324 The effect of precalving DMI on milk production is dependent on DMI in early lactation in grazing dairy systems. J. R. Roche*, *Dexcel, Hamilton, New Zealand*.

Sixty-eight multiparous grazing dairy cows (BW:523±62.6kg) were randomly allocated to two precalving pasture DMI for 29±7.7 days precalving (Low or High; 4.8 and 11.9 kg DM). At calving, cows in each precalving treatment were randomly allocated to one of two levels of feeding (Low or High; 8.6 and 13.5 kg DM) for 35 d postcalving in a 2x2 factorial arrangement. Following treatment all cows grazed together and were offered generous allowances of pasture and pasture silage. Daily milk yields were recorded, and fat, protein and lactose concentrations determined each wk for 15 wk. Blood was sampled regularly pre- and postcalving and analyzed for indicators of energy status, growth hormone (GH) and IGF-1. Data was analyzed by ANOVA for a factorial arrangement of treatments. Precalving restriction reduced (P<0.05) milk fat production by 8.4% during the first five weeks postcalving, but differences were not evident subsequently. In comparison, postcalving feed restriction reduced (P<0.001) yield of milk, fat and protein by 25, 21 and 28%, respectively, during the first five weeks postcalving. Decreased (P<0.01) yields of milk, fat and protein (12, 10 and 9%, respectively) were also evident for ten weeks after the feed restriction finished. There was a tendency (P=0.13) for a precalving x postcalving DMI interaction in milk component (fat and protein) yield during the first five weeks of lactation. High-High cows produced 7.1 kg more fat and protein than Low-High cows, but there was no effect of precalving level of feeding in cows that were restricted postcalving. The plasma concentration of NEFA, BHBA and GH were elevated (P<0.01) in restricted cows precalving and IGF-1 concentration declined. Plasma NEFA and BHBA concentrations were elevated (P<0.01) postcalving in restricted cows, but postcalving DMI did not affect GH or IGF-1 concentrations. The milk production gains from higher levels of feeding precalving are only realized when cows are fed well after calving in pasture-based systems. Irrespective, the effect of precalving DMI on postcalving milk production was small.

Key Words: Transition Cow, Pasture, Dry Matter Intake

Ruminant Nutrition: Dairy and Beef—Minerals

325 Dietary cation-anion difference and dietary protein effects on performance and acid-base status of dairy cows in early lactation. W. Hu*[1], M. R. Murphy[1], P. D. Constable[1], and E. Block[2], [1]*University of Illinois, Urbana*, [2]*Church & Dwight Co., Inc., Princeton, NJ*.

Our objective was to examine the effects of dietary cation-anion difference (DCAD) with different concentrations of dietary protein (CP) on performance and acid-base status in early lactation cows. Six lactating Holstein cows averaging 44 days in milk were used in a 6 × 6 Latin square design with a 2 × 3 factorial arrangement of treatments: DCAD of -3, 22, or 47 meq (Na + K - Cl - S)/100 g of dry matter (DM), and 16 or 19% CP (on a DM basis). Linear increases with DCAD occurred in DM intake (24.4, 25.9, and 27.6 kg/d; $P < 0.01$), milk fat percentage (2.99, 3.36, and 3.59%; $P = 0.01$), 4% fat-corrected milk production (30.7, 32.8, and 34.2 kg/d; $P = 0.01$), milk protein (3.11, 3.18, and 3.24%; $P < 0.01$), milk lactose (4.81, 4.78, and 4.90%; $P = 0.03$), milk total solids (11.92, 12.45, and 12.65%; $P = 0.01$), blood pH (7.387, 7.404, and 7.416; $P < 0.01$), and jugular venous HCO_3^- concentration (25.7, 27.5, and 28.3 mmol/l; $P < 0.01$). Milk production itself was unaffected by DCAD (36.0, 36.1, and 36.4 kg/d; $P > 0.10$) and whole blood Cl concentration decreased linearly with increasing DCAD (100.1, 98.9, and 97.5 mmol/l; $P < 0.01$). Cows fed 16% CP had lower milk urea N than cows fed 19% CP (14.8 and 20.7 mg/dl; $P < 0.01$); the same was true for plasma urea N (17.3 and 24.3 mg/dl; $P < 0.01$). Dry matter intake, milk production and milk composition, and acid-base status did not differ between 16 and 19% CP treatments. The DCAD affected DM intake and performance of dairy cows in early lactation, effects likely mediated by modification of acid-base status of the cows; however, these variables were not affected when early lactation cows were fed either 16 or 19% CP diets.

