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AÑO 3 * NUMERO 32 * ABRIL 2010

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DESARROLLO FOLICULAR POSINSEMINACIÓN Y FERTILIDAD

El porcentaje de pérdidas embrionarias en las vacas lecheras es aproximadamente 50% y se estima que 70 a 80% de estas pérdidas ocurren durante los primeros 17 días posinseminación. Una causa de pérdida embrionaria está relacionada con el retraso en el desarrollo del embrión, esto disminuye su capacidad para establecer el reconocimiento materno de la gestación (días 17 al 18 del ciclo). Las vacas presentan de dos a tres oleadas foliculares durante el ciclo estral. El desarrollo folicular después de la ovulación puede influir en la supervivencia embrionaria; se sabe que en las vacas que presentan tres oleadas foliculares después de la inseminación artificial, tienen mejor fertilidad que las vacas que presentan dos oleadas foliculares. El número de oleadas foliculares determina la longitud de la fase lútea, de tal manera que las vacas con tres oleadas foliculares presentan una fase lútea más larga, lo que favorece a los embriones que se han retrasado en su desarrollo, al proporcionarles más tiempo y así establecer el mecanismo de reconocimiento materno de la gestación. Existen tratamientos orientados a mejorar la fertilidad en las vacas lecheras mediante la manipulación de la dinámica folicular después de la inseminación; uno de los cuales consiste en eliminar el folículo dominante el día cinco posinseminación con hCG, con este tratamiento se forma un cuerpo lúteo accesorio y aumentan los niveles de progesterona, lo cual favorece el desarrollo embrionario; además, con la eliminación del folículo dominante se permite la emergencia temprana de la segunda oleada folicular y permite que una alta proporción de vacas presenten tres ondas foliculares. La luteinización del folículo dominante, entre los días 12 a 14 provoca la tercera oleada folicular y retraso de la regresión del cuerpo lúteo, lo que también puede favorecer la supervivencia del embrión. Debido a que las causas de la muerte embrionaria son de naturaleza diversa, el alargamiento de la fase lútea no puede ayudar a todos los embriones, de allí que en algunos estudios estas técnicas muestran resultados positivos mientras que en otros casos, el efecto ha sido nulo. Por lo anterior, es recomendable la validación de estos tratamientos, de acuerdo con las diferentes condiciones de producción.



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Journal of Dairy Science 93, 4, April 2010, 1596


Associations of elevated nonesterified fatty acids and β -hydroxybutyrate concentrations with early lactation reproductive performance and milk production in transition dairy cattle in the northeastern United States

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The objectives were to evaluate the effects of elevated pre- and postpartum nonesterified fatty acids (NEFA) and β -hydroxybutyrate (BHBA) concentrations during the transition period on reproductive performance and milk production in dairy cattle. In a prospective cohort study of 91 freestall, total mixed ration-fed herds in the northeastern United States, blood samples were collected from approximately 15 prepartum and 15 different postpartum transition animals in each herd. All samples were stratified based on pre- or postpartum status at the time of sample collection, and 2,259 and 2,290 animals were used to evaluate reproductive and milk production performance, respectively. Reproductive performance was assessed by time to conception within 70 d post-voluntary waiting period (VWP) and milk production was assessed using mature-equivalent 305-d (ME305) milk yield estimated at 120 d in milk. While controlling for body condition score (BCS), calving season, median ME305 milk production, and parity, NEFA and BHBA concentrations were evaluated with time to event analysis to investigate reproductive performance. These same predictor variables were used to determine the effects of elevated NEFA and BHBA concentrations on ME305 milk yield with herd as a random effect. Heifers and cows were grouped in the final analyses if the results between groups were similar. In all animals sampled prepartum, the risk of pregnancy within 70 d post-VWP was reduced by 19% when NEFA concentrations were ≥ 0.27 mEq/L. In all animals sampled postpartum, those with NEFA concentrations ≥ 0.72 mEq/L had a 16% decrease in risk of pregnancy and those with BHBA concentrations ≥ 10 mg/dL had a 13% decrease in risk. In

cows and heifers, ME305 milk yield was decreased by 683 kg when prepartum NEFA concentrations were ≥ 0.33 mEq/L. In heifers sampled postpartum, ME305 milk yield was increased by 488 kg when NEFA concentrations were ≥ 0.57 mEq/L and increased by 403 kg when BHBA concentrations were ≥ 9 mg/dL. In cows sampled postpartum, ME305 milk yield was decreased by 647 kg when NEFA concentrations were ≥ 0.72 mEq/L and decreased by 393 kg when BHBA concentrations were ≥ 10 mg/dL. With the exception of milk production in heifers, this study indicates that increased concentrations of serum NEFA and BHBA had a detrimental effect on reproductive performance and milk production. 


