be an interaction between flaxseed and enzyme for ileal *Lactobacilli* concentrations; in absence of flaxseed, enzyme tended to increase ileal *Lactobacilli* concentrations compared to unsupplemented diets. Flaxseed diets reduced ileal anaerobic spore formers (2.6 vs. 3.1 log10 CFU/g; *P*0.05), lactic acid (1115 vs. 2354 µmol/L; *P*<0.01) and total organic acids (2220 vs. 4133 µmol/L; *P*<0.01) compared to non-flaxseed diets, however, ileal pH was not affected by dietary treatments. Enzyme supplementation tended to increase (*P*=0.10) ileal lactic acid and total organic acids compared to non-enzyme diets. Inclusion of enzyme blend in non-flaxseed diets resulted in reduced (*P*=0.06) ileal ammonia content. Flaxseed diets had a lower fecal pH (6.4 vs. 6.8; *P*<0.01) and tended to have lower fecal ammonia content (32.4 vs. 40.4 mg/L; *P*=0.07) than non-flaxseed diets. Results suggest that flaxseed suppressed ileal microbial numbers and organic acids concentration while enzyme supplementation increased organic acids and tended to increase *Lactobacilli* concentration.

Key Words: Flaxseed, Multi-carbohydrase enzyme, Ileal microbial activities

Physiology and Endocrinology: Reproductive Physiology

577 Effect of decreasing the interval from GnRH to PGF_{2A} and lengthening proestrus on reproductive performance in GnRH-CIDR-PGF_{2A} synchronization programs. L. A. Helser*[1], G. A. Bridges[1], D. E. Grum[1], M. L. Mussard[1], C. L. Gasser[2], D. M. Lantz[1], and M. L. Day[1], [1]*The Ohio State University*, *Columbus*, [2]*Southern Utah University*, *Cedar City*.

We have previously reported similar reproductive performance in GnRH-based programs when the interval from the initial GnRH injection to CIDR withdrawal and $PGF_{2\alpha}$ (PGF) was reduced from 7 to 5 d and two PGF doses were given 12 h apart. In order to determine the efficacy of a single PGF injection at CIDR withdrawal in a 5 d program, two experiments were conducted to compare reproductive performance between a 7 d (7SS) or 5 d (5SS) Select Synch + CIDR program. Lactating beef cows (n = 137; Expt 1) and yearling heifers (n = 159; Expt 2) received the 7SS or 5SS program with a single PGF. In cows, estrus response was greater (P < 0.05) in the 7SS (98.5%) than 5SS (89.9%) treatment. Treatment by status (cyclic, anestrous; P < 0.05) and age (2 yr-old, mature; P < 0.05) interactions implied that cyclic and mature cows benefited from the 7SS treatment, whereas the 5SS treatment favored the anestrous and 2 yr-old cows. In heifers (Expt 2), estrus response (92.5%) and pregnancy rates (59.7%) were similar between treatments. In a third experiment (n = 216; Expt 3), reproductive performance was compared for a 7 (7CO) and 5 (5CO) d CO-Synch + CIDR program in postpartum cows. Based upon results of Expt 1, two injections of PGF, 12 h apart, were used. In the 7CO treatment, timed AI, concurrent with GnRH, was performed at 60 h after the initial PGF, whereas this interval (proestrus) was extended to 72 h in the 5CO treatment. Timed-AI pregnancy rate was greater (P < 0.05) in the 5CO (80.0%) than 7CO (66.7%) treatment. In conclusion, it is questionable if decreasing the Select-Synch program to 5 d is advantageous in either cows or heifers if a single PGF is administered. Conversely, the modified CO-Synch + CIDR program increased timed-AI pregnancy rates in postpartum beef cows. The relative contributions of the shorter GnRH to PGF interval and the longer duration of proestrus to enhance fertility warrants further investigation.

Key Words: Beef cattle, CIDR, Synchronization

578 Effects of PES during in vitro culture of bovine embryos on pregnancy rates. M. Barcelo-Fimbres*, Z. Brink, and G. E. Seidel Jr, *Colorado State University*, *Fort Collins*.