Key Words: Dietary Cation-Anion Difference, Dietary Protein, Performance

326 Dietary cation-anion difference effect on performance and acid-base status of dairy cows in early lactation. W. Hu*[1], M. R. Murphy[1], P. D. Constable[1], and E. Block[2], [1]*University of Illinois, Urbana*, [2]*Church & Dwight Co., Inc., Princeton, NJ*.

Our objective was to examine the effect of dietary cation-anion difference (DCAD) on performance and acid-base status of cows in early lactation. Sixteen Holstein and 8 Jersey cows were used immediately after calving to compare two DCAD [22 and 47 meq (Na + K - Cl - S)/100 g of dry matter (DM)] in a completely randomized design. The corn silage based diets contained 19.0% crude protein, 25.4% neutral detergent fiber, 15.0% acid detergent fiber, and 1.69 Mcal of NE_L/kg (on a DM basis). An additional 2.3 kg of alfalfa hay was fed during the first 5 d postpartum then milk, blood, and urine samples were collected for 6 wk. Repeated-measures, with an extra between-subject effect, mixed model analysis indicated that DCAD did not affect ($P > 0.15$) DM intake (18.2 and 18.3 kg/d), milk production (33.5 and 33.3 kg/d), milk composition (3.96 and 4.11% fat, 3.11 and 3.00% protein, and 8.95 and 8.83% SNF), jugular venous HCO_3^- concentration (27.3 and 27.6 mmol/l), or pCO_2 (43.2 and 42.8 mmHg). Urinary pH increased with DCAD (8.12 and 8.20, $P = 0.08$), as did urinary Na:creatinine (1.08 and 1.57, $P = 0.01$) and K:creatinine (2.56 and 3.62, $P < 0.01$). Blood pH tended to increase as DCAD increased (7.421 and 7.428, $P = 0.11$); whereas, whole blood Cl concentration decreased as DCAD increased (98.8 and 97.6 mmol/l, $P = 0.06$). Intake of DM and performance of cows in early lactation were not improved when DCAD increased from 22 to 47 meq/100 g of DM.

Key Words: Dietary Cation-Anion Difference, Performance, Acid-Base Status

327 Utilization of phosphorus in lactating cows fed varying amounts of phosphorus and sources of fiber. Z. Wu*, *Pennsylvania State University., University Park*.

The effect of dietary P content and fiber source on P utilization in dairy cows was determined using the following 4 dietary treatments formed in a 2 x 2 factorial arrangement: low P, alfalfa hay (LPAH); low P, soyhulls (LPSH); high P, alfalfa hay (HPAH); and high P, soyhulls (HPSH). The P content was 0.32 or 0.44%, and the fiber source was varied by substituting 10% soyhulls for 6% alfalfa hay on a DM basis. Diets also contained approximately 50% corn silage and alfalfa silage for all treatments. The diets were fed to 32 Holsteins (97 ± 19 DIM) for 10 wk. Milk yield was 42.1 and 44.0 kg/d, fat 1.553 and 1.790 kg/d, and protein 1.240 and 1.323 kg/d, for the 0.32 and 0.44% P diets, respectively. Differences in milk production were associated with 1.5 kg/d less DMI for the lower P diets on average. Increasing dietary P increased fecal P excretion. Partial substitution of soyhulls for alfalfa hay did not affect milk production, but resulted in less fecal P excretion. Based on lactation performance 0.32% P appeared inadequate for cows milking 43 kg/d, while the requirement was 0.37%, calculated according to the 2001 NRC. Using highly digestible nonforage fiber sources in place of forage fiber sources in the diet may reduce fecal P excretion.

