

Colostrum ChT activity was 3912, 2124, 737, 403 and 465 nMol/ml/h at 1, 2, 3, 4, and 5 postpartum days, respectively. Statistical differences ($P < 0.05$) were shown between postpartum days.

Key Words: Chitotriosidase, Goat, Colostrum

276 Pre-pubertal nutrition affects mammary development and first lactation performance depending on growth potential in dairy sheep. A. Zidi¹, G. Caja^{*1}, M. Ayadi², V. Castillo¹, C. Flores¹, and X. Such¹, ¹Universitat Autònoma de Barcelona, Bellaterra, Spain, ²Institut Supérieur de Biologie Appliquée de Medenine, Tunisia.

A total of 57 ewe lambs of Manchega (MN, $n = 35$) and Lacaune (LC, $n = 22$) dairy sheep, born during winter and weaned at wk 5 of age, were used to evaluate the effects of pre-pubertal level of nutrition on long-term lactational performance. Nutritional treatments consisted of ad libitum (concentrate and alfalfa hay) or restricted (concentrate and straw) feeding to achieve the maximum ADG (MN, 254 g/d, $n = 18$; LC, 293 g/d, $n = 12$) or 65% ADG (MN, 164 g/d, $n = 17$; LC, 189 g/d, $n = 10$), respectively, from wk 5 to 22. After wk 22, ad libitum

ewe-lambs joined the adult ewe flock for grazing (MN, 183 g/d; LC, 201 g/d; $P < 0.05$). Compensatory growth was applied to restricted ewe-lambs from wk 22 to 27 (MN, 223 g/d; LC, 279 g/d; $P < 0.05$) to reach puberty and pregnancy during first fall. All ewe-lambs were exposed to rams and mated under control conditions after the second estrus cycle. Computerized axial tomography (CAT) was done at wk 16 and 36. Puberty was reached earlier in ad libitum than in restricted fed ewe lambs (MN, -35 d; LC, -21 d; $P < 0.05$). CAT images at wk 16 showed greater fat pad ($P < 0.05$) due to ad libitum feeding in both breeds (MN, +54%; LC, +32%). Parenchyma percentage was lower in the ad libitum fed MN ($P < 0.05$), but no differences were detected between the other groups. Conception rate (50.9%), prolificacy (1.24 lambs/ewe) and lamb body weight at birth were not affected by the dietary treatments. Milk yield varied according to treatment and breed, the breed \times treatment interaction being highly significant ($P < 0.001$). Restricted ewe lambs yielded more milk than ad libitum at first lactation (114 DIM) in MN (61.2 vs. 40.0 L; $P < 0.05$), whereas it was the opposite in LC (122.9 vs 143.5 L; $P < 0.05$). No significant differences in milk components were detected between feeding treatments, but milk of restricted MN had greater fat and protein contents.

Key Words: Dairy Sheep, Mammary Development, Lactation

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277 The relationship between negative energy balance and mastitis in dairy cattle during early lactation. K. M. Moyes^{*1}, T. Larsen², N. C. Friggens², J. K. Drackley¹, and K. L. Ingvarstsen², ¹University of Illinois, Urbana, ²University of Aarhus, Tjele, Denmark.

Our objective was to determine whether dairy cows experiencing more severe postpartal negative energy balance (NEB) are at a greater risk for developing mastitis during early lactation. Data from a total of 138 lactations from 117 cows were used in a case-control epidemiologic study. Cows were of 3 breeds (Danish Red, Danish Holstein and Jersey) ranging from parity 1 to 4. Blood samples were collected weekly from 56 d before expected calving date through 90 DIM. Blood was analyzed for insulin, aspartate aminotransferase (ASAT), NEFA, glucose and BHBA. Daily milk yield was measured and composite SCC were analyzed. Cows were classified as 1) healthy (H) if SCC $< 100,000$ cells/mL and they were not treated for mastitis; 2) sub-clinical mastitis (SM) if SCC $> 800,000$ cells/mL but were not treated for mastitis; or 3) clinical mastitis (CM) if SCC $> 800,000$ cells/mL and were treated for clinical mastitis. Cows that developed mastitis during the first 7 DIM were excluded from the dataset. The time of mastitis (TOM) was recorded as the DIM in which the first rise in SCC was observed and was recorded as TOM = 0. The time prior to and after TOM was distinguished as $\pm n$ wks relative to TOM = 0. Healthy cows were paired with either a SM or CM cow and the TOM for each H cow was equal to the TOM for their paired mastitic cow. Data from wk -2 relative to TOM were analyzed using the MIXED procedure of SAS. Cows that developed SM did not differ statistically from H cows. The CM cows had higher NEFA ($P < 0.05$) and ASAT ($P < 0.05$) than H cows. All other variables were similar among treatment groups. Cows in more severe NEB tended to have higher NEFA than cows experiencing 'normal' postpartal NEB. In addition, higher ASAT indicates that the CM cows may have experienced more liver tissue damage prior to the development of mastitis when compared with

H cows. Our results indicate that cows experiencing more severe postpartal NEB may be at a greater risk for developing mastitis.

