

Ruminant Nutrition: Forage & Fiber

302 Meta analysis of ruminant digestive responses of cattle to dietary NDF. D. Sauvant*¹ and D. Mertens², ¹Institut National Agronomique Paris Grignon, Paris, France, ²US Dairy Forage Research Center, Madison, WI.

Ruminal responses to dietary NDF are useful for improving feeding systems. A database was compiled from 176 published experiments (n = 448 treatments) where dietary NDF or concentrate content varied. Dietary NDF averaged 38.5 ± 13.3% of dry matter (DM from 13 to 80%). Data were analysed using GLM to separate among and within experiment variance. Equations are in the table. Ruminal pH (6.23 ± 0.33) was related curvilinearly to NDF. Duration of time with ruminal pH below 6 (TpH6 = 395 ± 360 min/d) decreased as NDF increased. Acetate/propionate ratio (A/P = 3.26 ± 0.92) increased curvilinearly with NDF. Apparently (DOMa = 39.7 ± 10.8 %DM) and truly (DOMr = 53.0 ± 10.5 %DM) digested OM in the rumen were inversely related to NDF. Microbial crude protein synthesis (MCP = 8.1 ± 2.7 %DM) was depressed as NDF increased, however microbial growth efficiency was not altered by dietary NDF. Fractional outflow rates of particles (kp = 4.32 ± 1.67 %/h) and liquid (kl = 10.06 ± 3.13 %/h) were affected by dietary NDF. Rumen liquid (RL = 5.30 ± 2.57 g/100g DMI) and rumen liquid outflow rate (ROUTL = 12.15 ± 4.15 g/100g DMI) were increased by dietary NDF. Similar results were observed when rumen liquid was expressed on a live weight basis. Most digestive responses were altered by dietary NDF, and the proposed equations can be used to evaluate rumen mechanistic models and improve feeding systems.

Table 1.

Variable	Cste	NDF	NDF2	n	nexp	rmse
PH	5.36	+0.029	-0.00017	249	98	0.13
TpH6	909	-13.6	-	70	30	181
A/P	0.82	+0.086	-0.00054	235	97	0.42
DOMa	48.7	-0.22	-	154	62	4.9
DOMr	58.7	-0.13	-	123	49	4.2
MCP	8.70	-	-0.0003	124	49	0.81
kp	4.67	+0.029	-0.0005	126	51	0.46
kl	6.5	+0.153	-0.0015	141	55	0.91
RL	3.96	-	+0.00074	142	60	0.66
ROUTL	2.27	+0.32	-0.0017	142	60	0.59
RLW[g/100gLW]	9.50	+0.062	-	135	58	1.08

Key Words: NDF, Ruminal pH, Ruminal digestion

303 Meta analysis of multiple responses of dairy goat to diet concentrate content. D. Sauvant*^{1,2} and S. Giger-Reverdin², ¹Institut National Agronomique Paris Grignon, Paris, France, ²Institut National de la Recherche Agronomique, Paris, France.

Dairy goat multiple responses to dietary concentrate are useful to develop feeding systems. A data base was built from 62 experiments (147 treatments) where the concentrate level (%CO = 43.2 ± standard deviation 21.1 % dry matter-DM), or the dietary NDF content, varied. %CO was considered as the explicative variable. The following parameters were collected: dry matter intake % of live weight (DMI = 4.05 ± 0.77 % LW), chewing time (CT = 673 ± 164 min/d), measured diet organic matter digestibility (OMD = 68.3 ± 7.5 %), diet energy density (ED = 1.51 ± 0.21 Mcal/kgDM), raw milk yield (RMY =