Item	LPAH	LPSH	HPAH	HPSH	SEM	P[1]	F[1]	P x F[1]
DMI, kg/d	25.8	24.2	26.9	26.1	0.7	0.04	0.11	0.57
Milk, kg/d	42.5	41.7	43.4	44.5	1.6	0.26	0.93	0.55
Fat, %	3.67	3.68	4.04	4.20	0.13	0.01	0.55	0.58
Fat, kg/d	1.542	1.564	1.753	1.827	0.102	0.03	0.64	0.80
Protein, %	3.02	2.89	3.04	3.06	0.07	0.19	0.40	0.28
Protein, kg/d	1.264	1.215	1.314	1.332	0.048	0.10	0.75	0.50
Fecal P, %	0.62	0.54	0.87	0.82	0.03	0.01	0.02	0.63
Fecal P, g/d	57.5	45.6	96.8	82.4	3.4	0.01	0.01	0.72

[1]*P* values for the effect of P, fiber source, and their interaction.

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Key Words: Phosphorus Requirement, Fiber Source, Dairy Cow

328 Estimate of phosphorus (P) maintenance requirement of lactating dairy cows over a range of feed intake rates. Z. H. Myers and D. K. Beede*, *Michigan State University*, *East Lansing*.

Inevitable fecal P excretion (IFPE) is endogenous fecal P excretion (EFPE) plus unabsorbed fecal P of dietary origin. By definition, EFPE of a ruminant animal fed very near its true requirement for P (zero P balance) represents the majority of the P maintenance requirement. In ruminants fed very near true requirement absorbability of dietary P is high (e.g., > 90%). Therefore, IFPE can be an estimate of EFPE and a large part of the P maintenance requirement. Objective was to evaluate German estimates of IFPE and the P maintenance requirement of lactating dairy cows over a range of DMI rates. Twenty-one lactating Holstein cows in early-, mid-, and late-lactation groups (n = 7/group) were used to achieve a range of DMI. Additionally, the DMI of mid- and late-lactation groups was restricted to 75 and 50% of pre-trial ad libitum intake rates, respectively. Resulting experimental treatments were DMI rates of 11.3, 15.3, and 25.1 kg/d for Treatments 1 (T1), 2 (T2), and 3 (T3), respectively. All cows were fed a low P diet (0.26% P, dry basis) so that total P intake was as near the true P requirement as possible. Phosphorus balances were not different from zero and unaffected by DMI treatment (P > 0.1). Average total IFPE was 15.3, 18.2, and 26.3 g/cow per d for T1, T2, and T3. Expressed as g/kg DMI, IFPE was 1.36, 1.19, and 1.04 for T1, T2, and T3 and decreased linearly with increasing DMI (P < 0.01). These values are similar to the German estimate of 1.2 g/kg DMI. The regression equation: (g IFPE/d) = [0.85 ± 0.070 (g/d)] x DMI (kg/d)] + [5.30 ± 1.224 (g/d)]; (R^2 = 0.90; P < 0.01) described IFPE across a range of DMI. Because P balances were not different from zero, the estimated IFPE is assumed to be EFPE, and the fecal portion of total P maintenance requirement.

Key Words: Phosphorus Maintenance Requirement, Inevitable Fecal Phosphorus Excretion, Dairy Cows

329 Effect of supplementing lactating dairy cows on a commercial dairy with chromium-L-methionine. M. Etchebarne[1], M. Socha*[2], and D. Tomlinson[2], [1]*Michel A. Etchebarne PhD, Inc.*, *Modesto, CA*, [2]*Zinpro Corporation*, *Eden Prairie, MN*.

Three hundred thirteen multiparous Holstein cows (162 control cows, 151 treatment cows) were blocked according to calving date and randomly assigned to a study to determine the effect of feeding 0 or 7.5 mg chromium/d from MiCroPlex chromium-L-methionine (Zinpro Corporation, Eden Prairie, MN) on lactation and reproductive performance. Treatments were incorporated into a TMR and delivered to cows twice daily. Cows received treatments from 3 wk precalving through 36 wk postpartum. All cows received a subcutaneous injection of 500 mg bovine somatotropin (Posilac, Monsanto Company, St. Louis, MO) every 14 d beginning at wk 15 postpartum. Chromium supplementation increased yield (P<0.05) of 3.5% fat-corrected milk (51.9 vs. 50.6 kg/d) and milk fat (1.87 vs. 1.81 kg/d) and tended to increase yield (P<0.15) of energy-corrected milk (50.5 vs. 49.5 kg/d) and milk solids (3.27 vs. 3.20 kg/d). Response to treatment did not vary by week (wk x treatment effect, P>0.15). Chromium supplementation decreased (P<0.05) milk protein content (2.81 vs. 2.84%), tended to (P<0.15) increase milk fat content (3.78 vs. 3.71%) and tended to (P<0.15) decrease somatic cell content (72,000 vs. 78,000). For cows that conceived in the first 250 d of lactation, chromium supplementation decreased (P<0.05) services per conception (2.5 vs. 2.7), increased (P<0.05) first service conception rates (36.8 vs. 21.7%) and tended to decrease (P<0.15) days open (94 vs. 106). Survival curve analysis of cows eligible to be bred indicated that chromium supplementation tended to (P<0.15) decrease percentage of cows pregnant. In conclusion, supplementing lactating dairy cows with chromium increased lactation performance and had mixed effects on reproductive performance.