Phenazine ethosulfate (PES) is an electron acceptor that oxidizes NADPH to NADP, which increases flux of glucose through the pentose phosphate pathway and decreases lipid accumulation in embryos (Reprod. Fert. Dev. 17:218). The aim of this experiment was to evaluate the effects of PES, days post estrus of the recipient at embryo transfer (synchrony), and embryo transfer grade (ET grade) on pregnancy rates. Oocytes were collected from slaughterhouse ovaries, matured, fertilized, and the resulting embryos cultured in vitro by standard procedures in a chemically defined medium (J. Anim. Sci. 78:152). Day 0 of culture was 18±2h after the onset of IVF. From 2.5 to 6.5 d of culture, half of the eight cell embryos were exposed to 0.3 µM PES, and the rest were controls. Day 7 PES or control blastocysts of good quality, were transferred nonsurgically (ET) to synchronized recipients. Only recipients in estrus 6 to 7.5 d earlier, with a detectable corpus luteum were used. The ET grades were: 1, good; 2, some cow movement; and 3, problematic (much cow movement and/or bloody transfer gun). Pregnancies were evaluated at 35 and 105 d post estrus by ultrasonography, by detecting an amniotic vesicle or live fetus. Use of PES during in vitro culture had no effect on pregnancy rates compared to control at 35 or 105 d (p>0.1) (Table 1). There was a significant effect of synchrony on pregnancy rates; (p<.05) (Table 1). ET grade 1 was superior to grades 2 and 3 (p<0.05) (Table 1). There was no interaction among treatments (p>0.1). Use of PES during in vitro culture did not affect pregnancy rates nor conceptus losses between d 35 and 105 of pregnancy, and 7 to 7.5 d recipients and grade1 ET were superior.

Table 1. Pregnancy rates after transfer of in vitro-produced embryos (%)

Pregnancy day	Treatment Control (n=35)	Treatment PES (n=38)	Synchrony 6-6.5 (n=38)	Synchrony 7-7.5 (n=35)	ET grade 1 (n=40)	ET grade 2 (n=20)	ET grade 3 (n=13)
35	37	40	29 [c]	49 [d]	53 [a]	30 [b]	8 [b]
105	26	24	15 [a]	34 [b]	38 [a]	15 [b]	0 [b]

[a,b,c,d] Values with different superscripts within treatments in the same row differ ([a,b] P<0.05; [c,d] P<0.06) by Fisher's exact test.

Key Words: *In vitro* produced embryos, Phenazine ethosulfate, Embryo transfer

579 Influence of a CIDR insert after a fixed-time AI on pregnancy rates and return to estrus of nonpregnant cows. K .N. Thielen[1], J. E. Larson*[1], B. J. Lovaas[2], D. J. Kesler[3], J. S. Stevenson[4], T. T. Marston[4], and G. C. Lamb[2], [1]*University of Minnesota*, *St. Paul*, [2]*University of Minnesota*, *Grand Rapids*, [3]*University of Illinois*, *Urbana*, [4]*Kansas State University*, *Manhattan*.

We determined whether resynchronization of an ovulatory estrus could be accomplished in nonpregnant cows without compromising

pregnancy in cows pregnant from a previous synchronized estrus or to those inseminated to the resynchronized estrus. Ovulation was synchronized in 937 suckled beef cows at 6 locations using a CO-Synch + CIDR protocol (a 100-µg injection of GnRH at the time of CIDR insertion, followed in 7 d by a 25-mg injection of $PGF_{2\alpha}$ at CIDR removal. At 60 h after $PGF_{2\alpha}$, cows received a fixed-time AI [TAI] plus a second injection of GnRH. After initial TAI cows were assigned randomly to 4 treatments; 1) untreated (control; n = 237); 2) CIDR inserted 5 d after TAI and removed 14 d after TAI (CIDR5-14; n = 234); 3) CIDR inserted 14 d after TAI and removed 21 d after TAI (CIDR14-21; n = 232); or 4) CIDR inserted 5 d after TAI and removed 14 d after TAI and then a new CIDR inserted at 14 d and removed 21 d after TAI (CIDR5-21; n = 234). After TAI, cows were observed twice daily until 25 d after TAI for estrus and inseminated according to the AM-PM rule. Pregnancy was determined at 29 and 59 d after TAI to determine conception to first- and second-service AI. Pregnancy rates to TAI were similar for control (55%), CIDR5-14 (54%), CIDR14-21 (48%), and CIDR5-21 (53%). A greater proportion of nonpregnant cows were resynchronized during a 2-d peak period in the CIDR5-21 (76/109, 70%) and CIDR14-21 (77/119, 65%) than controls (44/106, 42%) and CIDR5-14 (39/109, 36%) cows. Although overall pregnancy rates after second AI service were similar, conception rates of nonpregnant cows detected in estrus and inseminated seemed to be compromised (P < 0.05) in CIDR5-21 (41/76, 54%) and CIDR14-21 (71/77, 53%) compared with CIDR5-14 (28/39, 72%) cows, whereas controls (29/44, 66%) were intermediate. Insertion of a CIDR 5 d after a TAI did not compromise or enhance pregnancy rates to TAI, however, conception rates were compromised in nonpregnant cows that were resynchronized with a CIDR from d 5 or 14 until 21 d after TAI.