Key Words: Negative Energy Balance, Mastitis, Dairy Cattle

278 The use of the Rumensin Premix in dairy cows: factors influencing its effects on milk production and milk composition. J. Dubuc^{*1}, D. DuTremblay¹, M. Brodeur¹, R. Bagg², P. Dick², J. Baril², and L. DesCoteaux¹, ¹Université de Montréal, Saint-Hyacinthe, Québec, Canada, ²Elanco Animal Health, Guelph, Ontario, Canada.

The goal of this field trial was to evaluate the effects of 16 ppm of monensin sodium (Rumensin Premix, Elanco Animal Health, Canada) on production (PROD) and milk fat percentage (MFP) of commercial dairy herds. Another goal of this study was to identify possible interactions between monensin and nutritional factors on PROD and MFP. A randomized clinical trial was conducted on 49 Holstein herds in Quebec (Canada) between Nov. 2005 and May 2006. The herd was considered as the unit of interest. Herds were balanced in two groups for milk production, housing system, feeding system and size of farm. Monensin treatment was allocated in a crossover designed trial for each group. Monensin premix was added to the lactating dairy cow rations for a consecutive 3-month period for every herd. PROD and MFP were from weekly averages of daily bulk tank data. PROD and MFP were considered as outcome variables in linear mixed models. PROD and MFP were treated as repeated measures in herds. All models included treatment, group, season, parity and days in milk as fixed effects. Majority of herds were fed total mixed rations (TMR; $n=30$; 61%) and were housed in tie-stalls ($n=42$; 86%). Overall monensin effect on PROD was not significant ($P=0.54$). However, herds having high non-fiber carbohydrate level (NFC; $>41.0\%$) in their diet had a higher milk production ($+0.84\text{kg/d}$; $P=0.03$). Monensin had a decreasing effect (-0.12%) on MFP ($P < 0.01$). Statistical interactions

with monensin on MFP were observed for some nutritional factors. The decreased MFP effects were larger for herds: having a diet high in NFC (>39.0%; $P=0.01$); having low particle size in TMR when adding the results of the two top sieves of The Pennsylvania State University Particle Separator (<45.0%; $P=0.03$); not feeding dry hay as first meal in the morning ($P=0.05$); and not feeding protected fat in the diet ($P=0.07$). The results of this trial confirm that monensin lowers MFP at a dose of 16 ppm in lactating dairy cows. Interactions between monensin and nutritional factors having effects on PROD and MFP were mostly related to carbohydrate levels in the ration.

Key Words: Monensin, Dairy Cow, Milk Composition

279 The expression of genes regulating lipolysis in the adipose tissue of pregnant and lactating dairy cattle. J. M. Sumner* and J. P. McNamara, *Washington State University, Pullman.*

There is great variation among dairy cattle in body condition loss during early lactation, which affects all aspects of production, health and longevity. The objectives were to determine the change in expression of the beta 1, beta 2, and beta 3 adrenergic receptors, hormone sensitive lipase and its cofactor perilipin in the adipose tissue of Holstein dairy cattle during transition. We also wanted to know if the expression was related to animal level variables for milk production and body fat. Therefore, twenty Holstein dairy cattle were grouped by lactation number (1, 2, and 3 or more) in a randomized design and subcutaneous adipose tissue was sampled to measure lipolytic rates and gene expression. Duplicate samples were extracted for RNA and tissue was also incubated to measure basal and stimulated lipolysis. Basal lipolysis increased following parturition, stimulated lipolysis peaked at 90 days postpartum. The beta-1 receptor relative expression increased relative to prepartum by 170%, 72% and 112% at 30, 90, and 270 DIM. The beta-2 receptor relative expression increased by 75%, 121% and 100% at 30, 90, and 270 DIM compared to 30 days prepartum. The beta-3 receptor increased 111%, 125% and 69% at 30, 90, and 270 DIM. Hormone sensitive lipase increased ($P = 0.09$) at all postpartum sample points and was highest in primiparous animals ($P = 0.002$). The mean fold increase was 180%, 359% and 47% at 30, 90, and 270 days of lactation compared to prepartum. The relative abundance of the perilipin gene was the highest and the relative expression increased ($P = 0.04$) 227%, 1847% and 126% at 30, 90, and 270 DIM. This is the first time perilipin has been measured in the adipose tissue of dairy cattle. Expression of hormone sensitive lipase was negatively related to changes in BCS. This work demonstrates that increases in the expression of beta-adrenergic receptors, hormone sensitive lipase and perilipin is part of the regulation of lipolysis in dairy cattle during lactation.