Animal Reproduction Science 118 (2010) 171–175

Birth of offspring after artificial insemination of heifers with frozen-thawed, sex-sorted, re-frozen-thawed bull sperm

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Two field trials were conducted to determine the fertilising capacity of (i) frozen-thawed, sex-sorted re-frozen-thawed (FSF) dairy bull sperm inseminated close to the time of ovulation, (ii) FSF sperm following large dose insemination, and frozen-thawed, sex-sorted (FS) sperm inseminated within 12 h after sorting. In Trial 1, 24 heifers in synchronised oestrus were observed for standing heat over a 30-min period once every 3 h. Upon observation of standing heat, the size of the pre-ovulatory follicle was tracked by ultrasound every 6 h until ovulation was judged to be imminent. Heifers were inseminated with 4 \times 10⁶ X-bearing FSF or Control sperm within 6 h of ovulation. Ovaries were scanned 6 h after AI to ensure ovulation had occurred. All 24 heifers displayed standing oestrus and 20 of these subsequently ovulated. The mean length of standing oestrus was 16.8 \pm 0.4 h and ovulation occurred 27.6 \pm 1.1 h after the onset of standing heat from a pre-ovulatory follicle with a diameter of 16.1 \pm 0.3mm. All 12 heifers that received FSF sperm returned to oestrus < 26 d after AI. Of 8 heifers that received Control sperm, 6 (75%) were confirmed pregnant by

ultrasound 7 wk after AI, confirming that the method of AI and herd fertility were sound. In Trial 2 the number of sperm inseminated and the effect of eliminating the post-sort cryopreservation step were investigated. Heifers (n = 21) were synchronised for oestrus, and inseminated 24 h after the onset of standing oestrus with 10×10⁶ X-bearing FSF, 4×10⁶ X-bearing FS, or 10×10⁶ non-sorted frozen-thawed (Control) sperm. Heifers were observed for return to oestrus from 21 d, and diagnosed for pregnancy 7 wk after AI. Of the 7 heifers that received FSF sperm, one was confirmed pregnant (14.3%) and delivered a female calf. Four heifers inseminated with control sperm became pregnant and calved, but no pregnancies were obtained using FS sperm. The birth of a calf following AI with FSF sperm demonstrates the potential of sorting from frozen-thawed semen, and with further work, may be a promising technique that will give producers access to sexed sperm from a greater range of bulls. 

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Reprod Dom Anim 45, 368–372 (2010)
Short Communication

Clinical and Pathological Findings of a Sac-like Formation in the Tunica Vaginalis of a Nelore (*Bos indicus*) Bull

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A seven-month-old purebred Nelore calf was diagnosed with a bilateral finger-shaped swelling although more prominent at the left side of the scrotum, located longitudinal and parallel to epididymis corpus. The finding was present from 7 months of age up to castration (performed at 25 months of age). Scrotal circumference, testicular and epididymis consistency and symmetry as well as seminal quality were normal during the follow-up period. The ultrasonographic appearance of the scrotal wall, pampiniform plexus, gonad and epididymis was normal. However, an anechoic region surrounded by a wall forming a sac-like structure with a blind end at its dorsal pole was seen on the swelling area. The examination of fluid aspirated from the saccular contents revealed the presence of mononuclear cells mainly from lymphocytic and histiocytic type as well as some loosing degenerated mesothelial cells. Gross examination at castration revealed a blind sac-like appendix derived from an evagination in the parietal layer of the tunica vaginalis. The structure of approximately 5.0 cm in

length extended from the dorsal edge of the epididymis cauda. No adhesences with surrounded tissues were observed. Histopathology of the sac wall showed a smooth inner surface composed by scarce mesothelial cells forming in some areas papillary-like projections protruding to the vaginal cavity. Underneath, a thick layer of fibrous tissue mixed with collagen fibres and mononuclear inflammatory cells were seen. The potential consequences of this sacular formation at an older age in a bull are unknown. 