Key Words: Estrous synchronization, CIDR, Artificial insemination

580 Effects of estrous synchronization with a CIDR prior to the breeding season in bull-breeding herds on pregnancy rates. G. C. Lamb[1], C. R. Dahlen*[2], K. A. Vonnahme[3], G. R. Hansen[4], J. D. Arseneau[5], G. A. Perry[6], J. Clement[7], and J. D. Arthington[8], [1]*University of Minnesota*, *Grand Rapids*, [2]*University of Minnesota*, *Crookston*, [3]*North Dakota State University*, *Fargo*, [4]*University of Florida*, *Mariana*, [5]*Purdue University*, *West Lafayette, IN*, [6]*University of South Dakota*, *Brookings*, [7]*Clement Cow-Calf Consulting*, *Mandan, ND*, [8]*University of Florida*, *Ona*.

We determined whether insertion of a CIDR prior to the breeding season enhanced pregnancy rates and altered the date of conception in suckled beef cows mated naturally. One thousand seven hundred and fifty suckled beef cows from thirteen locations were randomly assigned to one of two treatments: 1) cows received a CIDR 7 d prior to the breeding season for 7 d (CIDR; n = 866); 2) cows received no treatment (Control; n = 884). On the first day of the breeding season bulls were introduced to the herd at a rate of 15 to 25 cows per yearling bull or 20 to 30 cows per mature bull. Cows were evaluated by transrectal ultrasonography for pregnancy at 56 d and 120 d after initiation of the breeding season to determine pregnancy status and date of conception. Overall pregnancy rates ranged from 59.3 to 98.9% among the 13 locations. Pregnancy rates within the first 30 days of the breeding season were similar between CIDR (64.4%) and Control (64.7%), and overall pregnancy rates were similar between CIDR (89.7%) and Control (89.6%). The average day of conception after initiation of the breeding season was shorter (P < 0.05) for CIDR (20.1 ± 0.8 d) compared to Control cows (23.2 ± 0.8 d). Of cows conceiving during the breeding season, more (P < 0.05) CIDR cows (43%) conceived during the first ten days of the breeding season than Control cows (35%). Body condition score and parity did not affect pregnancy rates or days to conception, whereas pregnancy rates and days to conception were affected (P < 0.01) by location and days postpartum. Days to conception were similar between treatments for cows calving within 50 d of initiation of the breeding season (28.2 ± 1.0 d), whereas cows calving earlier in the calving season treated with a CIDR (16.1 ± 0.9 d) conceived earlier (P < 0.05) than Control cows (20.7 ± 0.9 d). We concluded that insertion of a CIDR prior to the breeding season failed to increase overall pregnancy rates, but did influence the average day of conception in earlier calving cows.

Key Words: Estrous synchronization, CIDR, Beef cows

581 Prevalence and risk factors for postpartum anestrus in dairy cows. R. B. Walsh*[1], J. S. Walton[2], K. E. Leslie[1], and S. J. LeBlanc[1], [1]*University of Guelph*, *Ontario, Canada*, [2]*University of Guelph*, *Ontario, Canada*.

An observational study was conducted in 18 Ontario Dairy herds between January 2004 and April 2005. Milk samples were collected at 46 and 60 (± 7) DIM for progesterone (P4) analysis. Anestrus was defined as P4 < 1ng/ml in both skim milk samples. A total of 1341 animal had complete data for analysis with logistic regression and survival analysis controlling for the effects of clustering at the herd level. Overall, the prevalence of anestrus was 19.5% (95% confidence interval = 17.4 to 21.6%). The estimated herd specific prevalence varied from 5% to 44%. The prevalence of anestrus was not different among parities. Calving in the spring increased the odds of anestrus 1.7 times (p=0.02) relative to animals calving in the summer. In a representative subset of 1046 animals, milk b-hydroxybutyrate (BHBA) was measured once in each of the first two weeks after calving. Among these, 26% had subclinical ketosis (≥ 100 mmol/ml BHBA) in week 1 (range among herds, 5 to 82%) and 25% (range, 5 to 84%) in week 2 of lactation. Accounting for season and clustering at the herd level, cows with ketosis in week 1 were 1.5 times more likely (P=0.02) than non-ketotic animals to be classified as anestrus. Ketosis in the second week was not a significant risk factor. Other risk factors included displaced abomasum (OR 2.5; 95% CI 1.2 –5.0), twins (OR 2.1; 95% CI 1.1-3.9), and dystocia (OR 1.3, 95%CI 1.1 – 1.7). The risk of anestrus decreased as first DHI test projected 305ME increased to 9500 kg (OR= 0.9998/kg milk; p=0.03) while there was no change in the risk of anestrus associated with first projection > 9500 kg. Controlling for parity, season of calving and the impact of clustering at the farm level. Anovulatory cows were inseminated 3 days later than cycling animals (76 vs. 73; HR 0.8, p=0.03), and they were 40% less likely to conceive at first insemination (OR 0.6; 95% CI .42 - .83). Conception was delayed by 27 days (156 vs. 129) in anestrus cows. Anestrus animals were 1.4 times (95% CI 1.1 – 1.9) more likely to be culled than cycling cows at 60 DIM.