2.76 ± 1.12 kg/d), milk contents in fat (MFC = 3.58 ± 0.78 %) and protein (MPC = 3.10 ± 0.46 %), energy balance (EB = 0.18 ± 0.58 Milk Mcal/d). Data were analysed with the GLM procedure to separate across and within experiment variations which were captured by a curvilinear combination of %CO and %CO₂. Increase in %CO affected DMI with a maximum value for %CO near 57% (DMI = 3.40 + 0.029 %CO - 0.00025 %CO₂, n = 126, nexp = 52, rmse = 0.35). When NDF content was measured, it was closely linked to %CO (NDF = 55.0 - 0.245 %CO, n = 53, nexp = 19, rmse = 3.4). Chewing time was inversely related with %CO (CT = 1035 - 6.31 %CO, n = 21, nexp = 7, rmse = 56). OMD was positively and closely linked with %CO (OMD = 63.2 + 0.185 %CO, n = 34, nexp = 13, rmse = 2.7). The dietary ED was linearly enhanced by %CO increase (ED = 1.26 + 0.0064 %CO, n = 91, nexp = 37, rmse = 0.07). RMY was positively and curvilinearly linked with %CO, with a maximum beyond the range of %CO data (RMY = 1.80 + 0.032 %CO - 0.00020 %CO₂, n = 145, nexp = 61, rmse = 0.23). MFC was inversely related to %CO (MFC = 3.66 - 0.000063 %CO₂, n = 115, nexp = 48, rmse = 0.20), in contrast, MPC was not influenced. Energy balance was positively and curvilinearly related with %CO (EB = - 0.14 + 0.00016 %CO₂, n = 89, nexp = 36, rmse = 0.20). Significant equations allowed to describe fairly accurately marginal responses to dietary concentrate in dairy goat, they can be used to build formulation programs including strategy of concentrate supply.

Key Words: Dairy goat, Responses to concentrate supply, Meta-analysis

304 Investigating *Silphium perfoliatum* (cup plant) silage for growing cattle. M. H. Ramos*, J. W. Lehmkuhler, S. C. Arp, and K. A. Albrecht, *University of Wisconsin, Madison.*

Three experiments were conducted to examine the response of substituting cup plant silage for corn silage. In Exp. 1 thirty-six weaned steers (avg initial wt = 244 kg +/- 16) were blocked by source and assigned to nine pens. Treatments were randomly assigned to pens within blocks. Basal diets were corn silage (CS), 33% cup plant+67% corn silage (1/3 cup) or 67% cup plant+33% corn silage (2/3 cup) DM basis. All diets received the same suppl. Diets were offered for 110d. ADG was significantly different (P<0.05) among treatments averaging 1.38, 1.20 and 0.77 kg/d, respectively for CS, 1/3 cup and 2/3 cup. DMI was not different (P>0.05) between CS and 1/3 cup (6.43 kg/d vs 6.38 kg/d) while 2/3 cup had the lowest (P<0.01) intake of the three treatments (5.33 kg/d). G:F was different (P<0.05) for treatments with CS>1/3 cup>2/3 cup. Exp. 2 used twenty-four yearling steers (avg initial wt = 353 kg +/- 22) and twelve yearling heifers (avg initial wt = 362 kg +/- 11) for 62 d from late August through late October of 2005. The same diets as Exp. 1 were tested. Animals were blocked by sex and allotted to nine pens with treatment randomly assigned to pens within blocks. ADG did not differ (P>0.05) between CS and 1/3 cup (1.40 kg/d vs 1.13 kg/d) while 2/3 cup (0.98 kg/d) was significantly (P<0.05) lower than CS. DMI was not different (P>0.05) among diets. G:F was different (P<0.05) with CS>2/3 cup while 1/3 cup was similar to both (P>0.05). A digestibility trial using a 3x3 Latin Square design with an extra observation was conducted using the same feed offered during Exp. 2. Animals were fed ad libitum 2 times a day. During the 5d adaptation period steers were bolused with 5g of TiO₂ at 12h intervals. During the 3d collection period fecal samples were collected at 6h intervals. DMI was greatest (P<0.05) for CS at 5.90 kg/d while 1/3 cup was not different (P>0.05) than 2/3 cup (5.34 kg/d vs 5.08 kg/d,

respectively). Corn silage had higher ($P < 0.05$) DM, OM and NDF digestibility than 1/3 cup and 2/3 cup. NDF intake was not different ($P > 0.05$) between treatments. We conclude that corn silage substituted by cup plant at low level allows for respectable performance.