Acknowledgements: The authors would like to acknowledge the dedication and hard work of Ryan Mattingly, John Fiscalini and the staff at Fiscalini Farms in carrying out the trial protocol.

Key Words: Chromium, Lactating Dairy Cow, Reproduction

330 Selenium yeast improved selenium status in blood and milk in first calf heifers. R. Wallace*[1], R. Aberle[1], M. Hutjens[1], T. Herdt[2], and I. Yoon[3], [1]*University of Illinois*, *Urbana*, [2]*Michigan State University*, *East Lansing*, [3]*Diamond V Mills*, *Cedar Rapids, IA*.

Thirty eight pregnant Holstein heifers were randomly assigned to one of two treatment groups, organic (SelenoSource™AF, Diamond V Mills, Cedar Rapids, IA) or inorganic selenium (sodium selenite) diets to determine the effect of source of selenium (Se) on Se concentrations in blood and milk. Beginning 60 days before projected due date, the heifers were placed in tie stalls and fed respective experimental diets containing 0.3 ppm added Se. After calving, the cows were switched to post-calving TMR diets that contained the same source and concentration of Se by treatment group. On day 21, all cows were moved from individual tie stalls to loose housing with free stalls and placed on the same diet containing sodium selenite. Whole blood was collected at day -60, -21, 0, +21, +60 days relative to calving (day 0). Milk was collected at calving (colostrums) and at days 21 and 60. At the start of the trial (day -60), there was no significant difference in whole blood Se for heifers fed organic Se when compared to heifers fed inorganic Se (171 ng/ml vs. 188 ng/ml, P=0.25). At calving, heifers fed organic Se had increased (P<0.01) whole blood Se compared to heifers fed inorganic Se (236 ng/ml vs. 196 ng/ml). From enrollment to calving (~60 days), whole blood Se for heifers fed the organic Se diet increased 65 ng/ml while whole blood Se values for the heifers fed the inorganic Se diet only increased 8 ng/ml. This trend continued through 21 d postpartum when mean whole blood Se for heifers fed organic Se remained 29 ng/ml higher than those fed inorganic Se. Organic Se increased (P<0.01) Se concentration in milk at calving (128 ng/ml vs. 92 ng/ml) and 21 d postpartum (61 ng/ml vs. 38 ng/ml). These results suggest that organic Se transferred dietary Se into blood and milk more efficiently than inorganic Se. The effect of organic Se on blood Se was not detected until after 60 days of feeding; suggesting that feeding organic Se for more than 40 days may be required to see this effect. Increased serum and milk Se concentrations in heifers fed organic Se disappeared by day 60 postpartum after all heifers were switched to inorganic Se at day 21.

Key Words: Selenium, Organic, Blood

331 Effect of trace mineral source and level on production and fertility of dairy cattle in two successive lactations. J. Nocek*[1], M. Socha[2], and D. Tomlinson[2], [1]*Spruce Haven Farm and Research Center*, *Auburn, NY*, [2]*Zinpro Corporation*, *Eden Prairie, MN*.