Key Words: Anestrus, Milk progesterone, Risk factors

582 Effect of feeding flax or linseed meal on progesterone clearance rate in ovariectomized ewes. C. W. Galbreath*, M. R. O'Neil, J. D. Kirsch, J. W. Schroeder, K. G. Odde, G. P. Lardy, and K. A. Vonnahme, *North Dakota State University*, *Fargo*.

Evidence suggests feeding flax can increase fertility in dairy cows, and women who consume linseed meal (LSM) had a longer luteal phase during their menstrual cycle. We hypothesized that flax or LSM

decreases the rate of progesterone (P4) metabolism in cyclic females. Our objective was to determine if flax or LSM decreases the clearance rate of P4 in ovariectomized ewes receiving a P4 releasing device (CIDR). Mature ewes (n = 21) were ovariectomized and fed a phytoestrogen (PE)-free diet based on beet pulp, for at least 30 d post-ovariectomy. Ewes were fed at maintenance based on metabolic body wt and were weighed every 2 wk throughout the feeding period. Thereafter, ewes were assigned randomly to control (PE-free; n = 7), flax (n = 7), or LSM (n = 7) diets. All diets were isocaloric and isonitrogenous. Body condition score (BCS; scale 1-5) was also measured at the onset and conclusion of the trial. On d 20 of feeding, a CIDR was inserted vaginally. Beginning on d 25, blood samples were obtained via jugular venipuncture. Samples were collected before CIDR removal (0 h) and at 0.5, 1, 2, 6, 12, and 24 h post-CIDR removal. Serum was assayed for P4. There was no difference in initial body wt (P = 0.97) or BCS (P = 0.47; 63.8 ± 1.7 kg or 3.3 ± 1.8, respectively) and no difference in final body wt (P = 0.89) or BCS (P = 0.56; 67.5 ± 1.9 kg or 3.4 ± 0.2, respectively). There was no time by diet interaction (P = 0.15) on P4 concentrations. From 0 to 24 h, P4 decreased (P < 0.01; 1.55 ± 0.09 to 0.27 ± 0.01 ng/ml). Ewes fed LSM had greater (P < 0.04) P4 across all sampling times compared to control- and flax-fed ewes (LSM = 0.65 ± 0.08; control = 0.57 ± 0.06; flax = 0.56 ± 0.05). Progesterone at 0 h was greater (P < 0.05) in LSM-fed ewes (1.82 ± 0.20 ng/ml) compared to flax- (1.39 ± 0.07 ng/ml) and control-fed (1.45 ± 0.13 ng/ml) ewes. Although clearance rates did not differ, LSM-fed ewes appeared to absorb a greater level of P4 from the CIDR. Feeding LSM to cyclic females may increase circulating P4 aiding in maintenance of pregnancy. Further investigation is warranted to determine the mechanism by which LSM influences P4 concentrations.

Key Words: Ewes, Flax, Progesterone

583 Digital infrared thermal imaging of the eye as correlated to rectal and vaginal temperature measurements in the ewe. S. T. Willard[1], M. C. Vinson[2], and R. W. Godfrey*[2], [1]*Mississippi State University*, *Mississippi State*, [2]*University of the Virgin Islands*, *St. Croix*.

