximately 1500 h daily, and the allotted level of ACV was incorporated into the mixture. Hay from large round bales of predominantly bermudagrass (72.4% NDF, 36.3% ADF) was chopped using a bedding chopper to an approximate fiber length of 2.5 cm and offered ad libitum to each ewe through a 10-d adaptation period followed by 6 d of total fecal collections. Data were analyzed using SAS PROC MIXED, where animal served as the experimental unit. Level of inclusion of ACV did not affect DM intake ($P = 0.17$), digestible DM intake ($P = 0.22$), DM digestibility ($P = 0.52$), NDF digestibility ($P = 0.23$), or ADF digestibility ($P = 0.13$). Based on these data, ACV is not a viable supplement for enhancing digestibility of bermudagrass hay at levels of inclusion up to 30 mL/d.

Key Words: apple cider vinegar, dry matter digestibility, Katahdin

W120 Evaluation of microwave irradiation effects on ruminal and post-ruminal degradation of guar meal. S. N. Garajeh^{2,1}, A. Taghizadeh*¹, N. M. Sis², F. P. Khajehdizaj¹, and B. B. Nobari¹, ¹*Department of Animal Science, Faculty of Agriculture, University of Tabriz, Tabriz, Eastern Azarbaijan, Iran,* ²*Department of Animal Science, Shabestar branch, Islamic Azad University, Shabestar, Iran.*

Knowledge of the extent of RUP is important in formulating diets with adequate RDP to support rumen microorganisms. When protein degradation in the rumen exceeds the microbes ability to assimilate N into microbial crude protein (MCP), excessive rumen ammonia concentrations can occur. The DM of 1 g sample of guar meal (DM 95.5%, CP 49.6%, NDF 15.1%, ADF 6.6%, EE 4.7% and OM 94.9%) in duplicate was determined and water was added to increase the moisture content of 1kg guar meal to 300 g/kg. Approximately 500 g of samples were subjected to microwave irradiation (Butane microwave BC380W) at a power of 900w for 2 and 4 min, separately. The ruminal and post-ruminal degradation were determined according to Gargallo et al. (2006) with 3 fistulated sheep fed diet containing 60:40 hay to commercial concentrate. Ruminal degradability of guar meal DM and CP were decreased linearly ($P < 0.0001$) as microwave irradiation time increased. Similar result was observed for post-ruminal degradation of guar meal CP. It seems that

microwave treatment resulted in decreasing protein solubility and led to decrease in CP degradation. When secondary and tertiary structures of a protein are unfolded, hydrophobic groups interact and reduce water binding. Moreover, hydrophobic interactions lead to aggregation followed by coagulation and precipitation, probably reducing ruminal CP degradability.

Table 1. Ruminal and post-ruminal degradability of DM and CP of untreated and microwave treated guar meal

	Microwave treated			SEM	Contrast	
	Untreated	2 min	4 min		Linear	Quadratic
Ruminal degradability for 12 h incubation (%)						
DM	84.8	75.4	69.8	1.09	<0.0001	0.1841
CP	79.2	73.7	59.3	1.45	<0.0001	0.0350
Post-ruminal degradability (%)						
DM	76.3	81.1	79.1	0.58	0.0140	0.0030
CP	95.3	90.5	93.0	0.21	0.0003	<0.0001

Key Words: microwave irradiation, guar meal, ruminal and post-ruminal degradation

W121 Effect of feeding a corn straw or mixed forage diet on rumen fermentation parameters and ruminal papillae morphology in dairy cows. X. X. Weng^{1,2}, J. Q. Wang^{*1,2}, D. P. Bu¹, Y. D. Zhang¹, and F. D. Li², ¹State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China, ²College of Animal Science and Technology, Gansu Agricultural University, Lanzhou, China.

Papillae protruding from the rumen wall greatly increase the surface area for absorption of nutrients, and diets play an important part for papillae development. The objective of this study was to determine the effect of dietary forage sources on rumen fermentation parameters and ruminal papillae morphology in dairy cows. Ten primiparous and rumen-cannulated Holstein dairy cows averaging 127 ± 13 d in milk (mean ± SD) were randomly assigned to mixed forage diet (MF, forage: concentrate = 60: 40) with Chinese wildrye, alfalfa hay and corn silage as the forage source or corn straw diet (CS, forage: concentrate = 40: 60) with corn straw as the forage source. Diets were formulated to be iso-energetic and iso-nitrogenous. The experiment lasted for 63 d. Samples of rumen fluid were collected via cannula every 6 h over a 72-h duration starting on d 37 of experiment period to analyze pH, ammonia and VFA concentrations. At the end of experiment, rumen papillae were biopsied from the ventral sac and observed using light and transmission electron microscope. Results showed that cows fed MF diet had higher ($P < 0.01$) ruminal acetate concentrate and ratio of acetate to propionate, and lower concentrations of ammonia-N ($P < 0.01$), propionate ($P < 0.05$), butyrate ($P < 0.01$), isobutyrate ($P < 0.01$), valerate ($P < 0.01$) and isovalerate ($P < 0.01$) than cows fed CS diet. Microscopic examination revealed a reduction ($P < 0.01$) in the width of papillae when cows fed MF diet. No significant differences ($P > 0.05$) were found for the thickness of stratum corneum, stratum granulosum, stratum spinosum, and stratum basale between dietary treatments. Biopsied papillae exhibited a decline in cellular junctions, large spaces between cells, moderate sloughing of the stratum corneum, and an accelerated migratory state in all strata below the stratum corneum in cows fed CS diet. These results suggest that increasing permeability throughout the ruminal epithelium caused by a decline of cellular junctions may be deleterious to the animal's health when cows were fed CS diet.

Key Words: forage source, morphology, ruminal papillae

W122 Effects of pistachio by-product as a replacement for alfalfa hay on milk fatty acid composition in Saanen dairy goats fed a diet containing fish oil. M. H. Ghaffari¹, A. M. Tahmasbi¹, M. Khorvash², A. H. Ghaffari¹, and S. Kargar^{*2}, ¹Faculty of Agriculture, Excellence Center in Animal Science, Ferdowsi University of Mashhad, Mashhad, Iran, ²Department of Animal Sciences, Faculty of Agriculture, Isfahan University of Technology, Isfahan, Iran.

