Physiology and Endocrinology: Dairy Cow Synchronization and Fertility

161 Alternative protocols to presynchronize estrous cycles in dairy cattle before a timed AI program. J. S. Stevenson*, *Kansas State University*, *Manhattan*.

Our objective was to test potential presynchronization protocols applied before a timed AI (TAI) protocol to improve the percentage of cows having a functional CL, high concentrations of progesterone, and successful ovulation after both GnRH injections. At calving, cows were assigned randomly to receive either of 5 presynchronization treatments. Three Presynch protocols were tested in which 2 injections of $PGF_{2\alpha}$ (PGF) were administered 14 d apart, with either 14 d (PRE14; n = 122), 12 d (PRE12; n = 123), or 10 d (PRE10; n = 151) intervening before initiating a TAI protocol. Two treatments were a progesterone (P4) insert (CIDR) for 7 d plus PGF at insert removal. Insert removal occurred either 10 d (CIDR10; n = 157) or 3 d (CIDR3; n = 117) before initiating a TAI protocol. The TAI protocol was a standard Cosynch protocol (GnRH 7 d before and 72 h after PGF with TAI at 72 h after PGF). Cosynch was the control (n = 157) with cows starting this protocol at random stages of the estrous cycle. From a subset of cows (49 to 51 cows per treatment), blood samples were collected at d −28, −14, 0 (onset of TAI protocol), 7, 9, 14, and 21 d. Ovarian scans occurred on d 0, 7, 9, and 14. Diameter of follicles and CL were measured at each exam and ovulation response to both GnRH injections was determined at d 7 and 14. Ovulatory incidence after the first and second GnRH injections varied but did not differ among treatments. Concentrations of P4 were greater ($P \leq 0.05$) before the first GnRH injection in all treatments compared with CIDR3. Before the second GnRH injection, P4 was greater ($P \leq 0.05$) in the CIDR3 treatment than in all other treatments. Luteal regression and synchronization rate (successful luteolysis and ovulation after second GnRH injection) did not differ among treatments. Pregnancy rate per AI (PR/AI) at 60 d post timed AI was less ($P \leq 0.05$) in CIDR3 cows compared with all other treatments. It was concluded that none of the Presynch treatments improved key responses (ovulation, luteolysis, and synchronization rate) known to improve PR/AI compared with a standard Cosynch protocol without presynchronization.

Table 1. Key responses of treated cows during the timed AI ovulation synchronization protocol

Treatment	n	First GnRH Ovulation, %	P4 ng/mL	2nd GnRH Ovulation, %	P4 ng/mL	Luteal regression, %	Synch rate, %	n	60-d PR/AI
PRE14	50	62.0	3.9[a]	86.0	1.0[a]	93.9	86.0	122	28.7
PRE12	51	60.8	3.7[a]	88.2	0.5[c]	100	88.2	123	33.6
PRE10	49	67.3	2.4[b]	79.6	0.7[ac]	95.7	79.6	151	30.5
CIDR10	51	64.7	3.0[ab]	86.3	0.6[ac]	100	86.3	157	30.3
CIDR3	51	47.1	0.9[c]	90.2	1.5[b]	83.0	86.3	117	13.9
Cosynch	50	62.0	3.7[a]	78.0	0.9[ac]	93.0	76.0	157	30.6

[a-c] Means differ ($P \leq 0.05$).

Key Words: ovulation, luteolysis, timed AI

162 Effects of presynchronizations with GnRH/$PGF_{2\alpha}$ vs. progesterone before Ovsynch in noncyclic dairy cows. G. Yilmazbas-Mecitoglu*[1], A. Keskin[1], A. Gumen[1], E. Karakaya[1], R. Darici[2], and H. Okut[3], [1]*University of Uludag*, *Bursa, Turkey*, [2]*Tarfas Co.*, *Bursa, Turkey*, [3]*University of Yuzuncu Yil*, *Van, Turkey*.

