788 The relationship between the severity of ruminal acidosis and the expression of genes associated with the absorption and metabolism of volatile fatty acids and glucose in ruminal tissue. G. B. Penner*[1], M. Taniguchi[1], L. L. Guan[1], K. A. Beauchemin[2], and M. Oba[1], [1]*University of Alberta*, *Edmonton, AB, Canada*, [2]*Agriculture and Agri-Food Canada*, *Lethbridge, AB, Canada*.

The objective of this study was to determine the relationship between the severity of ruminal acidosis and the expression of genes related to the absorption and metabolism of volatile fatty acids (VFA) and glucose in ruminal tissue. We hypothesized that cows with lower expression for genes related to the absorption and metabolism of VFA and glucose in ruminal tissue would have more severe ruminal acidosis. Six ruminally cannulated dry Holstein cull cows were fed a diet containing 60.9% barley grain, 30.2% barley silage, 5.7% grass/alfalfa hay, 1.8% mineral, 1.4% canola meal, and 0.1% canola oil (DM basis) to predispose them to ruminal acidosis. After a 28-d diet adaptation period, ruminal pH (4320 data points/72 h/cow), ruminal VFA concentrations, ruminal content volume, and in vivo VFA clearance rates were measured. An acidosis index was calculated by dividing the area below pH 5.8 by dry matter intake (pH × min/kg) in order to describe the severity of ruminal acidosis for each cow. Cows were euthanized and ruminal tissue was harvested (ventral sac) for gene expression analysis using quantitative real-time PCR. The fold change (FC) in gene expression relative to the cow with the lowest acidosis score was determined for each gene. Mean ruminal pH, the area below pH 5.8, and the acidosis index varied from 5.88 to 6.19, 895 to 9250 pH × sec/d, and 84.7 to 459.0, respectively. The acidosis index was not correlated to the fractional rate of VFA absorption or clearance, but was negatively correlated to the FC for butyrl CoA synthetase (r = -0.919; $P < 0.001$) and pyruvate carboxylase (r = -0.884; $P = 0.02$). Further, the acidosis index tended to be negatively related to the FC for β–hydroxybutyrate dehydrogenase (r = -0.753; $P = 0.08$). These data indicate that cows with higher gene expression levels for enzymes involved in butyrate or glucose metabolism in rumen tissue might be more tolerant to ruminal acidosis.

Key Words: Ruminal Acidosis, Gene Expression, VFA Metabolism

789 Effects of bulk density of steam-flaked corn and dietary roughage concentration on performance, rate of intake, and acid-base balance of Holstein steers. K. E. Hales*, K. R. Wilson, J. T. Vasconcelos, J. C. Declerck, M. L. May, M. J. Quinn, and M. L. Galyean, *Texas Tech University*, *Lubbock*.

Effects of bulk density of steam-flaked corn and roughage concentration on performance, rate of intake, and acid-base balance were evaluated in 24 Holstein steers (initial BW = 507 kg) in a completely random design. Each steer was housed in a partially slotted-floor pen (12 steers/treatment). The 2 treatments consisted of either: (1) 334.7 g/L steam-flaked corn with 6% (DM basis) coarsely ground alfalfa hay (**LOWBD**); or (2) 387.0 g/L steam-flaked corn with 10% (DM basis) alfalfa (**HIGHBD**). Cattle were fed an 85% concentrate diet, and baseline measurements were collected before they were switched to treatment diets for an experimental period of 29 d. Feed intake was measured at 0.5, 1.0, 1.5, 2.0, 3.0, 4.0, 6.0, and 8.0 h after feeding on d 7, 14, 21, and 28. On d 8, 15, 22, and 29, urine pH was measured, and arterial blood samples were taken for measurement of pH, partial pressures of CO_2 and O_2, hematocrit, and concentrations of Na^+, K^+, and ionized Ca^+. No differences ($P > 0.10$) between treatments were noted for blood gases and electrolytes or urine pH; however, day effects ($P < 0.02$) were detected for blood pH, partial pressure of CO_2, Na^+, K^+, ionized Ca^+, and urine pH. Rate of intake data were fit to a quadratic model and solved for time required to consume 25, 50, 75, and 100% of the daily intake. A treatment x day interaction was detected ($P < 0.03$) for time to consume 25, 50, and 75% of the daily intake. No differences were noted on d 7, 21, and 28, but on d 14 steers fed the HIGHBD diet consumed 25, 50, and 75% ($P = 0.06$, 0.05, and 0.08, respectively) of their daily intake in less time than those fed the LOWBD diet, with no difference in time to consume 100% of daily intake. Results suggest that bulk density of steam-flaked corn and dietary roughage concentration within the ranges fed in this study have little effect on blood acid base balance; however, the combination of greater bulk density and greater roughage concentration increased rate of feed consumption on d 14 of the experimental period.