The objective of this study was to evaluate the effect of feeding pistachio by-product (PBP) as a replacement for alfalfa hay (AH) on milk fatty acid composition in Saanen dairy goats fed a diet containing fish oil. Fifteen multiparous lactating Saanen goats (on d 25 postpartum; average BW of 38.2 ± 1.2 kg) were randomly assigned to one of 3 treatments in a completely randomized design with 5 goats per treatment. Treatments consisted of feeding the following diets: 1) control (alfalfa hay), 2) 30% PBP, 3) 30% PBP + polyethylene glycol (PEG; 0.1% DM). The experiment lasted 21 d, including 16 d of treatment adaptation and 5 d of data collection. The milk fatty acid composition is presented in Table 1. Data were analyzed using the PROC MIXED procedure of SAS. The goats fed PBP (with and without PEG) had higher amounts of C16:0, and trans - C18:1 isomer in milk fat than those fed AH, while C24:0 was detected at higher concentrations in the goats fed AH ($P < 0.05$) than those of the others. Overall, different treatments did not affect saturated (SFA), mono (MUFA) and polyunsaturated fatty acid (PUFA) concentrations in milk fat. The concentrations of trans fatty acids (TFA) were higher ($P < 0.05$) for PBP and PBP-PEG than those fed AH. However, no significant differences were detected in the concentrations of short (SCFA), medium (MCFA) and long chain fatty acids (LCFA) among treatments. These findings reveal that feeding of PBP as a replacement for AH in the diet of dairy Saanen goats can modify the fatty acid profile of milk in dairy goat.

Table 1. Effect of treatments on milk FAs (g/100 g of total FA)

Item	Treatments			SEM	P-value
	AH	PBP	PBP+PEG		
C16:0	18.51 ^b	24.08 ^a	23.63 ^a	0.50	0.03
C18:1 total trans	13.23 ^b	18.76 ^a	16.84 ^a	0.39	0.02
SFA	58.15	56.36	54.98	3.73	0.73
MUFA	38.61	40.60	41.91	2.43	0.68
PUFA	5.54	4.28	5.25	0.51	0.37
TFA	15.61 ^b	20.23 ^a	19.03 ^a	0.48	0.04
SCFA	17.83	15.17	14.71	0.58	0.26
MCFA	31.65	37.46	36.42	1.26	0.14
LCFA	44.11	44.98	46.31	3.26	0.89

Key Words: pistachio by-product, milk fatty acid, polyethylene glycol

W123 Effects of pistachio by-product as a replacement for alfalfa hay on ruminal fermentation, blood metabolites, and milk yield and composition in Saanen dairy goats fed a diet containing fish oil. M. H. Ghaffari¹, A. M. Tahmasbi¹, M. Khorvash², A. Naserian¹, and S. Kargar^{*2}, ¹Faculty of Agriculture, Excellence Center in Animal Science, Ferdowsi University of Mashhad, Mashhad, Iran, ²Department of Animal Sciences, College of Agriculture, Isfahan University of Technology, Isfahan, Iran.

The objective of this study was to evaluate the effect of feeding pistachio by-product (PBP) as a replacement for alfalfa hay (AH) on their milk fatty acid composition in Saanen dairy goats fed a diet containing fish oil. Fifteen multiparous lactating Saanen goats (on d 25 postpartum; average BW: 38.2 ± 1.2 kg) were randomly assigned to the 3 treatment diets in a completely randomized design with 5 goats per treatment. Treatments

consisted of feeding the following diets: (1) control (alfalfa hay), (2) 30% PBP, (3) 30% PBP + polyethylene glycol (PEG, 0.1% DM). The experiment lasted 21 d, including 16 d of adaptation to the experimental diets followed by a 5-d sampling period for determining the milk yield and composition. Ruminal fluid samples were taken at 3 h after morning feeding on 20 d of the experiment. Blood samples from all the goats were obtained from the jugular vein 3 h after the morning feeding on 21 d of the experiment. Data were analyzed using the PROC MIXED procedure of SAS. The goats fed PBP had a lower ($P < 0.05$) dry matter intake (DMI) than the other treatments. There was no significant difference between the rumen pH, milk yield and composition among treatments, while rumen ammonia-N concentration was lower ($P < 0.01$) in goats fed PBP than the other treatments. There were no significant differences between treatments for blood metabolites. These findings reveal that feeding of PBP as a replacement for AH in the diet of dairy Saanen goats had no adverse effect on ruminal fermentation and blood metabolites.

Table 1. Effects of treatments on milk, rumen, and blood parameters

Item	Treatment			SEM	P-value
	AH	PBP	PBP+PEG		
DMI (kg/d)	1.59 ^a	1.43 ^b	1.61 ^a	0.03	0.02
pH	6.50	6.46	6.69	0.07	0.09
Ruminal NH ₃ -N (mg/dL)	22.92 ^a	18.26 ^b	20.97 ^a	0.67	0.003
Blood glucose (mg/dL)	63.8	60.0	61.0	2.05	0.39
Blood triglyceride (mg/dL)	39.2	41.3	40.0	9.44	0.98
BUN (mg/dL)	25.1	23.5	21.3	2.91	0.67
Milk yield (g/d)	1221	1218	1198	39.92	0.36
Fat (%)	2.28	2.87	3.44	0.40	0.21
Protein (%)	2.89	2.55	2.57	0.21	0.43
Lactose (%)	4.55	4.35	4.16	0.15	0.27

Key Words: pistachio by-product, polyethylene glycol, Saanen goat

W124 Effects of pistachio by-products as a replacement for alfalfa hay on rumen bacteria involved in biohydrogenation of Baluchi male sheep. M. H. Ghaffari¹, A. M. Tahmasbi¹, A. H. Ghaffari¹, A. Naserian¹, and S. Kargar^{*2}, ¹Faculty of Agriculture, Excellence Center in Animal Science, Ferdowsi University of Mashhad, Mashhad, Iran, ²Department of Animal Sciences, College of Agriculture, Isfahan University of Technology, Isfahan, Iran.

The objective of this study was to investigate the effect of feeding pistachio by-products (PBP) as a replacement for alfalfa hay (AH) on populations of bacteria involved in rumen biohydrogenation in Baluchi sheep. Four Baluchi sheep (41 ± 1.3 kg BW) fitted with ruminal cannulas were assigned at random to 4 experimental diets in a 4 × 4 Latin square design. Treatments consisted of feeding the following diets: (1) control (0% PBP), (2) 12% PBP, (3) 24% PBP, and (4) 36% PBP. The basal diet was 36% DM alfalfa hay, 16% DM wheat straw, 20% DM barley grain, 0.3% DM sunflower oil. The experiment consisted of 4 periods. Each period lasted 20 d, comprising 16 d of adaptation to the experimental diet followed by 4 d for sampling. Bacterial populations were assessed by DNA extraction of samples of rumen liquor followed by rt-PCR analysis. All data were analyzed using the PROC MIXED procedure of SAS. Among the total ruminal bacterial community, the relative abundance of *Butyrivibrio fibrisolvens* and *Butyrivibrio proteoclasticus* were not affected by the treatments (Table 1). This finding suggests that dietary PBP at levels up to 36% DM had no effects on relative abundance of bacteria involved in rumen biohydrogenation.