Key Words: Gene Expression, Adipose, Lipolysis

280 Feeding a whey protein gel to prevent rumen hydrogenation of unsaturated fatty acids and increase the n3 and n6 fatty acid content of goat milk. J. A. Weinstein*, E. J. DePeters, M. Rosenberg, S. J. Taylor, and A. Aljadef, *University of California, Davis.*

Developing new approaches for reducing the risk of coronary disease from eating dairy products is a common objective in research, specifically, finding methods to increase the polyunsaturated fatty acid (PUFA) concentration of milk lipids. Previously, feeding whey

protein gels containing PUFA reduced rumen biohydrogenation and increased the levels of target milk fatty acids. Our objective was to test the efficacy of whey protein isolate (WPI) gels produced in a steam tunnel, as a method to alter the fatty acid (FA) composition of the triacylglycerol (TG) fraction of milk lipids in goats. Three primiparous Lamancha goats in midlactation were fed three diets in a 3x3 Latin square design. Each animal was fed an isoenergetic grain mix with WPI added as a supplemental lipid containing either: (1) 100% soybean (S) oil, (2) 100% linseed (L) oil, or (3) a 50/50 blend (S/L) of both soybean and linseed oils. S served as a source of n6 FA and L was a source of n3 FA. Periods were 22 days with the first 10 days used as an adjustment phase followed by a 12-day experimental period. During the adjustment phase all goats received yellow grease (YG) as their dietary lipid to provide a baseline for milk FA composition. During the experimental phase each goat received its assigned WPI. Significant changes in FA concentration were determined at $P<0.05$. Milk FA concentrations of C18:2 and C18:3 were 1.92 and .51 g/100g TG when goats were fed YG. Relative to YG, WPI S increased both C18:2 and C18:3 in milk fat to 9.37 and 1.51g/100g TG respectively. The S/L gel also increased C18:2 and C18:3, 6.45 and 3.86g/100g TG respectively. WPI L produced milk fat containing 3.99 and 5.97 g/100g TG of C18:2 and C18:3. WPI gels reduced rumen biohydrogenation of PUFA and increased the n6 and n3 content of milk fat in lactating does. WPI gels are a practical and efficient method to deliver PUFA posttruminally.

Key Words: Goat, Polyunsaturated Fatty Acids, Whey Protein Gel

281 Effect of time of AI and supplemental estradiol on pregnancy rates of lactating dairy cows. J. Hillegeass*, J. E. P. Santos, F. S. Lima, M. F. Sheley, and M. F. S. Filho, *University of California, Tulare.*

Objectives were to compare pregnancy rates and losses for lactating dairy cows time-inseminated either at 48 or 72 h after $\text{PGF}_{2\alpha}$ and supplemented or not with estradiol prior to AI. Holstein cows, 971, were randomly assigned to one of four treatments arranged as a 2 x 2 factorial. All cows were pre-synchronized with injections of $\text{PGF}_{2\alpha}$ at 37 and 51 DIM. At 64 DIM, they received an injection of GnRH, followed 7 d later by $\text{PGF}_{2\alpha}$. Cows were then assigned to one of four treatments; cows in the CoSynch at 48 h (CoS48) received a final injection of GnRH at the moment of timed AI 48 h after $\text{PGF}_{2\alpha}$, whereas cows in the CoSynch at 72 h (CoS72) received GnRH and were timed AI 72 h after $\text{PGF}_{2\alpha}$. Half of the cows in each CoSynch received an injection of 1 mg of estradiol cypionate (ECP) 24 h after $\text{PGF}_{2\alpha}$. Therefore, the 4 treatments were: CoS48-ECP ($n = 240$), CoS72-ECP ($n = 246$), CoS4+ECP ($n = 245$) and CoS72+ECP ($n = 240$). Blood samples were collected and progesterone measured in plasma of all cows at 7 d prior to and at the first GnRH of the CoSynch, and cows were classified as anovular when progesterone < 1.0 ng/mL in both samples. Pregnancy was diagnosed by palpation per rectum at 40 and 68 d after AI. A subset of 123 cows had their ovaries examined by ultrasonography to determine diameter of ovulatory follicle and ovulation rate. These same cows had blood sampled to evaluate plasma estradiol and progesterone concentrations after ECP and induction of ovulation with GnRH. Prevalence of anovular cows at 64 DIM was 27.6%, but it was similar across all treatments ($P = 0.19$). Pregnancy rates at 40 and 68 d after AI or pregnancy loss were not affected by timing of AI ($P = 0.27$) or supplementation with estradiol ($P = 0.13$). Delaying timed AI to 72 h and supplementation with ECP increased