Primiparous and multiparous Holstein cows (573) were blocked by parity and 305d Mature Equivalent milk yield (sire PTA for primiparous cows) and randomly assigned to a study to determine the effect of supplementing 1) 75% of NRC (2001) requirements (75C) for Zn, Mn and Cu using metal specific AA

complexes and Co using cobalt glucoheptonate (CTM, Zinpro Corporation, Eden Prairie, MN); 2) 100% of NRC Zn, Mn, Cu and Co requirements (100I) using inorganic sources; 3) 100% of NRC Zn, Mn, Cu and Co requirements (100C) using CTM; and 4) a combination of Zn, Mn, Cu and Co from inorganics and CTM (C/I). Supplemental Zn and Cu levels were similar between treatments 3 and 4; Mn and Co levels in treatment 4 were 3.4 and 9.1X Mn and Co levels in treatment 3. Cows were assigned to treatment 60 d prepartum and continued through a full lactation, a second dry period, and 200 d into the subsequent lactation. In lactation 1, C/I cows produced more (P<0.05) energy-corrected milk (ECM, 39.4 vs. 37.2), fat (1.47 vs. 1.40 kg/d) and protein (1.12 vs. 1.06 kg/d) than 100I cows. In lactation 2, 100C and C/I cows produced more (P<0.05) ECM (46.3, 45.5 vs. 43.3. 43.6 kg/d), fat (1.76, 1.72 vs. 1.62, 1.65 kg/d) and protein (1.27, 1.26 vs. 1.22, 1.21 kg/d) than 75C and 100I cows. In addition, 100C and C/I cows produced milk with lower (P<0.05) somatic cell content (x1,000) (234, 243 vs. 447, 437) than 75C and 100I cows. Compared to 100I cows, C/I cows had fewer days to first estrus (50 vs. 56 d), higher (P<0.05) first service conception rates (36.9 vs. 29.6%) and tended to have (P<0.15) fewer days open (116 vs. 132 d). Fortifying diets with trace elements from inorganic and CTM sources above NRC requirements increased production and appeared to improve fertility of dairy cattle. Performance was similar between cows supplemented at 75% of NRC Zn, Mn, Cu and Co requirements using CTM as cows supplemented at 100% of NRC Zn, Mn, Cu and Co requirements using inorganic sources.

Key Words: Trace Minerals, Lactation, Reproduction

332 Effects of dietary sulfur and sodium bicarbonate on performance of growing and finishing steers. J. W. Spears* and K. Lloyd, *North Carolina State University*, *Raleigh*.

An experiment was conducted to determine the effect of increasing dietary cation:anion balance with sodium bicarbonate ($NaHCO_3$) on performance of growing and finishing steers fed varying sulfur (S) concentrations. The experimental design was a 3x2 factorial with S (from NH_4SO_4) supplemented at 0, 0.15 or 0.30% DM, and $NaHCO_3$ added at 0 or 1.0% of DM. Each treatment consisted of three replicates containing 5 steers/pen and one replicate containing 4 steers/pen. Steers were fed a corn silage-based growing diet for 84 d and then gradually switched to a high corn finishing diet for 102 to 116 d. Growing diets analyzed 0.12, 0.30, and 0.46% S while finishing diets analyzed 0.13, 0.31 and 0.46% S for treatments supplemented with 0, 0.15 and 0.30% S, respectively. During the growing phase, ADG and gain:feed were higher (P<0.05) in steers supplemented with 0.15 compared to those supplemented with 0.30% S. Performance of control steers did not differ from those supplemented with 0.15 or 0.30% S during the growing phase. In the finishing phase, control steers had greater (P<0.05) feed intake than steers supplemented with 0.15 or 0.30% S. Average daily gain of steers supplemented with 0.15% S did not differ from controls, while steers receiving 0.30% supplemental S had lower (P<0.05) ADG than controls. However, gain:feed was not affected by dietary S during the finishing phase. Addition of 1% $NaHCO_3$ did not affect performance during the growing or finishing phases. In conclusion, steers tolerated a total dietary S of 0.30% (0.15% supplemental) without negative effects on ADG or gain:feed. A total dietary S of 0.46% reduced ADG and ADFI during the finishing phase. Increasing dietary cation-anion balance with $NaHCO_3$ did not prevent depressed ADG in steers fed high S.

Key Words: Sulfur, Cation-Anion Balance

333 Dietary copper effects on brain copper concentration and brain prion protein characteristics in mature Angus cows. L. R. Legleiter*[1], J. W. Spears[1], J. K. Ahola[2], and T. E. Engle[3], [1]*North Carolina State University*, *Raleigh*, [2]*University of Idaho*, *Caldwell*, [3]*Colorado State University*, *Fort Collins*.