Key Words: Beef cattle, Silage, Silphium perfoliate/cup plant

305 Particle size distribution in rumen contents and faeces from cows fed grass silages in different physical form or barley straw supplemented with grass pellets. P. Norgaard* and L. F. Kornfelt, *The Royal Veterinary & Agricultural University, Copenhagen, Denmark.*

The purpose of the experiment was to study effects of forage quality and physical form on particle size distribution in rumen contents and faeces. A 4 x 4 Latin square experiment was conducted with 4 rumen cannulated, non lactating Jersey cows fed 80% of ad libitum intake of unchopped grass silage (U), chopped grass silage (CS), barley straw (H) or 0.6 kg barley straw (L). Straw diets were supplemented with 3 kg grass pellets. NDF in DM were 34, 71 and 29% for grass pellets, barley straw and grass silages, respectively. Faeces and rumen contents sampled before and after the morning meal were washed in nylon bags (0.01 mm) and freeze-dried before sieving through 4.7, 2.8, 1 and 0.5 mm pore sizes into n fractions. The length (PL), width (PW) and area (PA) of particles in sub samples from each sieving fraction were measured by Image analysis. The arithmetic mean PL (APL_n) and PW (APW_n) were estimated by weighting with PA. The overall APL and APW values were estimated by weighting with the mass proportions in the individual fractions (m_n). The PL and PW distributions were estimated by gamma functions, and the overall most frequent PL (MoPL) and PW (MoPW) were estimated from a composite density distribution function by weighting with m_n . Data were analyzed by PROC MIXED in SAS v. 8.1 with treatment, period, T and T*treatment as fixed effects and cow as random. The rumen APL, APW and proportions of washed rumen particles retained in the bottom bowl and in the sieves with 4.7, 2.8 and 0.5 mm pore size were affected ($P < 0.05$) by time of sampling (T) and treatments. There was an interaction ($P < 0.02$) between treatments and T on rumen MoPL and APL. The MoPL and MoPW values of faeces particles were 0.28, 0.26, 0.41 and 0.44 mm, and 0.05, 0.04, 0.07 and 0.08 mm, respectively, for the CS, US, L and H treatments ($P < 0.01$). In conclusions, the mode dimensions of faeces particles appear to be affected by forage quality.

Key Words: Particle length, Image analysis

306 Effect of yeast culture on efficiency of nutrient utilization for milk production and impact on fiber digestibility and fecal particle size. J. Harrison¹, R. White*¹, D. Mertens², I. Yoon³, W. Sanchez³, and L. Nicholson³, ¹Washington State University, Puyallup, ²USDFRC, Madison, WI, ³Diamond V Mills, Cedar Rapids, IA.

Objectives of this study were to evaluate the effect of Diamond V XP Yeast Culture on milk production, fiber digestibility and fecal particle size. Two groups of 111 cows each (average DIM of 179 and 191 at initiation of trial) were utilized in a two-period (40 d and 49 d) switchback design. The BW and milk production data were analyzed using the GLM procedures of SAS. Cows received basal diets containing SBM, steam rolled corn, potatoes, canola meal, whole cottonseed, corn silage, alfalfa hay and vitamin-mineral mix once/d

and milked 3X. Treatment group received 140 g/d premix (ground corn, mill run and soybean meal) containing 56 g yeast culture. Control group received 140 g/d premix without yeast culture. The addition of yeast culture resulted in a trend for increased 3.5% FCM (43.0 vs 42.4 kg/d; $P < 0.19$), and increases in milk fat percentage (3.69 vs 3.61%; $P < 0.02$), milk fat production (1.53 vs 1.49 kg/d; $P < 0.08$), and body weight (BW) gain (1.31 kg vs 0.35 kg/d; $P < 0.001$). A numerical increase in dry matter intake (0.45 kg/d) was observed with yeast culture. Yeast culture did not affect milk protein percentage, MUN and estimated microbial protein production. Milk potential from BW gain was calculated based on energy value of body tissue and that of 3.5% FCM. This calculation resulted in an estimated 3.2 kg/d more 3.5% FCM for cows receiving yeast culture. Digestibility of NDF was numerically greater for cows receiving yeast culture (37.8 % vs 34.6%) resulting in a numerically higher percentage of smaller particles in the feces. Results suggest that addition of yeast culture can improve production of milk fat and 3.5 % FCM; and, may increase total tract NDF digestibility, and decrease fecal NDF particle size.