the proportion of cows displaying estrus at AI ($P < 0.0001$), and cows in estrus had increased pregnancy rates ($P < 0.0001$). These results indicate that delaying the day of AI from 48 to 72 h and supplemental ECP, in spite of increasing display of estrus at timed AI, did not improve reproductive performance of lactating dairy cows at first AI.

Key Words: Dairy Cow, Reproduction, Estradiol

282 Interactions of unsaturated fat or coconut oil with Rumensin on milk fat production might be mediated through inhibition of specific protozoal genera. C. Reveneau*, S. K. R. Karnati, C. V. D. M. Ribeiro, E. R. Oelker, B. Mathew, D. R. Bae, C. M. Drow, and J. L. Firkins, *The Ohio State University, Columbus.*

Feeding animal-vegetable (AV) fat or medium chain FA to dairy cows can decrease rumen protozoal count. In contrast, AV fat with Rumensin (R) can promote milk fat depression (MFD), whereas diets supplemented with coconut oil (CO; rich in medium chain FA) + R were not expected to cause MFD. In a 6x6 Latin square design (2x3 factorial), 6 rumen-cannulated cows were fed with +/-R (260 mg/d) and either: control (no fat), 5% AV, or 5% CO. Diets were balanced to have 21.5% forage NDF, 16.8% CP and 42% NFC. The mixed model included fixed (diet) and random (period, cow) effects. Contrasts were the main effects of: 1) Rumensin (+R), 2) fat supplementation (control vs. AV+CO, and 3) fat source (AV vs. CO); and 4 and 5) the interactions of R with contrasts 3 and 4. Significance was $P < 0.05$ for main effects and $P < 0.10$ for interactions. The log₁₀ of concentrations of total protozoa (cells/ml) were not different from control (5.97) vs. AV (5.95) but decreased by 93% with CO (4.79). *Isotricha* and *Entodinium* decreased by 99 and 97% by CO, whereas *Epidinium* was unchanged. In contrast, *Epidinium* were 67% lower for the main effect of +R and decreased 92% when AV was supplemented with R. Total VFA concentration (130 mM) was not affected by diet, but the A:P ratio decreased for CO (1.85) vs. control (2.95) or AV (2.58). The low A:P ratio was associated with a decreased total tract digestibility of NDF for CO (35.5%) vs. control (53.3%) and AV (46.5), with no difference in OM digestibility (averaging 67.9%). DMI was 5 kg/d lower with CO (15.3 kg/d) and not different for control and AV. Milk production was lower with +R (31.6 kg/d) and CO (30.3 kg/d) than AV (33.0 kg/d). MFD occurred with AV+R and CO: 1.08, 1.01, 0.71, 1.05, 0.87, and 0.74 kg/d for control, AV, CO, control+R, AV+R, and CO+R, respectively. Further analyses should elucidate the role of protozoal concentration and genera on bacterial biohydrogenation in the rumen.

Key Words: Protozoal Inhibition, Supplemental Fat, Milk Fat Depression

283 Effect of mannan-oligosaccharides on the mucosal immune system of dairy calves. V. C. Quezada*, B. B. Babatunde, and T. L. Frankel, *La Trobe University, Bundoora, Victoria, Australia.*

Eighteen Friesian bull calves were used to evaluate the effects of mannan-oligosaccharides (MOS) on immunity, in particular its effects on the jejunal and ileal Peyer's patches (PP) of the mucosal immune system. Pairs of age matched calves were obtained from two dairy farms over a 6 month period and were fed colostrum during the first 24 hours and commercial milk replacer (CMR) thereafter. At 2-3 days of age they were divided into groups and fed CMR only (CON) or CMR