The determination of body temperature using non-invasive means would decrease the need to handle animals to obtain such measures, and may have applications in non-domestic species where handling is impractical or impossible. To this end, we have investigated the use of digital infrared thermography (DITI) for quantifying maximum (MAX) eye temperature as a correlate to body temperature. The objective of this study was to correlate DITI of the eye with rectal (RT) and vaginal temperature (VT) in ewes. St. Croix White (STX; n = 10) and Dorper x STX (DX; n = 10) ewes were outfitted with intravaginal temperature loggers set to acquire a VT every 5 min. Data collected from the ewes at five sampling times (AM and PM daily) over a 48 hr period included RT and DITI of the right and left eye, orbital gland and facial hair coat (a background measure). Ambient temperature and humidity were recorded at the beginning and end of each sampling period. Analysis consisted of determining the correlation between DITI of the eye (MAX temperature) and VT and RT. Thermography of the eye revealed no difference in MAX temperature between the right and left eyes (P > 0.10). Right and left MAX eye temperatures were highly correlated (R = 0.88; P < 0.01). Right and left MAX eye temperatures were highly correlated to their respective corneal (R = 0.81 and 0.83; P < 0.01) and orbital gland (R = 0.76 and 0.77; P < 0.01) MAX temperatures. The gradient of temperatures obtained was (all differed at P < 0.01): VT (39.6 ± 0.04) > RT (39.5 ± 0.04) > MAX Eye (39.4 ± 0.06) > MAX Orbital gland (39.1 ± 0.09) > MAX Corneal (38.1 ± 0.07). As expected, RT and VT were highly correlated (R = 0.95; P < 0.01). Right and left eye MAX temperatures were significantly correlated (P < 0.01) with RT (R = 0.48 and 0.46, respectively) and VT (R = 0.50 and 0.44, respectively), and average eye MAX temperature (right eye MAX + left eye MAX / 2) was even more highly correlated (P < 0.01) with RT (R = 0.76) and VT (R = 0.77). These data suggest that thermography of eye (MAX temperature) may have application as a non-invasive method to measure body temperature in the ewe.

Key Words: Thermography, Ewe, Body temperature

584 The effects of immunization against LHRH using recombinant LHRH fusion protein OL on testicular development, ultrasonographic and histological appearance of the testis in buck kids. H. Ülker*[1], M. Küçük[1], A. Yilmaz[1], M. Yörük[1], L. Arslan[1], D. M. deAvila[2], and J. J. Reeves[2], [1]*Yüzüncü Yil University*, *Van, Turkey*, [2]*Washington State University*, *Pullman*.

The purpose of this study is to evaluate the effectiveness of recombinant ovalbumin-LHRH-7 (OL) fusion protein on reproductive traits in buck kids. Twenty buck kids at 18 wk of age were divided into control (C, n = 10) and immunization (I, n = 10) groups. Immunized animals received OL protein generated by recombinant DNA technology. Ultrasonographic and histological examination of the testes was performed. Animals were slaughtered at 44 wk of age. Semen and epididymis were evaluated for the presence of sperm cells. Testicular and accessory glands development and sperm production were suppressed in the immunized animals. Semineferous tubule diameters decreased, basal membrane of the tubule was thickened and hyalinized in immunized buck kids. Immunization affected ultrasonographic appearance of the testes drastically. While testes of control animals gained their normal ultrasonographic appearance as the age increased, immunized animals had uniform hypoechogenic testicular structure as observed at 18 wk of age until slaughter. In conclusion, these results indicate that recombinant ovalbumin-LHRH-7 fusion protein is effective in immunocastration in buck kids and has a potential to be used as an alternative to physical castration.

Key Words: Immunocastration, LHRH fusion protein, Buck kids

585 Using novel chimeric gonadotropins with single (FSH) or dual (LH and FSH) activity to induce follicle development in sheep. E. P. Lemke*[1], B. M. Adams[1], I. Boime[2], and T. E. Adams[1], [1]*University of California*, *Davis*, [2]*Washington University*, *St. Louis, MO*.

Follicle and corpus luteum (CL) development was examined in yearling lambs receiving novel chimeric gonadotropins with single (FSH) or dual (LH and FSH) activity. The gonadotropins were produced by CHO cells transfected with chimeric human genes that incorporate the coding regions of α, LHβ, and FSHβ subunits into single gene constructs (FSHβ-CTP-α [FCα] and FSHβ-CTP-LHβ-CTP-α [FCLCα], where CTP represents the sequence encoding the C-terminal portion of hCG). The constructs encode proteins with FSH (FCα) or dual (LH and FSH; FCLCα) activity. Estrous activity was synchronized using vaginal inserts (CIDRs). To negate the confounding effects of endogenous gonadotropins, animals were passively immunized against GnRH 1 d prior to CIDR removal. Sheep (bwt = 61 ± 1 kg; n = 6/treatment) received a single injection (iv) of vehicle or the FCα or FCLCα (5 IU/kg) at CIDR removal. Ovulation was induced 3 d thereafter using hCG (1000 IU, iv). Follicle development was assessed by monitoring serum concentrations of estradiol (E2). Ovaries were collected at