Twelve copper-deficient multiparous Angus cows were used to determine the effects of copper (Cu) repletion on brain Cu concentration and brain prion protein (PrP^c) characteristics. Cows were considered Cu-deficient based on liver Cu concentrations (< 30 mg Cu/kg DM) after receiving a low Cu diet supplemented with 5 mg molybdenum/kg of diet DM and 0.3% sulfur for 216 d. Copper-deficient cows received one of three treatments; 1) control (no supplemental Cu), 2) organic Cu (10 mg/kg DM), and 3) inorganic Cu (10 mg/kg DM), during a 159 d repletion phase. Liver and brain samples were taken immediately after euthanasia. Liver Cu concentrations were greater (P = 0.001) in supplemented (treatments 2 and 3) than non-supplemented (control) cows. Brain Cu concentrations tended (P = 0.17) to be greater for Cu-supplemented cows than control cows. Brain PrP^c were extracted from brain tissue by homogenization followed by centrifugation. Supernatant protein concentration was measured to ensure identical gel loading. Prion proteins were electrophoretically separated (10% Bis-Tris SDS-PAGE) and transferred to polyvinylidene diflouride membranes. Prions were probed with primary and secondary antibodies, visualized using chemiluminescence, and relative optical densities of bands quantified. Relative optical densities of bands were greater (P = 0.02) for Cu-supplemented cows than non-supplemented cows. Proteinase degradability was not affected by treatment as all PrP^c were completely degraded after exposure to proteinase K. The apparent molecular weight of PrP^c, as determined by comparison to a molecular weight standard, was not affected (P = 0.27) by treatment. These data suggest that PrP^c concentrations are affected by the Cu status of the animal.

Key Words: Prions, Copper

334 The effect of dietary selenium levels on human health and milk and milk product selenium content when supplemented in dairy cattle diets. J. K. Margerison*[1], J. A. Harrison[1], and D. Wilde[2], [1]*University of Plymouth*, *Plymouth, Devon, UK*, [2]*Alltech (UK) Ltd*, *Stamford, Lincs, UK*.

The effect of selenium supplementation on the selenium content of milk and cheese was measured using 12 lactating dairy cows which were assigned to one of three treatments: 6mgSe/d from sodium selenite (ST), 3mgSe/d from Sel-Plex (LS)(Alltech Inc, USA) or 6mgSe/d from Sel-Plex (HS). Cows were offered 7kg/h/d compound and ad libitum access to spring pasture. Individual milk samples were analysed for Se content (weekly) and used to manufacture a whole milk, unripened soft cheese. There were no difference in body weight, milk yield, milk composition between treatments except for milk protein which was significantly lower in the LS group (ST 31.1, LS 29.3, HS 30.7 g/kg; s.e.m. 0.30; P<0.05). Milk selenium content was significantly higher for the HS group (ST 14.7, LS 15.5, HS 21.6 mg/l; s.e.m. 0.65; P<0.001), Se content of cheese was higher in the HS group (0.10, 0.10, 0.16 mg/kg; s.e.m. 0.02), but not significatly. MC, pH, lactic acid levels, cheese yield were not significatly different, though less milk was required to produce 1kg of cheese from the HS group (ST 8.41, LS 8.15, HS 7.31 kg milk/kg cheese). Selenium from Sel-Plex is more bio-available than selenium from sodium selenite and significantly increased the selenium content of human foods such as milk. Although not significant, milk from cows offered 6mg/h/d Sel-Plex tended to have a higher cheese selenium content and a greater cheese yield.

335 Long term effects of dietary manganese in beef heifers on performance and manganese status of their offspring. S. L. Hansen*, C. S. Whisnant, K. E. Lloyd, L. R. Legleiter, H. S. Stahlhut, and J. W. Spears, *North Carolina State University*, *Raleigh*.