The aim of this study was to compare efficiency of GnRH/PGF2α vs. progesterone (P4) presynchronizations (Presynch) on overall Ovsynch (OVS) outcome in noncyclic dairy cows. Ultrasonographic examinations were done with 7 d interval to determine cyclicity. Noncyclic cows (n = 157; no CL in each ovary at both examinations) were randomly divided into 3 groups. In GP group (n = 61), PGF2α was administrated 7 d after GnRH injection and OVS was started 11 d after PGF2α administration (GnRH-7d-PGF2α-11d-OVS). In PR group (n = 54), cows were treated for 7 d with an intravaginal P4 implant (PRID; without oestradiol capsule) then 11 d after removing the implant OVS was started (7d PRID-11d-OVS). Control group (n = 42) did not receive any presynch protocol and OVS was started at the same time with other groups. Spontaneous recovery in control and presynch rates in GP and PR groups (cows became cyclic at the beginning OVS) were found to be different ($P < 0.004$) between control (47.6%; 20/42) and presynch groups (72.1%; 44/61 in GP and 77.8%; 42/54 in PR groups). Response to first GnRH of OVS did not differ among groups (73.8%; 31/42 in control, 73.8%; 45/61 in GP and 70.4%; 38/54 in PR groups). Interestingly, response to first GnRH of OVS was higher ($P < 0.0007$) in cows that did not respond to presynch than cows responded in GP and PR groups (96.5%; 28/29 and 47.8%; 55/86). Synchronization rates were similar among groups (78.6%; 33/42 in control, 88.5%; 54/61 in GP and 85.2%; 56/54 in PR). Conception rate (31 d) did not differ among groups (42.9%; 18/42 in control, 47.5%; 29/61 in GP and 46.3%; 25/54 in PR). Embryonic loss (between 31 and 62 d) did not differ among groups (4 cows in control, 1 cow in GP and 1 cow in PR). However, conception rate (31 d) was greater ($P < 0.001$) in cows that responded to presynch than those that did not respond in GP and PR groups (55.8%; 48/86 and 20.7%; 6/29). Although conception rate did not differ among groups, cows that responded to presynch had higher conception rate than cows that did not respond.

Key Words: Ovsynch, presynchronization, noncyclic dairy cows

163 Comparison of estrus and ovulation synchronization protocols: effects on ovarian follicular dynamics, corpus luteum growth, and circulating steroid concentrations in lactating dairy cows. M. M. Herlihy*[1,2], M. A. Crowe[2], M. G. Diskin[3], and S. T. Butler[1], [1]*Teagasc Moorepark DPRC*, *Cork, Ireland*, [2]*University College Dublin*, *Ireland*, [3]*Teagasc Athenry APRC*, *Galway, Ireland*.

This study compared estrus and ovulation synchronization protocols at first service in lactating dairy cows (n = 61) > 42 d postpartum. At 10 d before AI animals were randomly assigned to: 1) d −10 GnRH (10 µg i.m. Buserelin) and CIDR insert (1.38 g P4); d −3 $PGF_{2\alpha}$ (25 mg i.m. dinoprost); d −2 CIDR out and AI at observed estrus (CIDR_OBS); 2) same as CIDR_OBS, but GnRH 36h after CIDR out and TAI (timed AI) 18h later (CIDR_TAI) or 3) same as CIDR_TAI, but no CIDR (OVSYNCH). Transrectal ultrasound was used to assess follicle size before ovulation and on d8 and d15 after AI to measure the corpus luteum (CL). Blood samples were collected to determine concentrations of estradiol (d −3, d −2, d −1, d0) and progesterone (d −2, d −1, d0, d1, d4, d6, d8, d11, d15). P4 concentrations immediately before CIDR removal were greater ($P < 0.001$) for CIDR_OBS and CIDR_TAI compared with OVSYNCH (1.78, 1.59 and 0.62 ng/mL; CIDR_OBS, CIDR_TAI and OVSYNCH, respectively). At the time of the second GnRH, E2 was higher ($P < 0.06$) for CIDR_OBS and CIDR_TAI compared with OVSYNCH (2.78, 2.57 and 1.69 pg/mL). E2 concentrations at the time of expected AI were higher ($P < 0.001$) for CIDR_OBS compared with CIDR_TAI and OVSYNCH (1.59, 0.36 and 0.33 pg/ml). Diameter of the DF before ovulation was greater ($P < 0.05$) for CIDR_OBS compared with OVSYNCH (18.3 vs. 16.1 mm).