supplemented with 4 g of MOS/day. Blood samples were collected at 2-3 and 21 days of age. At 21 days of age 5-bromo-2'-deoxyuridine was administered intravenously to detect cell proliferation and calves were killed 1 hour later. Samples from the jejunal and ileal PP were removed for histological examination. Paraffin embedded sections were stained to measure morphology, cell proliferation and distribution of T and B cells in the villi, follicles, domes and interfollicular areas of the PP. Data was analysed with a t-test assuming equal variances. The decrease in serum IgG from days 2-3 to 21 was significantly less in MOS (-2.7 ± 0.8 mg/ml) than CON calves (-6.9 ± 1.4 mg/ml) ($P < 0.05$, $n = 8$). Height of ileal villi was greater in MOS (379.4 ± 25.1 μ m) compared with that of CON calves (313.6 ± 23.8 μ m) ($P < 0.05$, $n = 7$). Cell proliferation in jejunal PP follicles was lower in MOS (29.4 ± 2.7 cells/mm) than CON calves (38.9 ± 3.1 cells/mm) ($P < 0.05$, $n = 7$) but numbers of T cells in jejunal PP domes was greater (28.3 ± 2.5 /mm vs 21.6 ± 2.6 /mm, $n = 7$). In the ileum the only significant ($P < 0.05$) difference in PP between MOS and CON calves was B cell numbers in the interfollicular area (24.0 ± 5.7 /mm vs 44.6 ± 8.1 /mm, $n = 6$). Supplementing CMR of calves from 2-21 days of age with MOS had a beneficial effect on IgG levels. The effect of MOS on the mucosal immune system appeared, through reduced cell proliferation, to reduce its rate of development but the increased T cell numbers suggest an improvement in the defense functions of the PP.

Key Words: Calves, Mannan-Oligosaccharides, Peyer's Patches

284 Effect of anion supplementation to low potassium prepartum diets on macromineral status and performance of periparturient dairy cows. J. M. Ramos-Nieves*¹, B. J. Thering¹, P. W. Jardon², and T. R. Overton¹, ¹*Cornell University, Ithaca, NY*, ²*West Central[®], Ralston, IA.*

Holstein cows ($n=43$) entering second or greater lactation were used to determine whether further supplementation of anions to low potassium (K) prepartum diets would improve periparturient macromineral status and performance. Beginning 21 d before expected parturition, cows were fed either a control diet (1.29% K, +10 mEq/100 g; $n=21$) or an anionic diet (1.29% K, -15 mEq/100 g; $n=22$) with anions provided through a combination of sulfate from calcium sulfate (0.40% S total ration) and chloride (1.17% Cl total ration) from SoyChlor[®] 16-7 (West Central, Ralston, IA) in a completely randomized design. All cows were fed the same postpartum diet from parturition through 63 d postpartum. Feeding anions decreased overall urine pH (8.17 vs. 6.70, $P < 0.001$) during the prepartum period. Concentrations of plasma Ca tended to be increased in the two samples collected during the first 24 h postcalving (7.12 vs 7.99 mg/dL; $P < 0.07$) for cows fed the anionic diet prepartum. Overall concentrations of plasma P tended to be increased by feeding the anionic diet prepartum (5.05 vs. 5.36 mg/dL; $P < 0.09$); this effect was more pronounced during the immediate periparturient period (treatment by day, $P < 0.05$). Anionic supplementation did not affect incidence of clinical (< 5 mg/dL) and subclinical (5 - 8 mg/dL) hypocalcemia and clinical hypophosphatemia (< 2 mg/dL), but subclinical hypophosphatemia (2 - 4 mg/dL) tended ($P < 0.09$) to be decreased at 16 h postcalving and was decreased ($P < 0.02$) at d 2 postpartum for cows fed the anionic diet prepartum. Anionic supplementation decreased prepartum DMI (15.6 vs. 14.4 kg/d; $P < 0.01$), but did not affect postpartum DMI (22.4 vs. 23.0 kg/d; $P = 0.36$), milk yield (46.5 vs. 46.1 kg/d; $P = 0.88$), or content and yield of milk fat and true protein. Overall, anion supplementation to low K diets improved Ca status on the day after calving and P status

during the early postpartum period, but did not affect periparturient performance.

Key Words: Cation-Anion Difference, Mineral, Dairy Cow

285 Effects of an injectable chelated mineral supplement on dairy calf performance. J. R. Crenwelge^{*1}, T. D. Nennich², B. D. Lambert^{1,2}, N. M. Cherry², and E. R. Jordan³, ¹Tarleton State University, Stephenville, TX, ²Texas A&M University, Stephenville, ³Texas A&M University, Dallas.