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Animal Reproduction Science 118 (2010) 131–139
Dietary manipulation of *Bos indicus* × heifers during gestation affects the prepubertal reproductive development of their bull calves

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We determined the influence of nutritional protein and energy during the first and second trimesters of pregnancy in composite beef heifers on prepubertal reproductive parameters of their male calves. At artificial insemination, heifers were stratified by weight within each composite genotype into 4 treatment groups: High/High (HH = 250% crude protein (CP) and 243% metabolisable energy (ME) for first and 229% CP and 228% ME for second trimester of pregnancy), High/Low (HL = 250% CP and 243% ME for first trimester and 63% CP and 176% ME for second trimester) Low/High (LowH = 75% CP and 199% ME for first trimester and 229% CP and 228% ME for second trimester) or Low/Low (LL = 75% CP and 199% ME for first trimester and 63% CP and 176% ME for second trimester). At 5 months of age, male calves were castrated, and gonadotrophins and testosterone (pre- and post-GnRH challenge), IGF-I and leptin were measured along with testicular parameters.

Lower maternal dietary protein and energy levels during gestation were associated with increased prepubertal FSH concentrations (P = 0.03) and paired testicular volume (P = 0.04) in male offspring. Serum LH (P < 0.001) and FSH concentrations (P = 0.04) were correlated with seminiferous tubule diameter. Testosterone concentrations were positively correlated with testis measures: paired testicular weight (P < 0.001), volume (P = 0.03) and seminiferous tubule diameter (P < 0.001). Although leptin concentrations were associated with prepubertal age (P = 0.04) and body weight (P = 0.006),

they were not associated with any of the measures of reproductive development, but insulin-like growth factor-I was associated with prepubertal FSH ($P=0.005$). In conclusion, prepubertal reproductive development of bulls may be affected by prenatal nutrition during early and mid gestation.



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Animal Reproduction Science 118 (2010) 163–170
Dystocia in 3-year-old beef heifers; Relationship to maternal nutrient intake during early- and mid-gestation, pelvic area and hormonal indicators of placental function

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The influence of nutrition during the first and second trimesters of gestation on the occurrence of dystocia was investigated in 3-year-old composite-breed beef heifers. Heifers were allocated according to stratification by weight and genotype to either a high (H/–=76MJ metabolisable energy (ME) and 1.4 kg crude protein (CP)), or low (L/–=62MJME and 0.4 kg CP daily) nutritional treatment on the day of artificial insemination (day 0) to the same Senepol bull. Half of each nutritional group changed to an opposite nutritional group on day 93 of gestation (–/H = 82MJME and 1.4 kg CP; –/L = 63MJME and 0.4 kg CP daily), resulting in four treatment groups: HH ($n = 16$); HL ($n = 19$); LH ($n = 17$); LL ($n = 19$). From 180 days until calving all heifers were fed the same diets. Pelvic area measures were taken at heifer selection (–72 days) and at 117 days. Maternal circulating concentrations of estrone sulphate (ES), bovine placental lactogen (bPL), bovine pregnancy associated glycoprotein and progesterone were monitored throughout gestation. Heifers were observed continuously over the calving period and delivery type classified as being either eutocic or dystocic. The occurrence of dystocia was 14.1%. Increased calf birth weight increased the odds of occurrence of dystocia (odds ratio (OR) = 1.40; 95% confidence interval (95% CI) 1.12–1.76; $P < 0.01$). High diets in the second trimester were

associated with heavier calves at birth ($P = 0.01$). The mean pelvic area of eutocic heifers on –72 d, tended to be greater compared to that of dystocic heifers ($P = 0.08$) such that a 1-cm² difference in pelvic area tended to decrease the risk of dystocia (OR = 0.97; 95% CI 0.93–1.01; $P = 0.09$). Longer gestation length was associated with an increased risk of dystocia ($P = 0.03$). ES ($P = 0.04$) and bPL ($P = 0.09$) at calving were positively associated with the risk of dystocia. In conclusion, the current study demonstrates (a) that pelvic area measurement at selection in 3-year-old *Bos indicus* × *Bos taurus* heifers may be useful for identifying heifers at an increased risk of dystocia and (b) increased ES and bPL concentrations at calving are associated with increased risk of dystocia. Pelvic area measurements obtained prior to conception remain valid in their assessment of the relationship between pelvic area and likelihood of dystocia occurring in the event of changing maternal nutrient intake during gestation. This is an important finding given maternal diets high in protein and energy during the second trimester of gestation increased calf birth weight and calf birth weight was associated with an increase in the occurrence of dystocia in heifers calving as 3-year olds. 