Key Words: Dairy nutrition, Yeast culture, Fecal particle size

307 Effects of chop lengths of alfalfa and oat silage on feed intake, milk production, rumen pH, and feeding behavior of dairy cows fed total mixed rations. S. K. Bhandari*, J. C. Plaizier, K. H. Ominski, and K. M. Wittenberg, *University of Manitoba, Winnipeg, MB, Canada.*

Effects of chop length of alfalfa silage and oat silage on dry matter intake, rumen conditions, and milk production were investigated in 16 mid-lactation Holstein, four of which were rumen fistulated. Forages were chopped short (6 mm) or long (19 mm) using a New Holland Forage Harvester, model 790. A four by four replicated Latin square design with experimental periods of two adaptation weeks and one sampling week was used. Feeding behavior was monitored in 8 cows using video taping and a 5 min scan sampling technique. Cows were fed total mixed rations containing (DM basis) 42% barley grain based energy supplement, 10% protein supplement, and 24% long chop alfalfa silage (AL) or short chop alfalfa silage (AS) and 24% long chop oats silage (OL) or short chop oat silage (OS). Hence, the four diets were ALOL, ALOS, ASOL, and ASOS. Reducing the chop length reduced the proportion of the alfalfa silage and the oat silage retained by the 8 and 19 mm screens of the Penn State particle Separator (pe) from 83.5 to 75.3% of DM and from 81.8 to 74.8% of DM, respectively. This shows that all forages were coarse, and that theoretical chop length might not predict particle size distribution. The chop length reduction decreased the pH of alfalfa silage and oats silage from 6.0 to 4.9 and from 5.4 to 4.6, respectively. Statistical analysis was conducted with SAS Mixed procedure. The effects of alfalfa chop length and oats chop length were considered fixed. The effects of cow and period were considered random. Reducing the chop length of both silages reduced the pe of the diets from 71.4 to 64.6% DM (Table). Reducing oat silage chop length increased DMI, but did not alter rumen pH, feeding behavior, and milk production. Reducing alfalfa chop did not affect DMI, rumen pH, feeding behaviour, and milk production. In this study reducing chop length improved silage quality, but this did not result in increased milk production or put cows at risk for subacute ruminal acidosis.

Table 1.

	Diet ¹				SE	Effect ¹		P value
	ALOL	ALOS	ASOL	ASOS		AC	OC	
pe, %DM	71.4	68.9	69.3	64.6	4.5	0.30	0.21	
peNDF _{PS} , % DM	24.5	23.4	23.7	21.6	1.64	0.28	0.19	
peNDF _{NDF} , % DM	28.1	27.5	26.3	24.3	2.10	0.11	0.41	
DMI, kg/d	19.0	21.3	19.7	21.0	0.45	0.61	<0.01	
Avg. rumen pH	6.21	6.22	6.27	6.27	0.07	0.30	0.94	
Time < pH 5.6, hr/d	197	128	121	129	59.6	0.41	0.50	
Milk yield, kg/d	35.0	36.3	36.7	36.2	0.81	0.65	0.33	
Milk fat yield, kg/d	1.02	1.08	1.11	1.10	0.03	0.58	0.08	
Milk protein yield, kg/d	1.08	1.13	1.15	1.15	0.02	0.47	0.10	
Eating, h/d	6.0	6.4	5.9	5.9	0.23	0.09	0.28	
Ruminating, h/d	9.5	9.4	9.4	9.9	0.29	0.37	0.28	
Idle, h/d	8.5	8.2	8.7	8.2	0.37	0.68	0.13	

¹AC = alfalfa chop effect, OC = oats chop effect

Key Words: Forage chop length, Milk production, Feeding behavior

308 Effects of enhanced in vitro fiber digestibility of barley silage on dry matter intake and milk yield of dairy cows. L. Chow^{*1}, M. Oba¹, V. Baron², and R. Corbett³, ¹University of Alberta, Edmonton, AB, Canada, ²Agriculture, Agri-Food Canada, Lacombe, AB, Canada, ³Alberta Agriculture Food and Rural Development, Edmonton, AB, Canada.