Table 1. Populations of biohydrogenating bacteria¹ (percentage of total bacteria) in Baluchi male sheep fed different levels of pistachio by-product

Bacteria	Pistachio by-product level				SEM	P-value		
	0%	12%	24%	36%		Treatment	Linear	Quadratic
<i>B. fibrisolvens</i>	1.001	1.764	0.955	0.909	0.318	0.591	0.537	0.354
<i>B. proteoclasticus</i>	1.002	0.962	1.026	1.020	0.306	0.999	0.931	0.958

Within rows, means with different letters are significantly different ($P < 0.05$).

¹Fold change compared to control.

Key Words: biohydrogenation, pistachio by-product, real-time PCR

W125 Effects of pistachio by-products as a replacement for alfalfa hay in the diet of sheep on ruminal fermentation. M. H. Ghaffari¹, A. M. Tahmasbi¹, M. Khorvash², S. A. H. Ghaffari¹, and S. Kargar^{*2}, ¹Faculty of Agriculture, Excellence Center in Animal Science, Ferdowsi University of Mashhad, Mashhad, Iran, ²Department of Animal Sciences, College of Agriculture, Isfahan University of Technology, Isfahan, Iran.

The objective of this study was to investigate the effect of feeding pistachio by-products (PBP) as a replacement for alfalfa hay (AH) on ruminal fermentation in sheep. Four Baluchi sheep (41 ± 1.3 kg BW) were assigned at random to 4 experimental diets in a 4 × 4 Latin square design. Treatments consisted of feeding the following diets: (1) control (0% PBP), (2) 12% PBP, (3) 24% PBP, and (4) 36% PBP. The basal diet was 36% DM alfalfa hay, 16% DM wheat straw, 20% DM barley grain. The experiment consisted of 4 periods. Each period lasted 20 d, comprising 16 d of adaptation and 4 d for sampling. All data were analyzed as a 4 × 4 Latin square design using the PROC MIXED procedure of SAS. Results of ruminal fermentation parameters are presented in Table 1. Treatments had no effect on ruminal pH, while rumen ammonia-N concentration decreased linearly ($P < 0.05$) with increasing PBP levels up to 36% of DM. Reduction in the ruminal ammonia-N concentration with the feeding of PBP in the diet may have resulted from tannins (2.46% DM) bound to proteins, decreased proteolysis and subsequently lowered ammonia-N concentration in rumen fluid. Feeding of 36% PBP in the diet reduced ($P < 0.05$) total VFA and acetate concentrations, while the concentrations of propionate, butyrate and acetate to propionate ratio were similar to across all treatments. Reductions in the VFA concentration might be related to the lower microbial fermentation in presence of tannins in PBP.

Table 1. Ruminal fermentation parameters in sheep fed different levels of pistachio by-product meal (PBP)

Rumen parameter	Treatments				SEM	P-value
	0PBP	12PBP	24PBP	36PBP		
Rumen pH	6.31	6.33	6.26	6.38	0.06	0.541
Rumen NH ₃ -N (mg/dL)	19.41 ^a	17.46 ^{ab}	16.31 ^b	15.18 ^b	0.78	0.003
Total VFA (mmol/100 mol)	103.30 ^a	104.63 ^a	103.01 ^{ab}	100.33 ^b	0.87	0.024
Individual VFA (mmol/100 mol)						
Acetate	70.93 ^a	69.71 ^a	69.44 ^a	66.99 ^b	0.70	0.004
Propionate	21.14	23.79	22.35	22.25	0.91	0.653
Butyrate	11.24	11.13	11.23	11.11	0.29	0.82
Acetate:propionate ratio	3.36	2.96	3.11	3.02	0.14	0.186

Key Words: Baluchi sheep, pistachio by-product

W126 Substitution of ground corn with different levels of coarsely ground wheat in the diets of dairy cows on feed intake, nutrient digestion, microbial N supply, and plasma metabolite profiles. Y. Guo*, Y. Zou, S. Li, Z. Cao, X. Xu, and Z. Yang, *State Key Laboratory of Animal Nutrition, College of Animal Science and Technology, China Agricultural University, Beijing, China.*

The effects of increasing concentrations of coarsely ground wheat (CGW, 3-mm screen, geometric mean particle sizes: 1,139 μ m) substituted for ground corn (GC, 3.5-mm screen, geometric mean particle sizes: 666 μ m) on feed intake, nutrient digestion, microbial N supply and plasma metabolites were evaluated using 8 multiparous Holstein cows (569 \pm 47 kg of BW, 84 \pm 17 DIM) in a duplicated 4 \times 4 Latin square design with 21-d periods. The 4 diets contained 0, 9.6, 19.2, and 28.8% CGW and 27.9, 19.2, 9.6, and 0% GC (DM basis), respectively. The cows were fed a TMR, with a 47:53 forage to concentrate ratio, where forage was 27% corn silage, 14% alfalfa hay, and 6% Chinese wild rye. Increasing CGW in the diets resulted in a quadratic response ($P = 0.07$) in feed intake with numerically greater intake at 9.6 and 19.2% of diet DM. Apparent digestibility of CP and starch were not affected by dietary treatments; however, apparent digestibility of NDF and ADF decreased significantly ($P < 0.01$) when cows were fed 28.8% CGW diets. Apparent digestibility of DM ($P = 0.02$) and OM ($P = 0.01$) decreased linearly with increasing CGW in the diets. The appropriate amount of CGW can promote microbial N supply, and the optimal value is in 9.6% CGW diets; however, the calculated absorption of purine derivatives ($P = 0.04$) and intestinal flow of microbial N ($P = 0.02$) decreased significantly when cows were fed 28.8% CGW diets. With increasing the level of dietary CGW, plasma BHBA ($P = 0.07$), cholesterol ($P < 0.01$), and triglycerides ($P = 0.06$) decreased linearly, whereas plasma glucose ($P = 0.08$) and insulin ($P = 0.02$) increased linearly at 6h after morning feeding. These data indicate that CGW is a suitable replacement for CG in dairy cow diets when fed up to 19.2% of diet DM; however, the substitution percentage should not be too high, a great amount of CGW in the diets may increase the risk of digestive disturbance, depress microbial N supply, perturbs the patterns of plasma metabolites in lactating dairy cows.