An interaction ($P < 0.05$) was observed for P4 concentrations, where P4 tended to be lower in CIDR_OBS on d4 and 6, but greater on d15 compared with CIDR_TAI and OVSYNCH. CL diameter and volume was not affected by treatment on d8, but both CL volume (9991, 7808, and 8186 mm^3; $P = 0.1$) and diameter (27.0, 23.9, and 24.0; $P = 0.08$) on d15 tended to be affected by treatment (CIDR_OBS, CIDR_TAI and OVSYNCH, respectively). Both P4 supplementation and GnRH on the day before TAI impact ovulatory follicle size, E2 concentrations, and postovulatory P4 profiles.

Key Words: Ovsynch, CIDR, dairy cow

164 Effects of reducing interval from GnRH to $PGF_{2\alpha}$ in Ovsynch protocol on pregnancy rate in cyclic lactating dairy cows.

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Ovsynch protocol was designed to synchronize ovulation, thereby allowing timed artificial insemination (TAI) of all cows without detection of estrus and Ovsynch has been proven to be an acceptable alternative to estrus detection programs in large dairy farms. The aims of this study were 1) to ovulate one day younger follicle by decreasing interval between first GnRH to PGF2α of Ovsynch 2) to compare pregnancy rates in Ovsynch vs. Modified Ovsynch (interval between first GnRH to PGF2α decreased to 6 d) in cycling lactating dairy cows. The day of first GnRH of Ovsynch was designated d 0. The ovaries of cows were examined by ultrasonography twice, one week apart, to determine cyclic cows (had Corpus Luteum on either ovary) from −7 to 0 d. Cyclic cows (n = 859) were divided into 2 groups: OVS group (n = 421) received the Ovsynch protocol (GnRH-7d-PGF2α-56h-GnRH-18h-AI) and cows in MOV group (n = 438) had a Modified Ovsynch (MOV) protocol (GnRH-6d-PGF2α-56h-GnRH-18h-AI). Ultrasonography were performed at the time of first GnRH and PGF2α administration to detect first ovulatory response, at the time of AI to determine maximal follicle size and 7 d after AI to determine second ovulatory response. Pregnancy diagnosis was performed 30 and 60 d post insemination by ultrasonography. Response to first GnRH of Ovsynch was similar between OVS (54.2%, 228/421) and MOV (55.3%, 242/438) groups. Synchronization rate (ovulatory response to second GnRH of Ovsynch) was higher ($P < 0.004$) in MOV (90.4%, 396/438) than OVS (83.8%, 353/421). Pregnancy rate was similar in OVS (42.5%, 179/421) and MOV cows (37.9%, 166/438). Follicle size at the time of AI was greater ($P < 0.0001$) in OVS (16.01 ± 0.1 mm) than MOV (15.3 ± 0.1 mm). Thus, Modified Ovsynch protocol not only increased synchronization rate but also decreased follicle size. Unexpectedly, this protocol did not improve pregnancy rate in cycling dairy cows.

Key Words: synchronization, Ovsynch, dairy cows

165 Presynchronization with hCG 7 d before initiation of Resynch improves fertility similar to a double–Ovsynch Resynch protocol in lactating dairy cows.

J. O. Giordano*, J. N. Guenther, M. S. Ares, M. C. Wiltbank, and P. M. Fricke, *University of Wisconsin*, *Madison*.

Our objective was to compare a Double-Ovsynch protocol for resynchronization of ovulation (Resynch) to a novel Resynch protocol that reduces the interbreeding interval (IBI) to 35 d. Lactating Holstein cows on a commercial dairy received a Resynch protocol using GnRH and cloprostenol (PGF) as follows: (d 0, 200 µg GnRH; d 7, 750 µg PGF; 56 h, 100 µg GnRH; 16 h, TAI). Cows were blocked by parity and were randomly assigned to one of 3 treatments to receive: 1) Resynch–25 (C), Resynch protocol initiated 25 d after a prior TAI (n = 418, IBI = 35 d). 2) HGPG, hCG (2000 IU Chorulon on Day 18 after TAI) 7 d before Resynch–25 (n = 450, IBI = 35d); 3) Double–Ovsynch (DO), a modified Ovsynch protocol (d 0, 100 µg GnRH; d 7, 500 µg PGF; d 10, 100 µg GnRH) which was initiated 22 d after a prior TAI followed 7d later by Resynch–39 (DO, n = 405, IBI = 49 d). Pregnancy was diagnosed 29 d after Resynch TAI using ultrasound and 53 d after Resynch TAI using palpation to determine pregnancies per AI (P/AI). Based on logistical regression analysis, P/AI 29 d after TAI was not affected ($P = 0.42$) by parity, and HGPG and DO cows had more ($P < 0.01$) P/AI than C cows [HGPG = 37.3% (168/282; DO = 35.8% (145/260); C = 28.0% (117/301]. When analyzed separately, P/AI did not differ ($P = 0.64$) between HGPG and DO cows. Pregnancy loss from 29 to 53 d after TAI was not affected ($P = 0.88$) by lactation and did not differ ($P = 0.34$) among treatments [HGPG = 11.0% (18/145); DO = 6.3% (9/135); OV = 8.6% (10/106)]. At 53 d after TAI, HGPG and DO cows continued to have more ($P = 0.02$) P/AI than C cows [HGPG = 32.6% (145/300); DO = 33.4% (135/269); OV = 25.4% (106/311)], and P/AI did not differ ($P = 0.80$) for HGPG and DO cows. We conclude that the HGPG Resynch protocol increased fertility of resynchronized cows similar to that of a Double-Ovsynch Resynch protocol while reducing the interbreeding interval by 14 d.
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Key Words: Double-Ovsynch, hCG, resynchronization