In recent years, the use of trace mineral supplements to maximize growth or production of calves has gained the interest of researchers. Past research has found that trace mineral supplements may assist in enhancing immunity of the young, growing animals; but the role of these supplements on animal performance has varied. The overall objective of these studies was to determine the affect of supplementing a chelated injectable mineral product (MIN), containing 16 mg Cu/ml, 10 mg Mn/ml, 5 mg Se/ml, and 48 mg Zn/ml, on average daily gain (ADG), as well as blood and liver mineral concentration, of pre-weaned dairy calves. To meet the objectives, two separate studies were conducted. The first study (Study 1), a completely randomized design, included 123 Holstein heifers housed at a commercial dairy heifer operation. Treatment calves (n = 60) received an injection (1 ml) of MIN at one day of age. All calves were weighed at 3±2 and 42±3 days of age to determine ADG. Study 2 included ten Holstein bull calves, with treatment calves (n = 5) receiving an injection of MIN at 4 days of age. Blood samples and liver biopsies were collected 1 d previous to injection and 39 d after receiving the injection. In Study 1, calves were fed milk-replacer and calf starter; while in Study 2, calves were fed waste milk and calf starter. Average daily gains of calves receiving the mineral injection did not vary significantly (P > 0.05) from the control calves. The ADG for Control and MIN groups were 0.29 and 0.30 kg/d, and weaning weights were 49.0 and 50.1 kg, respectively. In Study 2, ADG for Control and MIN calves were not significantly different (P > 0.05) and averaged 0.49 and 0.50 kg/d, respectively. No significant treatment differences were observed in blood and liver mineral concentrations in Study 2. In summary, an injection of this chelated mineral product at birth did not significantly affect the ADG or blood and liver mineral concentrations of the dairy calves in these studies.

Key Words: Dairy, Calves, Chelated Minerals

286 Calcium and phosphorus balance and bone mobilization through lactation with varying dietary calcium concentrations. M. S. Taylor^{*1}, K. F. Knowlton¹, M. L. McGilliard¹, W. S. Swecker, Jr.¹, J. D. Ferguson², and Z. Wu², ¹Virginia Polytechnic Institute and State University, Blacksburg, ²University of Pennsylvania, Kennett Square.

The timing and extent of calcium (Ca) and phosphorus (P) mobilization from bone was evaluated through 20 wk of lactation to determine extent and timing of net resorption of bone mineral. Eighteen Holstein cows were blocked by parity, previous lactation milk yield, and calving date and randomly assigned to treatment. At calving cows began treatment diets of high Ca (1.1%, High), medium Ca (0.75%, Med), or low Ca (0.45%, low) concentration. Dietary P was 0.36% in all diets. Total collection of milk, urine, and feces was conducted 2 wk prior to

calving and in wk 2, 5, 8, 11, and 20 of lactation. Blood samples were collected at -14 and -10 d prior to calving and 0, 1, 3, 5, 10, 14, 21, 28, 35, 56, 70, 84, 98, and 140 d relative to calving. Blood samples were analyzed for Ca, P, Mg, and parathyroid hormone concentration. Serum concentrations of osteocalcin (OC), a marker of bone formation, and deoxypyridinoline, a marker of bone resorption, were measured to determine bone mobilization. Rib bone biopsies were conducted within 10 d of calving and during wk 11 and 20. This was a complete randomized block design with significance declared at P < 0.05. Calcium retention increased until wk 11 and then decreased. At wk 20 Ca balance was 66.7, 40.8, and 25.5 g/d for the High, Med, and Low diets, respectively. Phosphorus balance increased until wk 20 and then decreased. Feces Ca and P excretion were higher in multiparous than in primiparous cows (153.3 vs.128.9 g Ca/d; 58.0 vs.44.8 P g/d). Serum P was lower in multiparous than in primiparous cows (4.9 and 5.4 mg/dl). Serum Ca and P were not affected by treatment. Primiparous cows had higher serum OC concentrations than multiparous cows (68.3 vs.43.2 ng/ml). Week affected urine Ca and P excretion, feces Ca and P excretion, serum P, Mg, and OC concentration. Primiparous cows appear to be building more bone regardless of dietary treatment. This information may help refine dietary mineral recommendations and ultimately reduce their excretion.

Key Words: Calcium, Bone, Cows

287 Ovulation and CL development in mature cows given pLH or GnRH. T. O. Ree^{*1,2}, M. G. Colazo³, D. J. Ambrose^{3,2}, A. G. A. Lamont^{2,3}, J. P. Kastelic⁴, M. K. Dyck², R. J. Mapletoft⁵, and B. N. Ametaj², ¹Lakeland College, Vermilion, AB, Canada, ²University of Alberta, Edmonton, AB, Canada, ³Alberta Agriculture and Food, Edmonton, AB, Canada, ⁴Agriculture and Agri-food Canada, Lethbridge, AB, Canada, ⁵University of Saskatchewan, Saskatoon, SK, Canada.