Key Words: dairy cow, nutrient digestibility, wheat

W127 Particle size distribution of corn can predict starch degradability in rumen. Y. Zou*, Z. Yang, S. Li, and Z. Cao, *State Key Laboratory of Animal Nutrition, College of Animal Science and Technology, China Agricultural University, Beijing, China.*

A study using 5 Holstein cows with ruminal cannulas were conducted to evaluate the degradation mechanisms of different particles, and to establish the relationship between ruminal degradation dynamics and particle size distribution. The particle size of corn grain was prepared to pass 5 sieves: 6000, 2360, 600, 450, and 300 μ m. All nylon bags containing the tested corn were placed in rumen simultaneously, and 2 bags of each cow were removed at each time point after 2, 4, 8, 12, 24, and 48 h of incubation. In general, in situ disappearance and degradation curves of DM and starch were linearly ($P < 0.05$) increased from grounded (300 μ m) to coarsely rolled (6000 μ m) corn because of destruction of crystallization of corn. R^2 varied from 0.6790 ($P = 0.086$) to 0.9344 ($P = 0.008$) of DM and from 0.7467 ($P = 0.059$) to 0.9908 ($P < 0.001$) of starch disappearance, and for degradable variables varied from 0.6188 ($P = 0.115$) to 0.9010 ($P = 0.014$) of DM and from 0.6243 ($P = 0.112$) to 0.9290 ($P = 0.008$) of starch, expect for starch degradability at 0 h ($R^2 = 0.3113$, $P = 0.328$). Overall, a simple way for evaluating degradation characteristics of mixed particle corn in feed

was established, dynamic degradability and degradation variables can be predicted using the product of corresponding value of each particle calculated in the linear formula and the percentages of corn on each screen of a standard test sieve.

Table 1. Dry matter and starch degradation variables of corn kernel with 5 different particle sizes incubated in situ

Particle size, μ m	DM disappearance			Starch disappearance				
	a	b	K_d	RDDM	a	b	K_d	RDS
300	45.62 ^a	54.03 ^b	6.62 ^a	73.96 ^a	43.04 ^a	56.63 ^b	7.38 ^{ab}	74.28 ^a
450	32.82 ^b	62.51 ^{ab}	6.15 ^{ab}	64.46 ^b	25.55 ^c	67.53 ^{ab}	9.14 ^a	66.31 ^b
600	34.47 ^b	64.49 ^{ab}	3.63 ^b	58.79 ^c	36.53 ^b	62.55 ^{ab}	4.66 ^{bc}	63.87 ^b
2360	27.48 ^c	70.58 ^{ab}	3.47 ^{ab}	53.34 ^c	27.12 ^c	72.02 ^{ab}	3.81 ^{bc}	55.09 ^c
6000	12.61 ^d	84.67 ^a	2.29 ^b	36.00 ^d	15.99 ^d	83.66 ^a	2.28 ^c	39.03 ^d
SEM	0.591	3.802	0.489	0.656	0.703	0.962	4.574	6.281
Regression								
Intercept	39.53	58.57	5.61	67.96	36.43	60.84	7.21	70.12
Slope	-4.60	4.48	-0.61	-5.48	-3.49	3.93	-0.91	-5.36
R^2	0.854	0.901	0.619	0.879	0.653	0.862	0.624	0.929

^{abc}Different superscript letters with the same column represent a significant difference between treatments ($P < 0.05$).

Key Words: degradability, lactating cow, starch

W128 Ruminal fermentation kinetics of finishing feedlot beef diets with increasing levels of whole cottonseed. V. N. Gouvea*¹, J. T. Neves Neto², D. B. Galvani³, M. V. C. Ferraz Junior¹, J. A. Faleiro Neto¹, M. V. Bieh⁴, J. J. R. Fernandes², and A. V. Pires⁴, ¹University of São Paulo, Pirassununga, SP, Brazil, ²Federal University of Goiás, Goiânia, GO, SP, Brazil, ³EMBRAPA Goats and Sheep, Sobral, CE, Brazil, ⁴University of São Paulo, Piracicaba, SP, Brazil.

Whole cottonseed (WC) is the primary by-product included in Brazilian finishing feedlot beef diets. Because a high level of WC in the diet can impair animal performance, the objective of this study was to evaluate the in vitro fermentation kinetics of diets containing 0, 8, 16, 24, or 32% of WC (DM basis). Diets were composed of 0.85 concentrate and 0.15 of forage (corn silage), being formulated to meet protein and energy requirements of Nellore bulls (2.2% of N and 80% TDN, respectively). Samples of each diet (0.8 g) were weighed into 160 mL serum bottles, with 8 mL of inoculum and 72 mL of a buffer solution. Rumen inoculum was collected before the morning feeding from 2 Holstein cows fitted with permanent ruminal cannula and fed ad libitum a total mixed ration consisting of 0.30 commercial concentrate and 0.70 corn silage. Four bottles for each diet, plus 4 additional bottles containing buffered medium and rumen fluid inoculum only (blanks) were used. As the bottles were filled they were immediately closed with rubber stoppers, shaken and placed in the incubator at 39°C. The volume of gas produced was recorded at 2, 4, 6, 8, 10, 12, 15, 18, 21, 24, 36, 48, 72, and 96 h of incubation using the pressure reading technique. To estimate kinetic parameters of gas production (GP) data were fitted to the model $G = A[1 - \exp^{-c(t-L)}]$, where: G (ml) is the cumulative gas production at time t; A (ml) is asymptotic gas production; c (/h) is the fractional rate of gas production; and L (h) is the lag time. Increasing WC level in the diet linearly increased ($P < 0.001$) the fractional rate of gas production (0.048, 0.052, 0.053, 0.058, and 0.064/h). Discrete lag time also linearly increased (3.69, 3.79, 4.08, 4.42, 4.95 h; $P < 0.05$), while the asymptotic gas production decreased ($P < 0.05$) when the level of WC was greater than 8% in the diet (333.80, 353.65, 333.28,

320.03 and 323.55 mL/g DM), probably due to great contents of ether extract (17.5%) and lignin (13.0%) in the WC. Including WC in feedlot finishing diets for beef cattle at levels greater than 8% can impair ruminal fermentation.