166 Comparison of responses to Ovsynch for Holstein–Friesian and Swedish–Red cows.

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The Ovsynch protocol was designed to synchronize ovulation, thereby allowing timed artificial insemination (TAI) of all cows without detection of estrus; however, the effectiveness of Ovsynch in different breeds of dairy cows has not been previously compared. The aim of this study was to compare the response to Ovsynch in cycling lactating dairy cows of 2 different breeds (Holstein–Friesian [HF] vs. Swedish–Red [SR]). A total of 495 cyclic cows (n = 347 HF, n = 148 SR) were housed together and treated with Ovsynch (GnRH–7d–PGF2α–56h–GnRH–18h–TAI). Cows were not presynchronized before the Ovsynch. Milk production was different ($P < 0.001$) between breeds (40.3 ± 0.5 in HF and 34.9 ± 0.7 in SR). Ovulatory responses, synchronization rate, maximal follicle size at the time of AI, and percentage pregnant per AI (%P/AI at 31 and 62 d after AI) were compared between breeds. Ultrasonography was performed during Ovsynch at first GnRH, PGF2α, at time of AI, and 7 d after AI. Ovulatory response and synchronization rate were similar in HF vs. SR cows (60.2% vs. 62.1%; 88.4% vs. 88.5%, respectively). Cows that ovulated to the first GnRH of Ovsynch had reduced ($P = 0.02$) follicle size at time of AI (15.9 ± 0.12 vs. 16.4 ± 0.16 mm). Maximal follicle size at time of AI was greater ($P < 0.004$) for HF (16.4 ± 2.2 mm) than SR (15.5 ± 2.3 mm) cows. The %P/AI tended to be greater for SR than HF cows at the 31 d pregnancy diagnosis (58.1% vs. 51.1%; $P = 0.16$) and was greater in SR than HF cows at the 62 d pregnancy diagnosis (56.1% vs. 46.1%; $P = 0.04$). Embryonic loss was greater ($P = 0.04$) in HF (10.1%) than SR (3.4%) cows between 31 and 62 d of pregnancy. Hot season significantly decreased %P/AI in HF cows ($P < 0.001$), but not in SR cows. Thus, although the GnRH treatments of Ovsynch were equally effective in SR and HF cows, there was better fertility following Ovsynch in SR than HF cows, probably due to the decrease in fertility during the hot season in HF but not SR cows.

Key Words: Ovsynch, breed, reproduction

167 Manipulation of protein feed levels during Ovsynch TAI and early embryonic development to improve fertility in lactating dairy cows. M. B. Gordon* and R. Rajamahendran, *University of British Columbia*, *Vancouver, BC, Canada*.