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Animal Reproduction Science 118 (2010) 110–117
Effect of fixed-time embryo transfer on reproductive efficiency in high-producing repeat-breeder Holstein COWS

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The aim of the present study was to compare a synchronization of time of ovulation protocol for fixed-timed embryo transfer (FTET) with the usual administration of a single dose of prostaglandin associated with detection of estrus. Also, the effect of the presence of CL at the beginning of FTET protocol was evaluated. Lactating Holstein cows ($n = 651$) with three previous artificial inseminations were classified according to presence or absence of a corpus luteum (CL). Cows with a CL were randomly assigned to two additional treatments and submitted to embryo transfer after detection of estrus (PGFEstrus) or FTET (FTET-CL). Cows without CL were allocated to the FTET-NoCL treatment. On a

random day of the estrous cycle (Day 0), cows in the PGF-Estrus treatment (n = 229) were treated with 150µg d-cloprostenol (PGF) i.m. followed by detection of estrus from Day 1 through Day 5 after PGF. Embryos were transferred 6–8 days after estrus detection. Cows in the FTET-CL (n = 208; presence of CL) and FTET-NoCL (n = 214; absence of CL) treatments received a norgestomet ear implant plus 2mg estradiol benzoate (EB) and 50mg progesterone i.m. on Day 0. On Day 8, the implant was removed and 400 IUeCG, 150µg d-cloprostenol and 1mg estradiol cypionate i.m. were administered. No detection of estrus was performed and Day 10 was arbitrarily considered as the estrus day. Ultrasonographic exams were performed in all recipients and only cows with a single CL ≥ 15mm or multiple CL received a fresh or frozen-thawed embryo on Day 17. Pregnancy was diagnosed by ultrasonography at 30 and 60 days of pregnancy. When FTET and PGF-Estrus were compared, the proportion of cows receiving an embryo (recipients transferred-to-treated rate) was greater in the FTET-CL (75.0% (156/208) than in PGF-Estrus (34.5%, 79/229; P < 0.0001) treatment. Pregnancy rate (60 days) was also greater in FTET-CL (29.3%, 61/208) when compared to PGF-Estrus (16.2%, 37/229; P = 0.001). However, no differences were found in pregnancy loss [PGF-Estrus = 11.9% (5/42), FTET-CL = 9.0% (6/67); P = 0.62] and circulating progesterone concentration at embryo transfer [PGF-Estrus = 4.02±0.52 ng/mL (n = 25), FTET-CL = 3.33±0.32 ng/mL (n = 27); P = 0.25] among these treatments. The presence of CL at the beginning of FTET protocol resulted greater transferred-to-treated rate [FTET-CL = 75.0% (156/208) vs. FTET-NoCL = 61.2% (131/214); P = 0.003], but showed no effect on pregnancy rate at 60 days [FTET-CL = 29.3% (61/208) vs. FTET-NoCL = 22.9% (49/214); P = 0.13], pregnancy loss [FTET-CL = 9.0% (6/67) vs. FTET-NoCL = 2.0% (1/50); P = 0.15] and circulating progesterone concentration at ET [FTET-CL = 3.33±0.32 ng/mL (n = 27) compared to FTET-NoCL = 3.44±0.40 ng/mL (n = 29); P = 0.82]. In conclusion, the protocol for synchronization of time of ovulation using norgestomet ear implant, EB and eCG increased recipients transferred-to-treated and pregnancy rates in high-producing repeat-breeder Holstein cows. Also, recipients without CL at the beginning of the time of ovulation synchronization treatment resulted in similar pregnancy rate as recipients with CL submitted to FTET protocol. Thus, the suggested protocol allowed the performance of FTET, without the need for detection of estrus, simplifying the reproductive management and increasing the reproductive efficiency in repeat-breeder Holstein recipients. 

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Animal (2010), 4:4, pp 560–571

Effect of offering dairy cows diets differing in phosphorus concentration over four successive lactations: 2. Health, fertility, bone phosphorus reserves and nutrient utilisation