The effects of porcine LH (pLH) versus GnRH on ovulatory response (OR) during diestrus and proestrus, and on corpus luteum (CL) development were examined. In Expt 1, nonlactating cows (24 dairy, 51 beef) were given a progesterone (P4; 1.9 g) insert (CIDR) for 10 d and 500 µg cloprostenol (Estrumate; PG) at CIDR removal. Estrus detection (estrus=D0) was done 3x/d for 5 d. On D5 follicles (>8mm) were ablated. On D12, cows received, in a complete random design, 25, 12.5 or 8 mg pLH (Lutropin-V), or 100 µg GnRH (Fertiline; n=18 or 19/group), at which time plasma P4 was 5.6±0.2 ng/mL (mean±SEM; no effect of group). Ovulation was determined by ultrasonography at 27, 48 and 72 h. The OR to 25 mg pLH (84%) or GnRH (72%) was higher (P<0.05) than to 8 mg pLH (32%); OR to 12.5 mg pLH tended to be lower (P<0.07; 58%) than to 25 mg pLH. In Expt 2, 68 cows were given PG 2x, 10 d apart. Estrus was detected as in Expt 1, and on D7, cows were given PG; 36 h later (P4=0.3±0.05 ng/mL; no effect of group), they were given pLH or GnRH as in Expt 1 (17 cows/group). Ovulation was determined at 27, 36, 48, and 72 h. In a subset of 17 cows, blood (for P4) and CL data were collected every 48 h for 14 d. Data were analyzed using Proc FREQ (chi-square) or MIXED (repeated measures) in SAS. All cows ovulated; interval from treatment to ovulation did not differ among groups, but was most variable (P<0.01) in cows given 8 mg pLH (28.1±0.7, 29.1±1.0, 33.5±2.8, and 29.1±1.0 h for 25, 12.5, or 8 mg pLH and GnRH, respectively). Although CL area (mm²) was larger (P<0.02) in cows given 25 mg pLH (301.5±22.6) or GnRH (305.2±22.6) than those given 8 mg pLH (222.1±22.7), it did not differ from 12.5 mg pLH (260.8±20.3). Mean

plasma P4 was higher ($P<0.04$) in cows given 25 mg pLH (3.5 ± 0.3) or GnRH (3.8 ± 0.3) than those given 8 mg pLH (2.4 ± 0.3); P4 was lower with 12.5 mg pLH (2.6 ± 0.3) than with GnRH ($P<0.02$), and tended ($P<0.07$) to be lower than with 25 mg pLH. In summary, cows given 25 mg pLH or 100 μ g GnRH had greater OR, CL area, and plasma P4 than those treated with 8 mg pLH; 12.5 mg pLH gave intermediate responses. A dose of 8 mg pLH was not consistently effective for synchronizing ovulation in mature cows.

Key Words: Porcine LH, GnRH, Ovulatory Response, CL Development

288 Early postpartum biochemical and management characteristics related to dairy cow removal. C. S. McConnel*, S. M. Hiibel, J. A. Kidd, A. E. Hill, and F. B. Garry, *Colorado State University, Fort Collins.*

A large proportion of dairy cow death is concentrated within the early postpartum period. Detection of discriminating characteristics within this period may be useful for defining cows at risk for premature removal from a herd. This nested case-control study explored the value of analyzing standard biochemistry and management characteristics of early postpartum cows in determining features related to removal (death and culling). Serum was collected from cows at 3 to 5 days postpartum on two intensive, Colorado dairies. Biochemistry panels for 47 cows that were removed from the dairies within 30 days of parturition (cases) were compared with herd cohorts surviving through 100 days in milk (controls), matched by calving date and lactation. Wilcoxon signed-rank test analysis demonstrated that levels of calcium, total protein, albumin, total bilirubin (TB), creatine kinase (CK), aspartate aminotransferase (AST), potassium, and anion gaps differed significantly between cases and controls ($P<0.05$). Associations between dairy cow removal and biochemical (19) and animal management characteristics (4) were evaluated univariately via a Chi-square test. Ten variables with $P<0.15$ were selected for ordinal logistic regression analysis. Stepwise backward and forward selection resulted in four significant variables ($P<0.1$): TB, CK, AST, and drench administration. The odds of removal were 3.3, 2.8, and 5.7 times higher among cows with elevated levels of TB, CK, and AST. The odds of removal were 5.7 times higher among cows that were assessed to need systemic treatment in the form of a drench. Appropriate fresh cow management may be guided through adjunctive biochemical analysis, highlighting areas that require modification in an effort to improve postpartum health, such as transition cow and calving management, post-partum cow-side evaluation, and therapy protocols. Similarly, fresh cow

assessment that recognizes discriminating systemic characteristics (as evidenced by the application of a drench in this study) may provide insight into useful modifications for individual sick cow management.