slaughter 11 d after CIDR removal. Basal serum concentrations of E2 were maintained in control animals receiving vehicle. Conversely, serum levels of E2 were significantly increased 1-2 d after administration of either the FCα or FCLCα and peak concentration of E2 were noted 7-9 d thereafter. Combined ovarian weight 11 d after CIDR removal was 1.3 ± 0.1 gm in control animals. Ovarian weight was increased ($P < 0.05$) in animals receiving the FCα (14.0 ± 1.4 gm) or FCLCα (10.5 ± 1.0 gm) chimeras. Most of the ovarian enlargement in chimera-treated animals was attributed to the formation of CLs. Although no CLs were noted in control animals, multiple CLs were evident in animals treated with FCα or FCLCα (9.5 ± 1.1 and 6.7 ± 1.2 CLs/sheep, respectively). Collectively, these observations demonstrate that both chimeric human gonadotropins induce profound follicle development in sheep. Supported by the USDA (NRI Grant 5-35203-16274).

Key Words: Ovulation, Sheep, Chimeric gonadotropin

586 Estrus and luteal activity of postpartum beef cows after treatment with estradiol. N. M. Long*, M. P. Davis, M. J. Prado-Cooper, I. Rubio, and R. P. Wettemann, *Oklahoma Agriculture Experiment Station*, *Stillwater*.

Multiparous Hereford x Angus postpartum cows (n = 49) were used to determine the effects of days post partum (25 or 50 d) and body condition score (BCS) at calving (M ≥ 5 or T < 5) on estrus and luteal activity after treatment with estradiol cypionate (ECP). Cows were fed 1.8 kg/d of a 40% CP supplement and ad libitum hay after calving. An estrus detection system (Heatwatch, DDX inc.) was used commencing at 10 d before treatment. Cows were treated (im) with 1 mg ECP or corn oil (C) at 25 or 50 d after calving. Progesterone was quantified in plasma samples obtained from cows twice weekly for 2 wk before treatment, daily for 7 d after treatment, and twice weekly until the second estrus or 90 d after calving. Ovaries were examined by ultrasonography at treatment and concentrations of progesterone in plasma were used to ascertain the absence of corpora lutea. Data were analyzed with the GLM procedure (SAS). Treatment of cows with ECP at 25 d after calving increased ($P < 0.001$) the incidence of estrus within 4 d after treatment in M (55 vs 11 %) and T (50 vs 0 %) cows. Treatment of T cows at 50 d after calving increased ($P < 0.001$) estrus within 4 d (50 vs 0 %). Only 10 % of M cows were anovulatory at 50 d after calving and response to ECP could not be evaluated. Treatment with ECP did not influence the onset of ovarian luteal activity (LA, progesterone > 1ng/ml for 1 d) within 10 d after treatment. Onset of LA after calving was 53 ± 16 d for M cows compared with 82 ± 18 d for thin cows ($P < 0.001$). Days to LA were greater ($P < 0.05$) for T and M cows treated with ECP at 25 d post partum (74 ±23 d) compared with C cows (53 ± 16 d), and ECP tended to increase ($P = 0.07$) days to LA for T cows treated at 50 d post partum. BCS of cows did not influence the incidence of estrus when cows were treated with ECP at 25 d after calving. Although ECP induced estrus in beef cows during the first 50 d after calving, normal luteal function was not initiated.

Key Words: Beef cows, Estradiol, Estrus

587 Timed AI conception rates after variations of the Ovsynch protocol in dairy cattle. M. A. Portaluppi, J. S. Stevenson*, and D. E. Tenhouse, *Kansas State University*, *Manhattan*.

Our objective was to determine fertility in dairy females after altering time of the second GnRH injection and AI relative to PGF2α (PGF). Replacement heifers (n = 87) and 614 lactating cows previously inseminated were diagnosed not pregnant at biweekly intervals to form 78 breeding clusters spanning 36 mo. At not-pregnant diagnosis (d 0), females received 100 µg of GnRH, were blocked by lactation number (0, 1, 2, and +), and received 25 mg of PGF 7 d later. Females in 2 treatments received GnRH 48 h (G48) after PGF injection and TAI at the time of the second GnRH injection (G48 + TAI48) or 24 h later (G48 + TAI72). Females in the third treatment received GnRH 72 h after PGF when inseminated (G72 + TAI72). Ovaries of females in 66 clusters were scanned at d 0 (first GnRH injection) and 7 d later (PGF injection). Ovarian structures were mapped and ovulation in response to the first GnRH injection was detected on d 7. When estrus was detected before scheduled TAI, females were inseminated; otherwise TAI conception of remaining females was based on timing of GnRH and AI. On d 7, new corpora lutea (CL) were detected in 43.2% of females. Incidence of ovulation increased ($P < 0.05$) with increasing lactation number and total number of follicles ≥ 8 mm, but decreased ($P < 0.001$) with increasing number of CL on d 0. Follicle diameters on d 0 did not differ between females that did (13.2 ± 0.2 mm) and did not ovulate (12.9 ± 0.2 mm). Follicle diameters increased ($P < 0.05$) with increasing lactation number, but decreased ($P < 0.01$) with increasing numbers of CL and follicles ≥ 8 mm on d 0. Conception rate was 26.5% in 98 females that showed estrus and were inseminated early. Although timed AI conception rates or pregnancy rates did not differ among treatments, the G48 + TAI72 treatment resulted in the best timed AI conception rates, especially for heifers and cows in their third or greater lactation. When number of CL on d 0 and ovulation incidence was included in the model with 603 females, conception rate tended ($P = 0.06$) to be greater for G48 + TAI72 (32.4%) than for G48 + TAI48 (22.8%), but not for G72 + TAI 72 (25.2%).