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This experiment examined the long-term effects of offering diets containing low levels of dietary phosphorus (P) on dairy cow health, fertility and bone composition, and the effect of dietary P level on nutrient utilisation. One hundred winter-calving Holstein–Friesian dairy cows were offered diets containing either ‘high’ or ‘low’ levels of dietary P over a 4-year period. Rations offered during the winter included grass silage, maize silage (70:30 dry matter (DM) basis, approximately) and concentrates (10.0 to 12.0 kg/cow per day). During the summer periods in years 1 and 2, half of the cows grazed both day and night, while the remaining cows grazed by day, and were housed by night and offered grass silage. During years 3 and 4, all cows grazed both day and night during the summer period. Concentrate feed levels during the summer periods were 3.0 to 4.0 kg/cow per day. Different dietary P levels were achieved by offering concentrates containing either high or low P levels during the winter period (approximately 7.0 or 4.4 g P/kg DM, respectively) and during the summer period (approximately 6.8 or 3.6 g P/kg DM, respectively). Total ration P levels averaged 4.9 and 3.6 g P/kg DM for the high and low P winter diets, respectively, and 4.2 and 3.6 g P/kg DM for the high and low P summer diets, respectively. A total of 95, 70, 50 and 22 cows completed each of lactations from 1 to 4, respectively. Neither the incidence of lameness or mastitis, or milk somatic cell count, were affected by dietary P level (P.0.05), while none of the fertility parameters recorded in any of lactations from 1 to 4 was affected by the dietary P level (P.0.05). Dietary P level had no effect on the specific gravity, ash or calcium content of rib cortical bone cores (n578 cows), while the P content of cortical bone (g/kg fresh, g/kg DM and mg/ml fresh bone) was lower with cows offered low P diets (P.0.05). Dietary P level had no significant effect on the digestibility of either the DM, nitrogen, energy or acid detergent fibre fraction of the diet (P.0.05), while faecal P excretions were reduced by a mean of 27 g/cow per day with cows offered the low P diets during the winter period. The results of this study indicate that dietary P levels can be

reduced to proportionately 0.8 (approximately) of current UK feeding standards (Agricultural and Food Research Council, 1991), with no detrimental effect on dairy cow health or fertility, while having only minor effects on bone composition.



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Livestock Science 129 (2010) 111–121


Effects of nursing frequency and parity on the productive, metabolic and reproductive parameters of beef cows

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Nursing restriction and parity might be stressful factors influencing the challenging postpartum period. This experiment aimed to evaluate the effects of nursing frequency (in multiparous dams) and parity on faecal glucocorticoid metabolites after calving in beef cows (n=64). Also, the role of these effects on productive, metabolic and reproductive functions was assessed. From the day after calving, forty-six Parda de Montaña cows were assigned at random to three nursing frequencies: once-daily nursing (1×30 min at 0800 h) (RESTR1), twice-daily nursing (2×30 min at 0800 and 1530 h) (RESTR2) and ad libitum nursing (ADLIBC). Eighteen heifers were maintained with free access to their calves as in the ADLIB cow's group (ADLIBH). Data were analysed through analysis of variance and survival analysis. The faecal glucocorticoid metabolites during the first three days post-partum were not affected by either calf management or parity (P>0.10) but they were greater at 12 h post-partum than in subsequent samplings (P<0.05). Cow average daily gain (ADG) was greater in RESTR1 than in RESTR2 and ADLIBC (P<0.05). However, milk yield and calf ADG were lower in RESTR1 than in the rest (P<0.05). These traits did not differ between parities (P>0.10). Serum triglycerides and urea were not affected by calf management or parity (P>0.10). Peripheral cholesterol and IGF-I did not differ among suckling systems (P>0.10), but their mean concentration was lower in ADLIBC than in ADLIBH (P<0.05). Serum NEFA was lower in RESTR1 than in RESTR2 and ADLIBC on weeks 7 and 9 of lactation (P<0.05). Both RESTR1 and RESTR2 treatments showed lower serum NEFA than ADLIBC on week 11 post-partum (P<0.05). Serum NEFA were greater in ADLIBC than in ADLIBH on week 1 and after week 7 of lactation (P<0.05).

Serum β - hydroxybutyrate was lower in RESTR1 and RESTR2 than in ADLIBC (P<0.05). Calf management did not affect significantly the interval to first post-partum ovulation or oestrus (P>0.10) but ADLIBC had shorter post-partum intervals to first ovulation than ADLIBH (P<0.05). In conclusion, calf restriction and parity were factors that did not affect cow's welfare after parturition. Twice-daily and ad libitum suckled cows showed a similar productive and metabolic behaviour which differ from their once-daily suckled counterparts. This response did not trigger remarkable differences in the reproductive parameters of cows. Ad libitum suckled cows had different metabolic traits compared to heifers, as well as a shorter duration of the post-partum anoestrus than ad libitum suckled first-calf dams. 