Key Words: Dairy, Removal, Biochemistry

289 Effect of dietary energy and metabolizable protein in lactating dairy cows. A. G. Rius*, M.L. McGilliard, and M.D. Hanigan, *Virginia Polytechnic Institute and State University, Blacksburg, VA, USA.*

The objective of the study was to test NRC (2001) model predictions of energy and protein requirements for the dairy cow. We hypothesized that energy and protein have additive effects on production as opposed to the independent limiting effects assumed by the NRC. A complete randomized design in a 2x2 factorial arrangement was used with high and low energy (1.55 [HE] or 1.44 [le] Mcal NEL/kg DM) and RUP (6.5 [HP] or 4.5% [lp] RUP). Multiparous Holstein ($n=32$) and Jersey by Holstein cross-bred ($n=8$) cows were randomly assigned to one of the four dietary treatments (HEHP, HElp, leHP, and lelp). A common diet (HEHP) was fed from d 1 through 21 followed by the respective treatment diets from d 22 to 40. Diets were formulated for CP contents of 17.0 or 14.4%, and a constant RDP content of 10.4% using the NRC model. Feed intake, milk yield and body weight were measured daily. Milk composition and BCS was measured on weeks 3 and 7. The Proc Mixed procedure of SAS was used to test the main effects and their interactions. Milk yields were not significantly affected by treatment however, there was a tendency ($P<0.09$) and the LSM were 35.0, 33.5, 31.3 and, 26.8 kg/d for HEHP, HElp, leHP, and lelp respectively (SEM=2.4). Although milk yields were significantly different ($P<0.05$) for the average of HElp and leHP vs lelp (5.6; SEM=2.8), there was no difference ($P<0.41$) between HEHP vs the average of HElp and leHP (2.5; SEM=3). Milk protein yields were significantly affected by treatment ($P<0.05$) with LSM of 1.09, 1.01, 0.92 and, 0.88 kg/d; (SEM=0.06). The DMI was significantly affected by treatment ($P<0.05$) with LSM of 25.2, 25.0, 25.6, and 23.1 kg/d (SEM=0.69) for HEHP, HElp, leHP, and lelp treatments, respectively. Non-fat milk solids yields tended to be lower ($P<0.08$) when dietary energy was limiting with LSM of 3.11, 2.97, 2.68, and 2.42 kg/d (SEM=0.04). The results indicate that lower RUP diets can be fed with high energy diets without compromising milk production whereas the combination of low energy and low RUP significantly depressed milk and milk protein yields.

Key Words: Cow, Energy, Protein

Nonruminant Nutrition: Poultry Nutrition - Gut Health and Early Nutrition

290 Maternal dietary conjugated linoleic acid causes embryonic mortality in the absence of vitelline membrane disruption. V. A. Leone*¹, R. Aydin², D. Stransky¹, and M. E. Cook¹, ¹*University of Wisconsin, Madison,* ²*Kahramanmaras Sutcu Imam University, Kahramanmaras, Turkey.*

We have previously shown that conjugated linoleic acid (CLA) fed to the laying hen in a low-fat diet reduced hatchability when eggs were stored at 4°Celsius (C) for 24 hours. Mineral analysis of yolk and albumin of eggs from CLA-fed hens stored at 4°C for 10 weeks showed a significant change in mineral composition of Ca²⁺, Mg²⁺,

Fe³⁺, Na⁺, Cl⁻ and Zn²⁺ compared to eggs from control-fed hens. This suggests cooling CLA-containing eggs causes disruption of the vitelline membrane, altering mineral balance, and reducing hatchability. An experiment was performed to determine if maternal CLA-feeding reduced hatchability in the absence of vitelline membrane disruption. Hens (24) were assigned to diets containing 1% Corn Oil (CO) or 1% CLA-80 (40% c9, t11 and 40% t10, c12 isomers), and were artificially inseminated once weekly beginning one week prior to the onset of experimental feeding. Eggs were collected daily and placed directly in the incubator. Production, fertility, and hatchability were recorded.