The effect of enhanced in vitro NDF digestibility (IVFD) of barley silage on DMI and milk production was evaluated using thirty primiparous and multiparous cows (182.7 ± 71.7 days in milk; mean ± SD) in a crossover design with 19-d periods. Six of the multiparous cows were ruminally cannulated prior to the experiment. Two fields of barley were planted on either May 5, 2005 (BM) or June 7, 2005 (BJ), and both were harvested at the late-dough stage and ensiled. Concentrations of NDF and starch of fresh samples were 50.4% and 26.3% for BM, and 52.6% and 24.6% for BJ, respectively. The 30-h IVFD was greater for BJ by 8.8 units compared with BM (60.5 vs. 51.7%). It was hypothesized that barley silage with enhanced IVFD would reduce the physical fill of the rumen allowing for greater DMI and milk production. Experimental diets containing either BM or BJ at 59% of dietary DM were formulated for 37.1% and 39.5% dietary NDF concentrations for BM and BJ treatments, respectively. Both diets were formulated for 17% CP, and fed as a total mixed ration. The DMI (20.4 vs. 19.9 kg/d) and milk yield (27.2 vs. 27.1 kg/d) was similar for both BM and BJ treatments, respectively. Mean ruminal pH was numerically lower for cows fed BJ compared with BM (5.97 vs. 6.07), but was not statistically significant (P = 0.16). Body weight gain was greater for cows fed BJ compared with BM (864 vs. 504 g/d). A significant interaction between parity and treatment effects was observed for BCS; BJ increased BCS gain compared with BM only for multiparous cows (0.13 vs. -0.02; P < 0.05). Lack of responses in DMI and milk production to enhanced IVFD of barley silage might be attributed to relatively lower milk production or later stage of lactation for cows used in this experiment; physical fill may not limit maximum DMI and milk yield. Then, expected additional energy intake from enhanced NDF digestion for cows fed BJ might be partitioned to the body weight gain.

Key Words: In vitro fiber digestibility, Barley silage, Physical fill

309 Voluntary feed intake affects response to dietary forage content. J. A. Voelker Linton^{*} and M. S. Allen, Michigan State University, East Lansing.

The effect of appetite on the relative importance of physical fill and metabolic satiety in regulating feed intake was tested using 14 ruminally and duodenally cannulated Holstein cows in a crossover design experiment with a 14 d pretrial period and two 15 d experimental periods. During the pretrial period, 3.5% fat-corrected milk yield (FCMY) was 15 to 60 kg/d (mean = 40 kg/d), and pretrial voluntary DMI (pVDMI) was 20.6 to 30.5 kg/d (mean = 25.0 kg/d). Treatments were a low-forage diet (LF), containing 20% of dry matter as forage neutral detergent fiber (NDF) and 24% as total dietary NDF, and a high-forage diet (HF), containing 27% forage NDF and 31% total dietary NDF. The ability of linear and quadratic factors of pVDMI to predict the difference in responses of individual cows to treatments (Y_{LF} - Y_{HF}) was tested by analysis of variance, with treatment sequence as a covariate. In contrast to a previous experiment, differences in DMI and FCMY responses to LF and HF did not depend on pVDMI (P > 0.50). This might be because of combined physical fill and metabolic satiety effects of LF, especially in cows with greatest pVDMI. Ruminal DM and NDF pools do not indicate that a physical threshold was reached, but NDF digestion and(or) passage might have been inhibited on LF among high-intake cows. As pVDMI increased, NDF turnover time increased more greatly on LF than on HF (r = 0.79, P = 0.05). Among high-pVDMI cows, NDF turnover time was actually greater on LF than on HF. With increasing pVDMI, digestion rate of pdNDF decreased at a similar rate on both diets (P > 0.90); passage rates of potentially digestible NDF and indigestible NDF were not related to pVDMI, regardless of treatment (P > 0.40). Because mean and minimum ruminal pH were lower for LF than for HF (P < 0.0001, P = 0.02), a slight numerical reduction in pH with increasing pVDMI observed for both diets would likely inhibit NDF digestion more for LF than for HF. Inhibition of NDF digestion might cause low-forage and high-forage diets to have similar effects on DMI, depending on the VDMI of individual cows.