Previously we reported (J. Anim. Sci. 87(Suppl. 1):269) that feeding weanling heifers a control diet, containing only 18 mg manganese (Mn)/kg DM, during growth and development did not affect performance, but tended to reduce pregnancy rate compared to Mn-supplemented heifers. In the present study, 20 pregnant heifers receiving the control or 50 mg supplemental Mn/kg DM treatments were continued on their dietary Mn treatments during gestation and early lactation to determine if the low Mn diet would affect performance or result in deficiency signs in their offspring. Heifers were group fed by treatment (4 pens per treatment, 2 head per pen). Heifers were approximately 23 mo of age at calving and had been on treatments for 380 d. Calves were weighed and a blood sample collected within 24 h of birth. Calves born to dams fed the control diet had

lower birth weights (P=0.05) than calves born to dams fed supplemental Mn (32.5 vs. 38.3 kg). Whole blood samples were lower in Mn (P=0.01) from calves born to control heifers than calves born to supplemented heifers. Several calves born to control heifers suffered from varying signs of Mn deficiency. These symptoms included unsteadiness, enlarged joints, dwarfism, and superior brachygnathism. Results of this study indicate that 18 mg Mn/kg diet DM during gestation is not adequate for normal calf development.

Key Words: Manganese, Heifers, Reproduction

336 Effects of nutrient restriction and organically bound selenium on maternal and fetal organ mass in pregnant ewe lambs. M. A. Ward*[1], J. S. Caton[1], J. B. Taylor[2], J. J. Reed[1], P. P. Borowicz[1], K. A. Vonnahme[1], D. A. Redmer[1], and L. P. Reynolds[1], [1]*North Dakota State University*, *Fargo*, [2]*USDA-ARS Sheep Experiment Station*, *Dubois, ID*.

To examine effects of nutrient restriction and dietary Se on maternal and fetal visceral tissues, 36 pregnant Targhee-cross ewe lambs (53.8 ± 1.3 kg) were randomly allotted to one of four treatments in a 2 x 2 factorial design. Factors were nutrition (maintenance; M vs. 60% maintenance; R) and dietary Se (7.4 µg/kg BW; NSe vs. 81.5 µg/kg BW; HSe) from a seleno-yeast product. Selenium treatments were initiated 21 d before breeding and restriction treatments on d 64 of gestation. All diets were similar in CP (16.0%) and energy (2.12 Mcal/kg) density. On d 140 ± 5 of gestation, ewes were slaughtered and tissues harvested. There were no nutrition x Se interactions in ewe data; therefore, main effects are reported. Maintenance fed ewes had heavier ($P < 0.09$) BW (66.3 vs. 55.9 ± 1 kg), stomach complex (1266.3 vs. 935.5 ± 24.9 g), small intestine (569.9 vs. 456.5 ± 12.4 g), large intestine (367.7 vs. 271.3 ± 13.6 g), liver (688.4 vs. 563.3 ± 16.1 g), and kidney (142.9 vs. 127.7 ± 3.6 g) compared with R. Stomach and intestinal differences persisted when data were scaled by empty body weight (EBW). Lung and blood mass (% of EBW) increased ($P < 0.09$) in ewes fed R compared with M diets. Ewes fed HSe had lower ($P < 0.05$) lung mass (0.90 vs. 0.97 ± 0.03 % EBW) compared with NSe. Restricted maternal diets decreased ($P < 0.05$) fetal BW, empty carcass weight, crown rump length, and liver, pancreas, perirenal fat, small intestine, and spleen weights compared with fetuses from M fed ewes. Ewes fed HSe had fetuses with heavier ($P < 0.05$) BW, empty carcass, total viscera, heart, lung, kidney, spleen, and large intestine compared with those fed NSe. These data indicate that maternal nutrition impacts both maternal and fetal organ mass. Further research is needed to assess impacts of maternal nutrition on growth and production of offspring.

Key Words: Nutrient Restriction, Pregnancy, Selenium

Ruminant Nutrition: Small Ruminants

337 Nutritional evaluation of broccoli (Brassica oleracea) fodder for goats. K. R. Yadav*, B. S. Tewatia, and S. S. Khirwar, *CCS Haryana Agricultural University*, *Hisar, Haryana, India*.