Key Words: Acid-Base Balance, Beef Cattle, Bulk Density

790 Effect of dietary cation-anion difference on feedlot performance, N mass balance, and manure pH in open feedlot pens. M. K Luebbe*, G. E. Erickson, T. J. Klopfenstein, and J. R. Benton, *University of Nebraska*, *Lincoln*.

A summer feedlot trial was conducted to evaluate the impact of dietary cation-anion difference on performance and N mass balance. Ninety-six steers (260±56 kg) were stratified by BW and assigned randomly to 12 pens (6 pens/treatment). Steers were fed for 145 d from June to October. Basal diets consisted of high-moisture and dry-rolled corn, fed at a constant 1:1 ratio (DM basis), 20% modified wet distillers grains, 7.5% alfalfa, and 5% supplement. Calcium chloride and sodium bicarbonate were used in the supplement to adjust dietary cation-anion difference (DCAD) to 20 mEq for the positive (POS) diet and -16 mEq for the negative (NEG) diet. Nitrogen excretion was determined by the difference between N intake and individual steer N retention. Total N lost was calculated by subtracting manure and runoff N from excreted N. Dry matter intake was not different (P=0.17) among treatments and was 11.1 and 11.4 kg for NEG and POS, respectively. Average daily gain was not different (P=0.82) among treatments and was 1.84 and 1.83 kg for NEG and POS, respectively. Gain efficiency was not different (P=0.11) among treatments and was 0.166 and 0.160 for NEG and POS, respectively. Carcass characteristics were not different (P>0.20) among treatments except for marbling score. Marbling score was greater (P=0.04) for POS than NEG (543 and 523, respectively). Intake, retention, and excretion of N were not different (P>0.10) among treatments. Manure N was not different (P=0.67) among treatments (11.1 and 11.7 kg for POS and NEG, respectively). Percent N lost was not different among treatments (64.6 and 61.3% for POS and NEG respectively). Manure pH was greater (P<0.01) for POS than NEG (8.12 and 7.70, respectively). Pen surface soil core pH was not different (P=0.29) among treatments (8.01 and 8.07 for POS and NEG, respectively). Amount of DM and OM removed from pens was similar (P>0.50) among treatments. Lowering DCAD in diets with wet distillers grains decreases manure pH but not soil core pH. The decrease in manure pH is likely not enough to decrease N losses in open feedlot pens.

Key Words: Acid Base Equilibrium, Cattle, Nitrogen

791 Grain species and cultivars and ruminal acidosis. I. Determination of challenge level. I. J. Lean*[1], A. R. Rabiee[1], J. L. Black[2], and R. H. King[3], [1]*Bovine Research Australasia*, *Camden, NSW, Australia*, [2]*John L. Black Consulting*, *Warrimoo, NSW, Australia*, [3]*RHK Consulting*, *Essendon, Victoria, Australia*.