Table 1. Fertility Results

	G48 + TAI48	G48 + TAI72	G72 + TAI72
TAI conception rate[1], %	22.8 (226)	28.3 (232)	23.2 (234)
Pregnancy rate[2], %	22.0 (226)	21.8 (232)	16.7 (234)

[1]Excludes 98 females inseminated early before TAI. [2]Assumes early inseminated females would not have conceive if TAI.

Key Words: Ovsynch, Ovulation, Conception rate

588 Cis-9, trans-11 and trans-10, cis-12 conjugated linoleic acids reduce prostaglandin F2A production by bovine endometrial cells. N. R. Kendall[1], A. L. Lock[2], D. E. Bauman[2], B. K. Campbell[3], and G. E. Mann*[1], [1]*University of Nottingham*, *Sutton Bonington, Loughborough, UK*, [2]*Cornell University*, *Ithaca, NY*, [3]*University of Nottingham*, *Queens Medical Centre, UK*.

In cows, the establishment of pregnancy results from the embryo inhibiting the release of prostaglandin F2α (PGF2α) responsible for the demise of the corpus luteum. Failure of this inhibition contributes to high levels of early embryo loss. Any treatment that can reduce endogenous PGF2α secretion has the potential to increase pregnancy rates. Appropriate dietary modification can increase incorporation of conjugated linoleic acid (CLA) isomers into uterine tissues, though the effects of these CLA isomers on PGF2α secretion remain to be determined in the cow. The objective of this study was to examine the effects of cis-9, trans-11 and trans-10, cis-12 CLA on PGF2α production from cultured bovine uterine endometrial cells. Uterine endometrium was collected from cattle at a local slaughter house and endometrial cells collected by enzymatic dispersion and cultured (6

replicates) for 192h with or without addition of 50µM or 100µM of trans-10, cis-12 CLA or cis-9, trans-11 CLA. PGF2α was measured by radioimmunoassay in culture medium collected at 48 h intervals during culture. Culture with both isomers resulted in significant ($P < 0.001$) dose dependant ($P < 0.05$) inhibition of PGF2α secretion compared to control cultures. Treatment with trans-10, cis-12 CLA resulted in PGF2α concentrations at 48, 96, 144 and 192 h of culture of 78%, 55%, 38% and 23% of control values following treatment at 50µM and 43%, 28%, 21% and 19% of control values following treatment at 100µM. Treatment with cis-9, trans-11 CLA resulted in PGF2α concentration at 48, 96, 144 and 192 h of culture of 53%, 36%, 28% and 15% of control values following treatment at 50 µM and 21%, 12%, 7% and 8% of control values following treatment at 100 µM. The cis-9, trans-11 isomer consistently caused greater inhibition than the trans-10, cis-12 isomer. These results demonstrate that both CLA isomers significantly inhibited PGF2α secretion by uterine endometrial cells, and may have potential to improve the establishment of pregnancy in cows. Further work is required to determine whether these effects occur in vivo and to establish optimum doses.

Key Words: CLA, PGF2α, Endometrium

Ruminant Nutrition: Calves & Heifers – Dairy

589 Effects of dietary fish oil on immunocompetence of neonatal Jersey calves. M. A. Ballou* and E. J. DePeters, *University of California*, *Davis*.