Key Words: Dietary forage content, Digestion kinetics, Intake

310 Effect of SilAll4x4 inoculation on silage fermentation and protein quality of grass silage at different levels of dry matter. A. M. van Vuuren^{*}, P. G. van Wikselaar, and A. H. van Gelder, Animal Sciences Group of Wageningen UR, Lelystad, The Netherlands.

To study the influence of silage inoculant SilAll4x4 (Alltech, Lexington, KY) on the fermentation process in grass silages and on the nutritive value of the produced silages, an experiment with lab silos using perennial ryegrass was carried out. In May and September 2004, good quality grass was harvested and wilted to DM concentrations of 20, 35 and 50%. Wilted grass was cut and ensiled in 1-l Weck jars with or without SilAll4x4 (10 mg per kg of grass). After 3, 14, 28 and 90 days of ensiling, at least two jars per treatment were opened and analyzed for DM, ash, fermentation products (lactic acid, VFA, ammonia), and microbiological composition (lactic acid bacteria, entero bacteria, yeasts and moulds). After 90 days, samples were also incubated in rumen fluid and gas production was measured in time to determine the rate of OM degradation. At maximum rate of gas production the amount of purines in each vial was analyzed as a parameter for microbial biomass. The inoculated silages started with 10 times more LAB than the control silages which resulted in a faster pH drop and faster formation of lactic acid. Inoculated silages reached a stable pH value of 3.8 to 4.2 between day 14 and 28; control silages reached a

stable pH value of 4.2 to 4.6 after 28 days. The faster decline of pH in the inoculated silages resulted in a faster drop of enterobacteria. The levels of ammonia were significantly lower in inoculated silages. The insoluble nitrogen fraction was slightly ($P > 0.05$) higher in inoculated silages. The differences between inoculated and control silages were more pronounced in the high DM silages. Yeasts and moulds were detected at ensiling, but numbers were below detection levels after 90 days with no effect of inoculation. At maximum fermentation rate, amounts of purines in the incubation vials were higher for inoculated silages (18.8 versus 17.7 RNA-equivalents per g of OM for Control; $P = 0.02$). This suggests that inoculation with SilAll4x4 resulted in a better protein quality of the silage, which influences the efficiency of rumen microbial protein synthesis.

Key Words: Silage, Additive, Protein

311 Treating corn silage with formaldehyde and urea: Their effect on nutritive value using gas production technique. A. Taghizadeh*, M. Hatami, and G. A. Moghaddam, *Tabriz University, Tabriz, East Azarbayjan, Iran.*

In vitro gas production technique was used to measure the gas production from Iranian treated and untreated corn silage by formaldehyde and urea as test feeds. The formaldehyde and urea were added during the ensiling process for examine of their effect on preserving and fermentation characteristics of corn silage. The corn silage samples were chopped to 2 cm length. Treatments contain CS: untreated corn

silage, CSF: CS + 4 g/Kg DM formaldehyde, CSU: CS + 10 g/Kg DM urea, and CSFU: CS + 4 g/Kg DM formaldehyde + 10 g/Kg DM urea. Three sheep were used as donors of ruminal fluid for preparation of inoculum. The sheep (38±4 kg) were fed a diet consisting of 220 g kg⁻¹ concentrate and 780 g kg⁻¹ forage (corn silage and alfalfa) predicted metabolizable energy 2.98 Mcal/Kg DM and containing crude protein 140 g/Kg DM and used as ruminal fluid donor for the preparation of inoculums. The production of gas was measured in each vial after 2, 4, 8, 12, 16, 24, 36, 48, 72 and 96 h of incubation. The results were analyzed using completely randomized design (CRD) in each incubation time with Duncan's multiple range test used for the comparison of means. Feeds were the only sources of variation considered. Gas production data were in triplicate fitted to an equation of $p = a + b(1 - e^{-ct})$; where (p) is the gas production at time, t, (a+b) is the fermentation of soluble and the insoluble (but with time fermentable) fraction, (c) is the fractional rate at which b is fermented per hour. The soluble and insoluble fraction (a+b) for CS, CSF, CSU and CSFU was (ml/g) 241.8, 240.0, 225.0 and 238.1, respectively. The fractional rate (c) was (%/h) 0.028, 0.023, 0.025 and 0.027, respectively. The results showed the soluble and insoluble fraction (a+b) and the fractional rate (c) of CS was higher than the other treatments, ($P < 0.05$) The results showed that the differences between of chemical composition of treatments caused to change fermentation parameters determined by In vitro gas production technique. Urea and formaldehyde additions affected corn silage nutritive value.