This study compared the effects of feeding 2 levels of crude protein (CP, 16% vs. 18.5%) on fertility and milk production in lactating dairy cows subjected to a timed insemination. To achieve its milk yield potential the modern dairy cow is dependent on a high intake of dietary nitrogen. However, excessive protein intake, particularly rumen degradable protein is associated with reductions in fertility, plasma progesterone concentrations, and exacerbation of negative energy balance. Although Ovsynch timed artificial insemination (TAI) program allows for the control of ovarian follicular and corpus luteum development without the need for estrus detection, pregnancy rates are still far from the satisfactory rates achieved over 30 years ago. Lactating Holstein dairy cows (n = 180) were synchronized for first service breeding using Ovsynch TAI (2 treatments of GnRH, 9 d apart with a treatment of PGF2α 48 h before the second GnRH treatment, and TAI 16–18 h later). Cows were blocked for similar parity and DIM. Group 1 (control) was fed a diet consisting of 18.5% CP (High). Group 2 was fed a diet consisting of 16% CP (Low), which began 7 d before initiation of Ovsynch and continued until pregnancy diagnosis at 32 d. Groups were housed together with access to feed via Insentec electronic feed intake bins. Pregnancy per AI was 24.4% and 34.1% ($P = 0.08$) for High and Low groups, respectively. Parity had an affect on pregnancy per AI. A lower average milk production during the 49 d of treatment was observed in multiparous cows in the Low group (47.8 ± 1.05 kg) compared with the High group (50.2 ± 1.03 kg, $P = 0.11$). However, no differences in milk production were observed in the 3 weeks preceding and following treatment. Lower milk urea nitrogen was observed on d 7 and d28 in the low group ($P = 0.02$). No differences in progesterone concentrations were observed between treatments. In summary, feeding a diet with a slightly lower protein content increased pregnancy to TAI, with minimal effects on milk production.

Key Words: Ovsynch, fertility, crude protein

168 Reproductive tract differences in repeat-breeder cows. R. A. Cushman*, J. R. Miles, and S. E. Echternkamp, *U.S. Meat Animal Research Center*, *Clay Center, NE*.

The objective of the study was to evaluate the reproductive tracts of repeat-breeder cows that failed to calve in 2 consecutive years compared with cows that calved regularly. The hypothesis was that repeat-breeder cows would have smaller reproductive tracts and fewer antral follicles. Beef cows ranging from 3 to 13 years of age were classified as repeat-breeder (n = 37) or control (n = 34) cows. Cows were examined twice daily for behavioral estrus and artificially inseminated 12 h after observed estrus. Three to 8 d after estrus, cows were slaughtered, reproductive tracts were recovered and transported to the laboratory. All visible antral follicles were counted, ovaries were measured and weighed, and the diameter of the endometrium was measured in a subset of cows (n = 44) at the thickest point on the horn ipsilateral to the corpus luteum. The uterus was flushed and embryos were collected. Granulosa cells from small antral follicles (<5 mm) were pooled and frozen for real-time RT-PCR analysis. Reproductive traits were analyzed using the GLM or GLIMMIX procedure of SAS with group as the independent variable and day and age as co-variates. Repeat-breeder cows had smaller ovaries ($P \leq 0.006$) when corrected for day ($P > 0.13$) and age ($P > 0.17$), and fewer follicles ($P = 0.02$) when corrected for day ($P = 0.0009$) and age ($P = 0.42$). There was no difference in endometrial diameter ($P = 0.46$), or granulosa cell anti-Mullerian hormone ($P = 0.87$) or Pentraxin 3 ($P = 0.63$) mRNA levels between repeat-breeder and control cows when corrected for day ($P > 0.0.16$) and age ($P > 0.44$), but embryo recovery rate tended to be greater in control cows ($P = 0.06$). Regression analysis identified a positive relationship of antral follicle count to endometrial diameter ($P = 0.009$) and ovarian size ($P < 0.0001$). Fewer ovarian antral follicles in repeat-breeder cows may contribute to reduced fertility. The positive relationship between antral follicle count and endometrial diameter suggests that the number of ovarian follicles may influence proliferation of the endometrium in the early luteal phase of the cow.

Key Words: cow, reproductive tract, fertility

169 The effect of supplementation with conjugated linoleic acid on the reproductive performance of lactating dairy cows. I. A. Hutchinson*1,2, P. Lonergan[2], A. C. O. Evans[2], R. J. Dewhurst[3], and S. T. Butler[1], [1]*Teagasc*, *Moorepark DPRC, Cork, Ireland*, [2]*University College Dublin*, *Dublin, Ireland*, [3]*Teagasc*, *Grange, Meath, Ireland*.