Key Words: by-product, gas production, lag time

W129 Animal performance and fractional volatile fatty acid absorption rate through the rumen wall in lactating cows receiving a corn straw or mixed forage diet. X. X. Weng^{2,3}, J. Q. Wang^{*1,2}, D. P. Bu², Y. D. Zhang², and F. D. Li³, ¹*Agronomy College of Heilongjiang August First Land Reclamation University, Da qing, Heilongjiang, China*, ²*State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China*, ³*College of Animal Science and Technology, Gansu Agricultural University, Lanzhou, China*.

Objective of this experiment was to investigate effects of 2 types of forage diets on animal performance and fractional absorption rate of volatile fatty acids (VFA) through the rumen wall. Ten primiparous, rumen-cannulated Holstein dairy cows in late-lactation were randomly assigned to mixed forage diet (MF, forage: concentrate = 60: 40) with Chinese wildrye, alfalfa hay and corn silage as the forage source or corn straw diet (CS, forage: concentrate = 40: 60) with corn straw as the forage source. Cows were fed their respective diet for 58 d, following which *n*-valeric acid and Co-EDTA were used as markers for measuring ruminal VFA absorption and passage rates. Rumen fluid was collected from ventral sac of the rumen. Feed intake, body weight and milk production were monitored. Milk fat, protein, lactose and total solids were analyzed by near-infrared analysis. Results showed that dry matter intake was not affected ($P > 0.05$) by treatments, averaging 19.78 kg/d. Cows fed MF diet produced more 4% FCM ($P < 0.05$), milk fat ($P < 0.05$) and total solids ($P < 0.10$). Ruminal ammonia concentration was significantly higher in CS treatment ($P < 0.01$). Mixed forage treatment markedly increased rumen acetate concentration and acetate: propionate ratio ($P < 0.05$). Cows fed CS diet tended to have higher molar proportions of propionate and isobutyrate ($P < 0.10$). Fractional rates of total VFA absorption and passage from the rumen were not affected by dietary treatments, averaging 14.78 and 13.64%/h, respectively. However, cows fed MF diet had higher ($P < 0.05$) estimated clearance rate of acetate, as well as total VFA passage rate (mol/h). These results suggest that cows fed MF diet improve yields of 4% FCM, milk fat and total solids. Lower rumen ammonia concentration indicated a more efficient utilization of feed nitrogen in MF diet compared with CS diet. Dietary treatments did not affect fractional rate of VFA absorption in late lactating cows.

Key Words: animal performance, forage source, VFA absorption rate

W130 The use of Propolis in calf feeding: Effect on fecal score, health score and feed consumption behavior. P. Peravian*, K. Reza-yazdi, G. Nehzati, and M. Dehghan-Bonadaki, *University of Tehran, Tehran, Iran*.

Forty female Holstein calves with 41 ± 1 kg birth weight were assigned to a completely randomized design with 4 treatments and 10 replicates (calves) in each treatment from 14 until 65 d of age. Treatments were (1) Control (without monensin in starter and without Propolis in milk), (2) starter without monensin and 500 ppm soluble Propolis powder in milk, (3) starter without monensin and 1000 ppm soluble Propolis powder in milk, and (4) monensin in starter and without Propolis in milk. During the experiment calves were inhabited in individual boxes

and had free access to water and starter. The starter was formulated according to NRC 2001. To decrease the stress of weaning, calves stayed in their boxes after weaning for 9 d. Fecal score (fluidity score, 1 = normal, 2 = soft, 3 = runny 4 = watery) and health score (cough score: 1 = normal, 2 = induced single cough, 3 = induced repeated cough, 4 = repeated spontaneous cough, and nasal score: 1 = normal, 2 = unilateral cloudy discharge, 3 = bilateral cloudy discharge, 4 = copious bilateral discharge) were measured daily. dry matter intake behavior (time of feeding, ruminating, resting) was measured at the middle of the experiment. Means of fecal score (1.29, 1.21, 1.26, 1.22) ($P = 0.3$), nasal score (1.18, 1.19, 1.18, 1.17) and cough score (1.18, 1.19, 1.18, 1.17) ($P = 0.6$) for treatments 1–4 respectively, were not different among treatments. The times spent on feeding (147, 154, 154, 180 min/d), ruminating (397, 370, 343, 376 min/d), resting (706, 660, 620, 637 min/d) were not influenced by treatments ($P = 0.7$). The results showed that Propolis in milk or monensin in starter did not affect fecal score, health score and feed consumption behavior of Holstein female calves.

Key Words: fecal score, Holstein female calf, Propolis

W131 Effects of three different diets on productive performance and archenteric pH values of dairy cows at late lactation. J. N. Li^{1,2}, D. P. Bu¹, J. Q. Wang^{*1}, P. Sun¹, F. D. Li², C. F. Qin¹, and P. Zhang¹, ¹*State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China*, ²*College of Animal Science and Technology, Gansu Agricultural University, Lanzhou, Gansu, China*.

This study was to investigate the effects of 3 different types of diets on productive performance and archenteric pH values in late lactation dairy cows. Fifteen primiparous, permanently ruminally and duodenally fistulated Holstein cows at late lactation (DIM = 293 ± 5.34) were randomly assigned to 3 treatments ($n = 5$) mainly differing in forage: MF diet (alfalfa hay, Chinese wildrye, corn silage, soybean meal), CSA (corn straw, soybean meal), CSB (corn straw, cottonseed meal, corn gluten lipid, high protein corn meal). CP, NDF and NE_L in 3 diets were 18.02, 16.90 and 16.30%; 61.43, 56.73 and 57.06%; 1.48, 1.54 and 1.52 Mcal/kg, respectively. Dry matter intake and milk yield were recorded daily, body condition scoring (BCS) were conducted once weekly. Milk compositions were detected twice weekly, rumen and duodenum samples were collected with 2-h intervals and pH values were determined. Data were analyzed using the MIXED procedure (SAS 9.1). Compared with CSA treatment, cows fed MF diet had positive effect ($P < 0.05$) on composition of milk free fatty acid (FFA) (2.18 and 3.48%; $P < 0.05$), and tended to have negative effect on milk urea percentage (0.042 and 0.037%; $P = 0.09$). Cows in CSB group had higher FFA composition (2.18 and 2.76%; $P < 0.05$), somatic cell count (SCC) (155.43 and 179.16×10^3 mL⁻¹; $P < 0.05$) and lower density (1032.95 and 1031.93 g/L; $P < 0.05$) in milk compared with those in CSA group. There was no difference in other indexes of productive performance ($P > 0.05$). Compared with CSA treatment, the ruminal pH of MF group decreased at 1730 (6.80 and 6.25; $P < 0.01$), 1930 (6.44 and 6.10; $P < 0.01$), and CSB treatment decreased at 1730 (6.80 and 6.58; $P < 0.01$), and 2330 (5.92 and 6.06; $P < 0.05$). The population mean of duodenal pH in all treatments had no significant difference ($P > 0.05$). The results indicated that productive performance affected by forage patterns slightly, milk FFA composition, density and SCC of dairy cows at late lactation were influenced by different dietary protein sources. Ruminal and duodenal pH values were influenced by diet systems partly.