Fifty-one Jersey, bull calves (4±1 day old) were completely randomized to one of three treatments to evaluate the effects of dietary fish oil on immunocompetence. Treatments differed only in the fatty acid (FA) composition of the milk replacer, which was altered by supplementing 2% of the DM with FA from various lipids. Treatments included a control with a 3:1 blend of corn and canola oils, a 1:1 mix of fish oil and the control blend, and fish oil only. Body weight, height at withers, and length between withers and pins were measured weekly. Fecal and respiratory scores were recorded multiple times daily. Peripheral blood samples were collected on d 0, 7, 14, 21, and 42; the FA composition of plasma and peripheral blood mononuclear cell (PBMC) phospholipids was measured. Immunocompetence of calves was evaluated by the ability of neutrophils and monocytes to phagocytose *E. coli* and produce an oxidative burst, the change in ear thickness following an intradermal injection of phytohemagglutinin-P (PHA–P), and the primary and secondary humoral responses to ovalbumin (OVA). Adding fish oil to milk replacer significantly altered the omega-3, omega-6, and their FA ratios in both plasma and PBMC phospholipids and the response was dose and time dependent. Production and health parameters were unaffected by treatments. There were no significant treatment or treatment*time effects on phagocytosis; however there was a significant bell–shaped response on the percent of neutrophils producing an oxidative burst (49.9, 62.8, and 50.8 %; P=0.05). Fish oil did not affect the change in ear thickness in response to PHA-P. There was also no treatment effect on the primary IgG humoral response to OVA, but there was a significant bell-shaped treatment effect on the secondary IgG response (1.06, 0.79, and 1.03 OD; P=0.01). There was no significant IgM response in any treatment following either the primary or secondary OVA vaccination. Adding fish oil to milk replacer altered various functional immune responses and the effect was bell-shaped. However, no differences in the production or health of these calves were evident.

Key Words: Calves, Fish oil, Health

590 Modifying the acute phase response of neonatal Jersey calves by supplementing milk replacer with fish oil. M. A. Ballou* and E. J. DePeters, *University of California*, *Davis*.

Fifty-one Jersey, bull calves (4±1 day old) were completely randomized to one of three treatments to evaluate the effects of dietary fish oil on the acute phase response. Treatments differed only in the fatty acid composition of the milk replacer, which was altered by supplementing 2% of the dry matter (DM) with fatty acids from various lipids. Treatments included a control with a 3:1 blend of corn and canola oils, a 1:1 mix of fish oil and the control blend, and fish oil only. On d 23 each calf was injected subcutaneously with 4 µg/kg BW of *Salmonella typhimurium* endotoxin. Clinical, hematological, and biochemical parameters were measured at 0, 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 18, 24, and 72 h. Endotoxin caused a dramatic rise in respiratory rate; feeding fish oil significantly attenuated the increase (41.4, 35.1, 34.5 breaths/min; P=0.01). Heart rate and rectal temperature were not affected by treatment. Feeding fish oil attenuated the change in serum iron concentration over time (P=0.02). There was no effect of treatment on serum glucose concentration. Endotoxin also caused acute increases in blood urea nitrogen (BUN) and non-esterified fatty acids (NEFA); there were significant linear effects of fish oil on both BUN (8.34, 8.16, and 7.70 mg/dl; P=.02) and NEFA (0.689, 0.608, 0.524 mEq/L; P=0.02). Serum triglycerides (TG) were elevated beginning at 12 h after the endotoxin challenge and returned to baseline values within 72 h. Fish oil suppressed the rise in TG during this period, and the effect was linear (52.7, 42.8, and 33.4 mg/dl; P=0.01). There was no treatment effect on serum aspartamine aminotransferase activity, but there was a tendency (P=0.10) for fish oil to increase serum lactate dehydrogenase activity. Adding fish oil to milk replacer attenuates many aspects of the acute phase response, and the effect is linear in the range of 1 to 2% of the DM as fatty acids from fish oil. Adding fish oil might provide a better balance between a necessary versus an excessive acute phase response.

Key Words: Calves, Fish oil, Inflammation

591 Sodium zeolite A supplementation to dairy calves. K. Turner*[1], B. Nielsen[2], C. O'Connor[2], D. Rosenstein[2], H. Schott[2], C. Womack[2], F. Nielsen[3], and M. Orth[2], [1]*The University of Georgia*, *Athens*, [2]*Michigan State University*, *East Lansing*, [3]*Grand Forks Human Nutrition Research Center*, *Grand Forks, ND*.

Sodium zeolite A (SZA), an aluminosilicate, has been used in animal studies, but alterations in mineral metabolism and tissue composition have not been fully investigated. The objective of this study was to determine the effects of SZA on mineral metabolism and tissue mineral composition in bull calves. At three days of age, twenty calves were placed according to birth order into one of two groups: SS, receiving 0.05% BW SZA daily in milk replacer and CO, receiving only milk replacer. Blood samples were collected on d 0, 30, and 60 for mineral analysis (Si, Al, Ca, Cu, Fe, Mg, P, Zn). Total collections of feces and urine were performed on d 30 for mineral metabolism. Calves were euthanized on d 60 and multiple tissues were harvested for mineral