Spring-calving dairy cows (n = 389) on a single pasture-based commercial dairy farm were randomly assigned to one of 2 dietary treatments (lipid encapsulated conjugated linoleic acid (Lutrell, BASF, Germany; CLA, n = 192) or No supplement (Control, n = 197)). The CLA cows received 50 g/day of a lipid supplement containing 5 g of both trans-10, cis-12 and cis-9, trans-11 CLA from 0 to 60 d in milk. Milk samples were collected 3 times per week, and each sample was analyzed for progesterone using a competitive ELISA test to determine interval to first ovulation. Milk yield and composition were measured fortnightly. Breeding commenced on a fixed calendar mating start date (Apr 8 2009), and continued for 16 weeks. Trans-rectal ultrasonography was carried out at 30–36 d and 60–66 d post AI to diagnose pregnancy. Milk yield, milk composition, and interval to first ovulation data were analyzed using mixed model analysis. All other reproductive data was analyzed using Chi-squared analysis. A reduction in milk fat concentration (36.9 vs. 30.7 g/kg; $P < 0.001$) and yield (0.91 vs. 0.84 kg/day; $P = 0.031$) was observed in CLA cows during supplementation. Milk yield was increased during CLA supplementation (24.7 vs. 27.2; $P = 0.003$). There was no effect of CLA on interval to first ovulation postpartum (40.2 vs. 44.4 d, CLA and control, respectively), conception rate to first service (35.1 vs. 37.0%), embryo mortality (14.3% vs. 21.4%) or 6-week in-calf rate (43.6% vs. 37.0%, all $P > 0.1$). In conclusion, supplementing dairy cows with CLA reduced milk fat synthesis but did not improve measures of reproductive performance, perhaps indicating energy availability was not the most limiting factor influencing herd fertility in this study.

Key Words: CLA, reproduction, dairy cows

170 The impact on pregnancy rates in dairy cattle artificially inseminated with semen prepared by number of progressivley motile sperm. L. Rabinovitch*[1], U. Shalit[1], M. Deutsch[1], Y. Zeron[2], and P. Chenoweth[3], [1]*Medical Electronic Systems*, *Caesarea, Israel*, [2]*Sion A.I. Company*, *Shikmim, Israel*, [3]*Charles Sturt University*, *Wagga Wagga, New South Wales, Australia*.

The trial objective was to evaluate the pregnancy rates of dairy cattle inseminated with varying amounts of progressively motile sperm, post thaw (PMPT). In phase 1, straws were prepared to contain specific numbers of progressively motile sperm, post thaw. In phase 2, cows were inseminated and pregnancy rates were analyzed. All semen testing and dosing was performed at an operating AI stud facility (SION A.I. Company) using an SQA-Vb, automated sperm quality analyzer for bulls (Medical Electronic Systems). Forty ejaculates collected from four bulls were split into four groups and 2000 straws per group were targeted to contain: Group A, B and C; 1.5, 3.5 and 7.0 million PMPT sperm/straw respectively. The target for group D (Control) was 15.0 million total sperm per straw per the AI stud routine. Two hundred twenty-eight straws from groups A, B and C were quality control tested based on mean (+/− SE) values for PMPT sperm and demonstrated: (A) 1.5 (+/− 0.05); (B) 3.0 (+/− 0.09) and (C) 6.2 (+/− 0.18) million. Seventy-six straws from Group D (Control) established a mean (+/− SE) value of 13.6 (+/− 0.15) million. In total, 6,494 cows in over 500 farms were blindly inseminated between January and April 2009. At approximately 42 days post-insemination, pregnancy rates (per cow per cycle) were determined per rectal palpation by group as follows: (A) 34.2%; (B) 39.3%; (C) 43.2%; (D) 38.6%. The relative difference in pregnancy rates for groups A, B and C versus the control (D) were: −11.4%, 1.8% and 11.9%, respectively. Pregnancy rates in groups A, B and C correlated to the number of progressively motile sperm (r = 0.96). It is concluded that the number of progressively motile sperm per AI dose significantly impacts subsequent bovine pregnancy rates. Further, it is possible to accurately produce AI straws based on the number of PMPT sperm. Use of these findings could help improve bovine AI reproductive performance while allowing more effective utilization of superior bulls.

Key Words: bovine semen, SQA-Vb, bull AI

171 Effect of flunixin meglumine on prostaglandin metabolites and progesterone in lactating dairy cows. A. Ahmadzadeh*[1], S. Read[1], K. G. Carnahan[1], and J. C. Dalton[2], [1]*University of Idaho*, *Moscow*, [2]*University of Idaho*, *Caldwell R&E*.