Key Words: archenteric pH, diet system, productive performance

W132 Influence of diets with different protein sources on productive performance and rumen microbial communities in dairy cattle. J. W. Zhao^{1,2}, D. P. Bu¹, J. Q. Wang^{*1}, S. G. Zhao¹, and C. F. Qin¹, ¹State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China, ²College of Animal Science and Technology, Inner Mongolia University for the Nationalities, Tongliao, Inner Mongolia, China.

The objective of this experiment was to study the effects of diets with different protein sources on productive performance and composition of rumen microbial community in dairy cows. Ten Holstein cows (primiparous, DIM 314 ± 16 d, BW 540 ± 50 kg) were assigned to 2 groups randomly and fed with soybean meal diet (soybean meal, 23.6% DM) or miscellaneous meal diet (soybean meal, 3.3% DM; cottonseed meal, 2.6% DM; DDGS, 9.3% DM; Corn gluten lipid, 9.9% DM; and corn high meal, 11.9% DM). The content of crude protein of 2 diets was 18.02% DM and 16.90% DM, respectively. Completely randomized design was conducted and feeding lasted for 60 d. Ruminant fluid samples were collected from 6 dairy cows with rumen cannulas on d 30. Total DNA were extracted and analyzed by denaturing gradient gel electrophoresis (DGGE) with subsequent analysis on sequences and clusters. Results showed that diets with different protein sources had no effects on dry matter intake, body weight, milk production, standard milk production, milk fat, milk protein, lactose, fat/protein ratio, milk urea nitrogen and free fatty acid contents ($P > 0.05$). According to the above synthesis evaluation of performance indexes, soybean meal could be replaced by miscellaneous meal effectively. DGGE profiles of rumen microbial community from 2 groups showed that the quantity and optimal density of the DGGE bands which were analyzed with Quantity one were changed significantly. Shannon-Weiner index showed no difference ($P > 0.05$) between 2 groups. Sequences analysis in 2 groups showed that the uncultured bacteria belonged to the phylum of *Bacteroidetes*, *Firmicutes*, *Spirochaetes*, *Proteobacteria* and *Planctomycetes*. These results revealed that bacteria community structure from diets with different protein sources were unique but no difference existed in diversity of rumen bacteria.

Key Words: dairy cow, productive performance, rumen microbial

W133 Screening and analysis of dipeptidyl peptidase IV from microbial metagenomic library in the rumen of dairy cow. J. W. Zhao^{1,2}, J. Q. Wang^{*1}, S. G. Zhao¹, P. Sun¹, D. P. Bu¹, X. L. Hu¹, Y. F. Lu¹, D. D. Wang¹, and D. Jin¹, ¹State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China, ²College of Animal Science and Technology, Inner Mongolia University for the Nationalities, Tongliao, Inner Mongolia, China.

As the key enzyme of oligopeptides degradation, the study for sequence characteristics and enzymatic properties of dipeptidyl peptidases IV (DPP-IV) contribute to control the degrading of oligopeptides. Most of the DPP-IV sequences could not be obtained because limited culturable bacteria in the rumen. The purpose of this study was to reveal the characterization of DPP-IV sequences and enzymatic activity in the rumen of dairy cow by culturable-independent method. The dpp-IV degenerate primers were used to screen rumen microbial fosmid library including 17664 clones. The plasmids were extracted from the positive clones and digested by Hind III. The dpp-IV sequences were obtained by PCR, cloning and sequencing. The Fosmid end sequences and DPP-IV sequences of the positive clones were analyzed by blastx and blastp, respectively. The peptidase activity from the positive clones was measured using Gly-Pro-pNA as a substrate. Ten positive clones named DPI-DP10 containing dpp-IV fragment were obtained. 78% of the Fosmid end sequences could

match with the known genes (similarity 44–94%). DPP-IV sequences contained N-conservative region (DWVYEEE) and C-catalytic domain (GWSYGG). DPP-IV sequences matched to *Cyclobacterium marinum* (43%), *Capnocytophaga* sp. (63%), *Prevotella ruminicola* 23 (66%) and *Solitalea canadensis* (50%). The activity of DP7 peptidase is highest (6.88 U/mg). Ten positive clones obtained from rumen microbial fosmid library had different sequence characteristics and peptidase activity. In the future, we will overexpress the DPP-IV in vitro, and characterize the enzyme kinetics.

Key Words: dipeptidyl peptidase IV, enzyme activity, fosmid library

W134 Adhesion molecules of the immune system of dairy cows fed with n-3 and n-6 fatty acid sources in the transition period and early lactation. L. C. Verdurico*, J. R. Gandra, R. D. Mingoti, R. V. Barletta, J. E. Freitas Junior, L. Oliveira, G. D. Calomeni, R. Gardinal, C. S. Takyia, T. H. Vendramini, and F. P. Renno, *Universidade de Sao Paulo, Pirassununga, Sao Paulo, Brazil.*