Broccoli has been introduced in India recently and nearly 75% of the plant material is left out in the field after harvesting for human consumption. This left over material has potential value as animal feed. Chemical composition and in vitro dry matter digestibility of eight varieties of broccoli were determined with the objective of utilizing as green fodder for goats. These varieties contained 20.3 to 29.4% crude protein on dry matter (DM) basis while in vitro dry matter digestibility ranged from 77.4 to 92.6%. A digestion trial was conducted on five non-lactating Beetal goats having similar body weight and age, maintained on fresh chaffed broccoli plants as sole feed. The total DM intake of experimental goats was 624.4 ± 39.9 g/d, which was 2.67% of the body weight. Broccoli was highly palatable but its consumption was limited due to high moisture content. The digestibility coefficient of DM, OM, CP, EE, CF and NFE were 83.70, 84.04, 87.84, 87.08, 69.64 and 83.84%, respectively. The broccoli contained 23.94% digestible crude protein (DCP)and 87.20% total digestible nutrients (TDN) on DM basis. All the goats were in positive nitrogen, calcium and phosphorus balance. The results indicated that green broccoli could be utilized as animal feed after harvesting the heads for human consumption.

Key Words: Broccoli, Proximate Composition, Beetal Goat

338 Effects of linseed and cottonseed supplementation on fatty acid composition of goats milk and muscle of suckling kids. A. Nudda*, G. Battacone, S. Fancellu, and G. Pulina, *University of Sassari*, *Sassari, Italy*.

The effects of dietary fat supplements on fatty acid (FA) composition of goat milk and possible consequence in the FA profile of muscle in suckling kids was investigated. Fifteen Sarda breed goats, fed 1.2 kg/day of concentrate and hay ad libitum, were divided in two groups supplemented with: i) 40 g/d of fat from linseed (LS), characterized by a high C18:3 concentration, ii) 40 g/d of fat from cottonseed (CS), having high C18:2 content. Kids were fed exclusively on maternal milk until slaughtering (approximately 50 days of age). Twenty-four hours after slaughtering, the *Longissimus dorsi* (LD) muscle was removed from kids. FA profile of goats milk and kids LD was determined. The milk FA profile was significantly influenced by the diets. Compared to CS, the use of LS significantly decreased the content of C6-C14 (22.5vs 19.7%), C16:0 (23.0 vs 20.4) and n6/n3 ratio (7.9 vs 3.5), whereas increased the content of t11-C18:1 (4.54 vs 2.38%) and C18:3-n3 (1.34 vs 0.67%). Moreover, the content of conjugated linoleic acid (CLA) isomers c9,t11 (1.46 vs 0.86%), t11,c13 (0.10 vs 0.03%), t11,t13 (0.11 vs 0.06%) and others trans,trans isomers (0.13 vs 0.10%) were higher in LS group ($P<0.10$). The t10,c12 CLA content was low both in LS and CS (0.01 vs 0.02; $P = 0.13$). The differences in the FA profile of LD between LS and CS groups tended to mirror the differences observed in milk, even if the lack of significant difference probably due to the small number of kids. The results suggested that it may be possible to modify the nutritional value of FA profile of meat from suckling kids by manipulating the diet of the mothers.

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Key Words: Goat Milk, Kid Muscle, Fatty Acid

339 Effects of feeding oilseeds on total tract nutrient utilization and milk composition of lactating ewes. R. Zhang, A. Mustafa*, and X. Zhao, *McGill University*, *Ste-Anne-De-Bellevue, QC, Canada*.

Sixteen pure breed Dorset ewes (39 ± 8 DIM) were used in a completely randomized design to determine the effects of feeding different oilseeds on total tract nutrient utilization and milk composition of lactating ewes. Ewes were randomly assigned to one of four dietary treatments (4 ewes per treatment): a control diet with no oilseed (C), a canola seed supplemented diet (CS), a sunflower seed supplemented diet (SS) and a flaxseed supplemented diet (FS). All diets were formulated to be isonitrogenous and the oilseed diets were formulated to contain 6% fat. Experimental period was 21 d in duration with the first 14 d for diet adaptation and the last 7 d for data collection. Results showed that Oilseed supplementation had no effect on DMI (average 2.6 kg/d) or on total tract digestibility of CP (average 62%), NDF (average 57%) and ADF (average 55%). However, DM and gross energy digestibilities were higher ($P < 0.05$) for ewes fed FS than for those fed C or CS. Ether extract digestibility was highest for FS, intermediate for SS and lowest for CS and C ($P < 0.05$). Ewes fed CS produced less ($P < 0.05$) milk than those fed the other dietary treatments. Milk fat and protein percentages were higher ($P < 0.05$) for ewes fed the oilseed diets relative to those fed C. However, milk protein fractions were not affected by dietary treatments. Cheese yield was higher ($P < 0.5$) from milk of ewes fed