Strategies to inhibit or reduce secretion of $PGF_{2\alpha}$ during early embryonic development may reduce embryonic loss and increase reproductive performance of dairy cattle. The objective was to examine the effect of flunixin meglumine (FM), a non-steroidal, anti-inflammatory drug, on $PGF_{2\alpha}$ secretion and luteal function by characterizing plasma prostaglandin metabolites (PGFM) and progesterone (P4) concentrations in lactating dairy cows during the luteal phase of the estrous cycle. Starting on d −35, estrous cycles of cows were synchronized using Presynch-Ovsynch. On d −9 (12 d after the second $PGF_{2\alpha}$ injection), and after detection of a corpus luteum (CL), Ovsynch was initiated. Ultrasonography was performed on d 0, 3, 7 and 15 to confirm ovulation and presence of a CL. Cows were not inseminated. On d 15 cows were assigned randomly to 2 groups: 1) FM group (n = 9) received 2.0 mg per kg BW (i.m.) of FM, 2) Control group received saline (n = 8). Jugular blood samples were collected at 30 and 0 min before treatment and at 30 and 60 min and each h thereafter for 6 h. Blood samples were also collected daily from d 15 to d 22. Mean P4 concentrations on the day of treatment (d 15) were not different between groups (6.3 vs. 7.2 ± 0.5 ng/mL). Plasma PGFM concentrations were not different between groups before treatment. Flunixin meglumine caused a transient decrease ($P < 0.05$) in plasma PGFM concentrations (58 ± 8.5 pg/mL) within 60 min after administration and concentrations remained low throughout the sampling period. Plasma PGFM remained unchanged in saline-treated cows (150 ± 9.2 pg/mL). Mean P4 concentrations decreased ($P < 0.05$) during 7 d after treatment; however, the rate of P4 decline over time tended ($P = 0.09$) to be greater for Control compared with FM. The results suggest that FM decreased plasma PGFM, suggesting FM negatively affects $PFG_{2\alpha}$ secretion in lactating dairy cows during the luteal phase of the estrous cycle. Moreover, FM may enhance luteal function by decreasing $PFG_{2\alpha}$.

Key Words: flunixin meglumine, prostaglandin $F_{2\alpha}$, dairy cows

172 Development of a mechanistic metabolic model of regulation of reproductive processes in dairy cattle. P. Celi[2], I. Lean[2], H. Raadsma[2], A. Rabiee[2], and J. P. McNamara*[1], [1]*Washington State University*, *Pullman,* [2]*University of Sydney*, *Camden, NSW, Australia*.

The objective was to construct and begin evaluation of a deterministic, mechanistic, dynamic model of nutritional and genetic control of reproductive processes in the dairy cow. The objective of this conceptual research model is to describe control of reproductive processes in dairy cattle at the metabolic level; and to be suitable for evaluation of data, concepts and hypotheses regarding underlying genetic, nutritional and physiological control of reproduction. We began with an existing model of metabolism in the cow, published and validated (Molly, UC Davis), which describes utilization of glucose, amino acids and fatty acids by muscle, adipose, visceral and mammary tissues at an aggregated metabolic pathway level. Elements of genetic background, response to nutritional environment and metabolic hormones are explicitly embodied in equation forms and parameter values. Next, a model of reproductive processes was developed that included flux of follicle stimulating hormone, luteinizing hormone, estrogen and progesterone in cycling and pregnant animals; as well as development of the calf to term. The models are integrated into one system to link genetic elements (for example, genetic merit for milk); nutrient use and reproductive processes, with an integration interval of one day. Based on published data, equations describe production of estrogen and LH, breakdown of estrogen and progesterone by the liver (mass action related to rate of metabolism); growth of the follicles as a function of glucose, IGFI and growth hormone (Michaelis-Menten); conception and growth of a single calf to term as a function of progesterone, glucose, amino acids and total energy (Michaelis-Menten). Degradation of steroids is related to metabolic rate through both intake of nutrients and output of milk components and to continuation of pregnancy. The model behavior for these variables (pattern and direction of response) is consistent with literature values from studies not used in the development. This research model should be useful to frame specific hypotheses on control of reproductive processes by genetic and nutritional driven mechanisms.

Key Words: reproduction, nutrition, research model