The aim of this study was to evaluate effect of omega 3 and omega 6 supplementation, on expression of adhesion molecules of Holstein cows during transition period and early lactation. Forty-eight Holstein cows were divided in 4 experimental groups in randomized design. Animals were assigned to receive one of 4 treatments: 1) control (C; n = 12), without fat sources in pre- and postpartum; 2) flaxseed (FS; n = 12), fed 60 and 80 g/kg of DM of flaxseed in pre and postpartum; 3) whole raw soybeans (WS; n = 12), fed 120 and 160 g/kg of DM of whole raw soybeans in pre and postpartum; 4) calcium salts of unsaturated fatty acids (CSFA; n = 12; Megalac-E), fed 24 and 32 g/kg of DM of calcium salts of unsaturated fatty acids in pre and postpartum. Experimental diets were fed from 35 d before the estimate calving until 84 d of lactation, formulated to meet nutritional requirements of each period. Blood samples were taken -21, -14, -7 d in relation to prediction of birth, at birth and +7, +14, +21, +42, +84 d postpartum. Data were analyzed using the PROC MIXED of SAS 9.1 with fixed dietary effect, time effect, interaction between diet and time. Data were analyzed by orthogonal contrasts C vs. WS+CSFA+FS (C1); FS vs. WS+CSFA (C2); and WS vs. CSFA (C3). Was measured expression of adhesion molecules (cluster of differentiation) CD4+, CD8+, CD25+ and CD62L. Cows fed the FS, WS and CSFA treatments had higher expression of adhesion molecules CD4+, CD8+, CD25+ and CD62L than those fed the C diet. However, cows fed WS and CSFA treatments had higher expression of adhesion molecules CD14+ than those cows fed the FS diet peripartum period (30.6 and 25.1 vs. 18.2% of positive cellulose respectively). The inclusion of sources of fatty acids omega 3 and 6 in the diet of dairy cows improved the expression of adhesion molecules in the transition period.

Key Words: dairy cow, fat source, immune function

W135 Regulation of pancreatic amylase synthesis by leucine and phenylalanine is associated with the changes in mRNA abundance and/or phosphorylation of 4E-BP1. Z. Yu, K. Liu, Y. Liu, M. Xu, and J. Yao*, *College of Animal Science and Technology, Northwest A&F University, Yangling, Shaanxi, China.*

Insufficient pancreatic amylase secretion may be the critical limiting factor of low starch digestibility in the small intestine of ruminants. The present experiment, therefore, aimed to evaluate the regulating mechanism of duodenal leucine (Leu) and phenylalanine (Phe) to pancreatic enzyme activities. Twenty yearling ewe goats with duodenal catheters were used in a completely randomized design experiment. All goats

were fed the same diet twice daily at 0800 and 1800, and were randomly assigned to 4 treatments: duodenal infusion of water, 3 g/d Leu (3L), 9 g/d Leu (9L), and 2 g/d Phe (2P) for 21 d. On d 21, all goats were slaughtered for blood and pancreatic tissue sample collection. Pancreases were weighed, subsampled, frozen in liquid N₂, and stored at -80°C for the subsequent analysis. Pancreatic DNA concentration was reduced ($P < 0.05$) by 9L treatment. Pancreatic protein:DNA ratios increased markedly ($P < 0.05$) in 9L and 2P treatments. Both Leu and Phe infusions increased ($P < 0.05$) pancreatic amylase activity. Pancreatic trypsin activity (U/mg of protein) decreased ($P < 0.05$) when 2P was infused, while when expressed by per milligram DNA, pancreatic trypsin activity increased ($P < 0.05$) in 9L group. Pancreatic lipase activity (U/mg of DNA) was improved by 9L and 2P treatment. Amylase mRNA levels were higher ($P < 0.05$) in 9L and 2P groups. The Leu and Phe infusions had no effects ($P > 0.05$) on trypsin mRNA levels. Lipase mRNA levels were increased ($P < 0.05$) by 2P treatment. Leu infusions significantly stimulated ($P < 0.05$) phosphorylation of 4E-BP1, while no effects ($P > 0.05$) were observed when goats were infused Phe. Leu infusions also increased ($P < 0.05$) pancreatic free Leu concentration. Phe infusion trended to increase plasma CCK concentration ($0.05 < P < 0.10$). Leu and Phe infusions did not influence plasma insulin concentration ($P > 0.05$). These results indicate that cell size, not cell number, is critical for digestive enzyme production. Duodenal Leu and Phe infusions regulate pancreatic amylase expression mainly through transcriptional and/or translational events.

Key Words: amino acid, pancreatic amylase, regulation

W136 Microbial protein synthesis in sheep supplemented with extracts of *Salix babylonica* and exogenous enzymes. K. I. Valdes¹, A. Z. M. Salem*¹, M. Gonzalez-Ronquillo¹, R. Rojo², H. Gado³, N. Rivero¹, and N. Odongo⁴, ¹Facultad de Medicina Veterinaria, Universidad Autonoma del Estado de Mexico, Mexico, ²CU-UAEM Temascaltepec, Mexico, ³Department of Animal Production, Faculty of Agriculture, Ain Shams University, Qalubia, Egypt, ⁴Animal Production and Health Section, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, International Atomic Energy Agency, Vienna, Austria.

The aim of this study was to estimate microbial protein synthesis and urinary excretion of purine in lambs. In a completely randomized design, 16 male growing Suffolk lambs (27.5 ± 2.5 kg LW) were used, which were assigned to 4 treatments in individual pens. Treatments were: control (lambs were fed on 30% concentrate and 70% corn silage at 0700h and 1600h; SB: control diet supplemented with *Salix babylonica* extract (30 mL); EZ: control diet supplemented with 10 g exogenous enzymes of Zado and SBEZ: control diet supplemented with *Salix babylonica* extract and exogenous enzymes of Zado. Enzyme product of Zado is commercially available multi-enzyme feed additive in a powder form produced from *Ruminococcus flavefaciens* and manufactured by the Academy of Scientific Research and Technology in Cairo, Egypt. Average daily gain was increased ($P = 0.001$) with EZ, while dry matter intake was increased with SBEZ. Allantoin and xanthine concentrations were increased ($P < 0.001$) with SBEZ supplementation compared with the other treatments. Uric acid and total purine derivatives were increased ($P < 0.001$) with EZ addition in diets. The combination of the 2 additives increased ($P = 0.025$) allantoin-to-creatinine ratio compared with control diet. As a conclusion the addition of 10 g of exogenous enzymes of Zado or in combination with *Salix babylonica* extract in lamb's diet, increased the microbial protein synthesis.

Key Words: lamb, purine derivative, *Salix babylonica*

W137 Changes in the relative population size of target ruminal bacteria following a grain-induced challenge in beef cattle receiving viable and nonviable active dried yeast. R. Mohammed¹, D. Vyas*¹, A. Uwizeye¹, W. Z. Yang¹, K. A. Beauchemin¹, and N. Walker², ¹Agriculture and Agri-Food Canada, Lethbridge, Alberta, Canada, ²AB Vista, Marlborough, Wiltshire, UK.