Two grain challenge diets containing (Triticale cv Jackie; and a mix of 20 grains (Wheat (n = 6), Barley (n = 4), Triticale (n = 4), Sorghum (n = 3), Oats (n = 3)) were used to determine the amount required to produce a moderate acidotic change in rumen function following ingestion. Holstein-Friesian heifers, <18 months of age (n = 8), Holstein-Friesian dairy cows (n = 8) were stratified on parity and randomly allocated to the 2 challenge diets, fed at four different levels. There was a pre-adaptation period of 7 days - 1kg of mixed grain and *ad libitum* grass silage, an adaptation period of 5 days- 1 kg of the test grains and *ad libitum* grass silage. In the challenge period; cattle were withheld from all feed for 14h and fed the challenge diets. The 4 different levels of intake were 0, 0.4, 0.8 and 1.2% of body weight (BW). The trial was a single treatment, repeated measures study conducted with four levels of intake. There was a significant reduction in rumen pH (P = 0.01) of cattle fed at 1.2% BW. Concentrations of VFAs were higher in cattle fed at 0.8% and 1.2% BW than the control (0.0%). Concentrations of valerate (P < 0.001) and ammonia (P = 0.04) were significantly greater in cattle fed 1.2% BW. Rumen concentrations of valerate were significantly (P = 0.05) higher in cattle fed with Triticale than mixed grain. Rumen pH, volatile fatty acids (VFA), lactate and ammonia data were used in a discriminant analysis algorithm derived from earlier field studies to provide an acidosis index. Cattle fed at 1.2% BW had a higher acidosis index compared with cattle fed grain at 0%, 0.4% and 0.8% BW. The acidosis index of Triticale Jackie grain was also greater than the mixed grain.

Key Words: Acidosis, Dairy Cows, Grain

792 Grain species and cultivars and ruminal acidosis. II. Comparisons and validation of a near infra-red reflectance assay. I. J. Lean*[1], A. R. Rabiee[1], J. L. Black[2], S. Nielsen[3], and R. H. King[4], [1]*Bovine Research Australasia*, *Camden, NSW, Australia*, [2]*John L Black Consulting*, *Warimoo, NSW, Australia*, [3]*NSW Department of Primary Industries*, *Orange, NSW, Australia*, [4]*RHK Consulting*, *Essendon, Victoria, Australia*.

We compared effects of twenty different grains (Wheat (n=6), Barley (n=4), Triticale (n=4), Sorghum (n=3), Oats (n=3)) and a mixed grain control fed to cattle on ruminal pH and ruminal volatile fatty acids (VFAs), lactate (D-and L-) and ammonia. We determined correlations between near infra-red reflectance (NIR) derived *in vitro* estimates of acidotic risk of grains and *in vivo* effects of the same grains. The study comprised 40 rows (heifers) and column (run) with cattle in four groups of 10. Feeding was divided into a pre-trial (mixed silage and 1kg mixed grain), adaptation (1kg of test grain with mixed silage for four days), withholding period (feed withheld for 14 hours), and then were fed test grains at 1.2% body weight. Ruminal samples were collected by stomach tube immediately after the challenge over the next 5h. A 9-day wash out period was used between study phases. Rumen pH significantly changed throughout sampling (P<0.01). Rumen pH 4h after challenge was lower in cattle fed barley, triticale and wheat, than oats or sorghum. Rumen concentrations of propionate, butyrate, isobutyrate, valerate, isovalerate and D-Lactate changed significantly during sampling (P<0.05). Concentrations of propionate, isovalerate, valerate and ammonia were significantly different among grains (P<0.05). The acidosis index based on discriminant analysis showed that triticale and wheats had the highest acidosis index. The *in vivo* discriminant scores were significantly correlated with rankings of rumen valerate concentrations derived from a mixed effect model (P<0.0001). The coefficients of discriminant scores (P=0.0003) or rumen valerate (P=0.017) were correlated with the NIR results derived from the tests ranking. Only the discriminant scores are related to biological measures of acidosis.

Key Words: Acidosis, Dairy Cows, Grain

793 Influence of electrolyzed alkaline water on milk production in dairy cows. J. D. Ferguson*, D. Remsberg, and Z. Wu, *University of Pennsylvania*, *Kennett Square*.

Electrolyzed alkaline water (EAU Technologies) may have some anti-oxidation and rumen stabilization properties. This pilot study examined the influence of electrolyzed water (EAU) on milk production, water intake, and blood physiology over a 12 wk period in 62 lactating Holstein cows (81 ± 56 DIM). Cows were blocked on parity, milk production and DIM and randomly assigned to EAU water or untreated well water (CON) following a 2-wk covariate period. Overall covariate adjusted milk yield was not different between the groups, but a significant interaction between water source and initial DIM (P<0.03) was apparent. Cows <60 DIM consuming EAU produced 2.1 kg/d more milk over the course of the study than the CON cows. Cows >60 DIM at the beginning of the study consuming the EAU water produced less milk than cows consuming CON water (-0.8 kg/d). It appeared that cows required a 4-6 wk period to adapt to the alkaline water. Water coliform counts were consistently lower from EAU waterers. Consuming EAU water may enhance production in early lactation and increase milk fat content.