Key Words: Gas production, Corn silage, Formaldehyde

Ruminant Nutrition: Transition Cow Metabolism

312 Phlorizin administration does not attenuate hypophagia induced by intraruminal propionate infusion. B. J. Bradford* and M. S. Allen, *Michigan State University, East Lansing.*

Propionate infusion decreases dry matter intake (DMI). Our working hypothesis is that propionate oxidation in the liver stimulates satiety and decreases meal size. In this experiment, phlorizin was used to increase glucose demand, which was expected to decrease propionate oxidation and attenuate the decrease in DMI caused by propionate infusion. Twelve multiparous Holstein cows (49 ± 33 DIM, 40 ± 7 kg/d milk; mean ± SD) were randomly assigned to square and treatment sequence in a replicated 4x4 Latin square experiment with a 2x2 factorial arrangement of treatments. Treatments were subcutaneous injection of phlorizin or propylene glycol in combination with intraruminal infusion of either Na acetate or Na propionate. Following a 7 d adaptation period, phlorizin (4 g/d) and control injections were administered every 6 h for 7 d. During the final 2 d of injections, Na acetate or Na propionate solutions (1 M, pH 6.0) were infused continuously at the rate of 0.80 L/h. Feeding behavior data were collected during the final 2 d of treatment. Statistical analyses were completed using mixed-effects models. Phlorizin caused urinary excretion of 400 g glucose/d across infusion types. Phlorizin increased plasma non-esterified fatty acid and beta-hydroxybutyrate concentrations in combination with Na acetate infusion, but not with Na propionate infusion. Phlorizin decreased and Na propionate increased plasma insulin and glucose concentrations (all $P < 0.01$). Infusion of Na propionate decreased DMI (18.4 vs. 21.1 kg/d, $P < 0.001$) through an increase in intermeal interval (77.3 vs. 89.2 min, $P = 0.03$), resulting in a decrease in the number of meals/d (13.7 vs.

11.6, $P < 0.001$). Phlorizin did not alter DMI or measures of feeding behavior, nor were there interactions with infusion type. We conclude that increasing glucose demand does not limit the extent to which propionate decreases DMI in lactating dairy cows.

Key Words: Propionate, Glucose demand, Dry matter intake

313 Response of plasma concentrations of gut peptides to abomasal infusion of casein, starch, or soybean oil in lactating dairy cows. A. E. Relling* and C. K. Reynolds, *The Ohio State University, Wooster.*

The effect of nutrient supply to the small intestine on gut peptide secretion in ruminants, and particularly cattle, has not been characterized. The objective of the present study was to determine the effects of abomasal infusion of macronutrients on DMI and plasma concentrations of glucagon-like peptide-1 (GLP1), glucose-dependent insulinotropic polypeptide (GIP), and cholecystokinin (CCK). Four rumen cannulated Holstein cows fed a ration containing (DM basis) 17 % alfalfa haylage, 38 % corn silage and 45 % concentrate were used in a 4 X 4 Latin square design with 2-wk periods. Treatments were 7 d abomasal infusions of water (12 kg/d), soybean oil (500 g/d), starch (1100 g/d), or casein (800 g/d). Hormone concentrations (pmol/L, Table 1) were measured in plasma from jugular vein samples (15/d at 30 min intervals) taken during day 1 and 7 of infusions. Oil infusion decreased DMI (kg/d), but not ME, decreased CCK concentration, and increased GLP1 concentration on day 7. Casein and starch infusion had no effect on DMI, but ME and GIP concentration were increased on day 1 and 7. Casein infusion increased CCK concentration on day 1 and