This study was conducted to characterize changes in the relative population size (RPS) of selected ruminal bacteria in cattle fed active dried yeast (*Saccharomyces cerevisiae*) following an induced ruminal acidosis. Six ruminally cannulated beef heifers fed a 50:50 forage:concentrate diet (DM basis) were used in a double 3×3 Latin square design. Treatments were control (Ctrl; no yeast), active dried yeast (ADY; 4 g providing 10^{10} cfu/g; AB Vista, UK), and killed dried yeast (KDY; 4 g autoclaved ADY). A day before acid challenge (d21), intakes were restricted to 50% of ad libitum intake. Acidosis was induced on d22 by adding barley grain (amount equivalent to 25% of DMI) directly into the rumen before feeding. Ruminal digesta was collected on d22 of each period at time 0 (before feeding), 3, 6, 9, 12, 24 h, and 168 h. Real-time PCR data from the liquid and solid ingesta were summed by cow at each time and reported as % (16S copies for time t relative to time 0). The RPS of *S. ruminantium* was greater ($P = 0.03$), and that of *R. flavefaciens* tended to be greater ($P = 0.06$), for heifers fed ADY and KDY compared with Ctrl. Treatment \times time interactions were not significant. There was a time effect on the RPS of *S. ruminantium* reaching peak values 12 h post-challenge. The RPS of *F. succinogenes* decreased until 9 h post-challenge and recovered to the 0 h value by 168 h. The RPS of *S. ruminantium* ($r^2 = 0.62$; $P < 0.01$), *M. elsdenii* ($r^2 = 0.57$; $P < 0.01$) and *S. bovis* ($r^2 = 0.31$; $P = 0.03$) were positively related to lactate concentration, while RPS of *F. succinogenes* ($r^2 = 0.30$; $P = 0.03$) was negatively related to lactate. The RPS of *S. ruminantium* ($r^2 = 0.62$; $P < 0.01$) and *M. elsdenii* ($r^2 = 0.38$; $P = 0.01$) were negatively related to ruminal pH while RPS of *F. succinogenes* ($r^2 = 0.43$; $P = 0.01$) and *R. flavefaciens* ($r^2 = 0.38$; $P = 0.01$) were positively related to pH. Feeding active dried yeast, regardless of its viability, during a period of acidosis can help increase the RPS of *S. ruminantium* that utilize lactic acid and *R. flavefaciens* that digest fiber.

Key Words: acid-challenge, active dry yeast, ruminal bacteria

W138 Effect of ensiling high moisture corn with aspen wood byproducts on in situ dry matter disappearance of the final ensiled product. E. Caldera*, J. J. Wagner, and T. E. Engle, Colorado State University, Fort Collins.

The objective of this study was to investigate the effect of ensiling high moisture corn (HMC) with aspen wood byproducts (bark, shavings, and saw dust) on in situ dry matter disappearance (DMD) of the final ensiled product. Treatments consisted of (1) 100% HMC; (2) 90% HMC, 10% bark; (3) 90% HMC, 10% shavings; (4) 90% HMC, 10% saw dust; (5) 100% bark; (6) 100% shavings; and (7) 100% saw dust; with 5 replications per treatment. All ratios were calculated for similar DM. Treatments were individually packed by placing each experimental silo ($0.368 \text{ m} \times 0.302 \text{ m} \times 0.267 \text{ m}$) into a modified press. A torque wrench was used to apply the same packing pressure (2.76 kg-m) and densities across treatments. Prior to packing each silo, 50 kg of HMC was prepared by mixing water and dry rolled corn at a desired ratio (29.4% water to 70.40% dry rolled corn) then mixed with each aspen wood byproduct specific for each treatment. After 30 d of storage in a well-ventilated room at 25°C, silos were opened, weighed, and subsampled for DM determination. Following DM analysis, samples were ground through a 2 mm screen and composited. Two sets of in situ bags for each treatment (including blank bags) were prepared for 6 different time periods (0, 6, 12, 24, 48,

and 72 h; in triplicate) and placed in 2 fistulated steers maintained on a roughage based diet for 3 weeks before in situ incubation. Steers were then switched to a high concentrate diet for 3 weeks and the in situ incubation was repeated. Area under the curve (AUC) was calculated for each replicate within each treatment over the 72-h incubation time period. Using the DMD results from the 100% HMC, bark, shavings, and saw dust treatments, a predicted digestion curve was generated for treatments 2, 3, and 4. Predicted and actual AUC were compared for treatments 2, 3, and 4. In situ DMD AUC for predicted and actual digestion curves in roughage and concentrate fed steers were similar across treatments 2, 3, and 4. These data indicate that under conditions of this experiment, ensiling HMC with aspen wood byproducts had no effect on in situ DMD of the final mixture.

Key Words: ensiling, in situ, wood

W139 Neutrophil (PMN) expression of extracellular trap formation and immunometabolic genes in response to prepartal energy intake and postpartal intramammary lipopolysaccharide challenge in postpartal dairy cows. K. M. Moyes^{*1}, D. E. Graugnard², J. K. Drackley², M. J. Khan², M. Bionaz², and J. J. Looor², ¹*University of Maryland, College Park*, ²*University of Illinois, Urbana*.

Our objectives were to determine the effect of intramammary (IM) LPS challenge during the postpartal period on the expression of key genes

associated with extracellular trap formation and immunometabolic response in blood neutrophils (PMN) for cows fed control (CON; 1.34 Mcal/kg dry matter; n = 8) or excess energy (OVE; 1.62 kg/dry matter; n = 5) during the dry period (~45 d before expected calving date). All cows were fed a common lactation ration after parturition. At 7 d in milk, all cows received LPS (200 mg) into one rear mammary quarter. Blood PMN were isolated before (0 h) and after (12 h) after IM LPS challenge for gene expression analysis using real-time quantitative PCR (qPCR). The effect of time, diet and their interaction was analyzed using the MIXED procedure of SAS with repeated measures. Regardless of prepartal diet, intramammary (IM) LPS challenge increased the expression of genes associated with the immune response (i.e., SELL, STAT3 and SOD2). Diet altered gene expression where cows fed CON during the prepartal period had decreased expression of genes associated with inflammation (ALOX5; -8.8-fold change) and metabolism (PLA2GA4; -2.3-fold change) when compared with OVE cows. At 0 h, we observed a -2.5-fold change in expression of S100A9, a gene associated with extracellular trap formation, for CON when compared with OVE cows. At 12 h, NFKB1 expression, a key gene associated with the inflammatory response, decreased (-1.5-fold change) for CON when compared with OVE cows. Results suggest a downregulation of genes associated with extracellular trap formation and the immunometabolic response after postpartal IM LPS challenge in blood PMN from cows fed a controlled energy diet during the prepartum period.

Key Words: immune, metabolism, neutrophil