Table 1. Influence of electrolyzed water on water, blood chemistry, and production

Item		EAU	SEM	CON	SEM	P<
Water	pH	9.4	0.1	6.1	0.1	0.01
	Alkalinity, mg/L	154.4	7.3	52.1	7.3	0.01
	Na, mg/L	137.8	21.8	22.2	21.8	0.01
	Cl, mg/L	86.6	11.8	107.5	37.2	0.15
	Mg, mg/L	1.5	0.9	23.2	0.9	0.01
	Inatke, L/d	228.5	35.8	174.4	30.3	0.05
Blood	Base excess, mmol/L	4.0	0.2	5.5	0.3	0.05
	Bicarbonate, mmol/L	26.9	0.3	28.6	0.2	0.05
	Total CO2, mmol/L	28.0	0.3	29.7	0.2	0.05
Milk	Yield, kg/d	33.5	0.3	33.8	0.3	0.44
	Fat,%	4.02	0.04	3.68	0.04	0.01
	Protein,%	3.03	0.01	3.00	0.01	0.02
	MUN, mg/dl	11.5	0.1	12.6	0.1	0.01

Key Words: Water, Dairy Cattle, Production

794 Timothy hays differing in dietary cation-anion difference affect the capability to maintain calcium homeostasis in dairy cows. V. S. Heron*[1], G. F. Tremblay[2], and M. Oba[1], [1]*University of Alberta*, *Edmonton, AB, Canada*, [2]*Agriculture and Agri-Food Canada*, *Quebec, QC, Canada*.

The objective of this study was to evaluate the effectiveness of timothy hays differing in dietary cation-anion difference (DCAD) at maintaining calcium homeostasis. Six non-lactating, non-pregnant multiparous cows were fed diets containing timothy (*Phleum pratense L.*) hay with DCAD values of 4.1 ± 3.6 (LOW), 14.1 ± 3.0 (MED), or 25.1 ± 2.5 (HIGH) mEq/100 g DM in a duplicated 3 × 3 Latin square design with 14-d periods. The LOW and MED hays were produced by fertilizing established timothy fields at a rate of 224 kg $CaCl_2$/ha, and HIGH hay was obtained from the same field that LOW hay was produced, but from a section not fertilized with $CaCl_2$. Experimental diets, containing LOW, MED or HIGH timothy hay at 70% of dietary DM, had DCAD values of 0.72, 7.26, and 14.4 mEq/100 g DM, respectively. Animals were limit-fed at 108% of their energy requirement. For each period, after a 12-d diet adaptation, cows were subject to an EDTA challenge (3 cows each on d 13 and 14); infusion of EDTA solution into the jugular vein decreases the availability of blood ionized calcium. The EDTA challenge protocol determined the resistance time and recovery time: the time required to reduce blood calcium concentration to 60%, and time required for recovery from 60 to 90% respective to the pre-challenge value, respectively. Urine pH was reduced for cows fed LOW compared to HIGH diet (6.88 vs. 7.83; $P = 0.04$), but both of them did not differ from that for cows fed MED diet (7.15). However, immediately prior to the EDTA challenge, blood pH were lower ($P = 0.01$) for cows fed LOW or MED compared to HIGH diet (7.44 and 7.44 vs. 7.47, respectively). Although the resistance time was not affected by treatment, averaging 155 min, the recovery time was shorter ($P = 0.01$) for cows fed LOW compared to MED or HIGH diet (185 vs. 248 and 263 min, respectively). Cows fed LOW or MED diet decreased the extent of metabolic alkalosis, but the capability to maintain calcium homeostasis was enhanced only for cows fed LOW diet, in which the DCAD value was lowered to below 1 mEq/100 g DM.

Key Words: EDTA Challenge, Low DCAD Timothy Hay, Hypocalcemia