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Journal of Dairy Science 93, 4, April 2010, 1551

Effects of clinical mastitis caused by gram-positive and gram-negative bacteria and other organisms on the probability of conception in New York State Holstein dairy cows

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The objective of this study was to estimate the effects of different types of clinical mastitis (CM) on the probability of conception in New York State Holstein cows. Data were available on 55,372 artificial inseminations (AI) in 23,695 lactations from 14,148 cows in 7 herds. We used generalized linear mixed models to model whether or not a cow conceived after a particular AI. Independent variables included AI number (first, second, third, fourth), parity, season when AI occurred, farm, type of CM (due to gram-positive bacteria, gram-negative bacteria, or other organisms) in the 6 wk before and after an AI, and occurrence of other diseases. Older cows were less likely to conceive. Inseminations occurring in the summer were least likely to be successful. Retained placenta decreased the probability of

conception. Conception was also less likely with each successive AI. The probability of conception associated with the first AI was 0.29. The probability of conception decreased to 0.26, 0.25, and 0.24 for the second, third, and fourth AI, respectively. Clinical mastitis occurring any time between 14 d before until 35 d after an AI was associated with a lower probability of conception; the greatest effect was an 80% reduction associated with gram-negative CM occurring in the week after AI. In general, CM due to gram-negative bacteria had a more detrimental effect on probability of conception than did CM caused by gram-positive bacteria or other organisms. Furthermore, CM had more effect on probability of conception immediately around the time of AI. Additional information about CM (i.e., its timing with respect to AI, and whether the causative agent is gram-positive or gram-negative bacteria, or other organisms) is valuable to dairy personnel in determining why some cows are unable to conceive in a timely manner. These findings are also beneficial for the management of mastitic cows (especially those with gram-negative CM) when mastitis occurs close to AI. 

Animal Reproduction Science 118 (2010) 182–187
Equine chorionic gonadotropin improves the efficacy of a progestin-based fixed-time artificial insemination protocol in Nelore (Bos indicus) heifers


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A total of 177 Nelore heifers were examined by ultrasonography to determine the presence or absence of a corpus luteum (CL) and received a 3mg norgestomet ear implant plus 2mg of estradiol benzoate i.m. On Day 8, implants were removed and 150µg of d-cloprostenol i.m. was administered. At the time of norgestomet implant removal, heifers with or without CL at the time of initiating treatment were assigned equally and by replicate to be treated with 0 IU (n = 87) or 400 IU (n = 90) eCG i.m. All heifers received 1mg of EB i.m. on Day 9 and were submitted to fixed-time artificial insemination (FTAI) 30–34 h later. The addition of eCG increased the diameter of the largest follicle (LF) at FTAI (10.6±0.2mm vs. 9.5±0.2mm; P = 0.003; mean±SEM), the final growth rate of the LF (1.14±0.1mm/day vs. 0.64±0.1

mm/day; P = 0.0009), ovulation rate [94.4% (85/90) vs. 73.6% (64/87); P = 0.0006], the diameter of the CL at Day 15 (15.5±0.3mm vs. 13.8±0.3mm; P = 0.0002), serum concentrations of progesterone 5 days after FTAI (6.6±1.0 ng/ml vs. 3.6±0.7 ng/ml; P = 0.0009), and pregnancy per AI [P/AI; 50.0% (45/90) vs. 36.8% (32/87); P = 0.04]. The absence of a CL at the beginning of the treatment negatively influenced the P/AI [30.2% (16/53) vs. 49.2% (61/124); P = 0.01]. Therefore, the presence of a CL (and/or onset of puberty) must be considered in setting up FTAI programs in heifers. In addition, eCG may be an important tool for the enhancement of follicular growth, ovulation, size and function of the subsequent CL, and pregnancy rates in progestin-based FTAI protocols in *Bos indicus* heifers. 

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Animal Reproduction Science 118 (2010) 201–209
Heat shock protein patterns in the bovine ovary and relation with cystic ovarian disease

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The present study was performed to determine how the development of cystic ovarian disease (COD) affecting the ovarian expression of heat shock proteins (HSP) in cows were expressing extrous cycles. HSP27, HSP60, HSP70 and HSP90 were evaluated in different ovarian components by Western blot and semiquantitative immunohistochemical analysis. Greater expression of the HSP27 gene was detected in the granulosa and theca cells of primary, secondary, tertiary and cystic follicles, with decreasing amount in atretic follicles. HSP60, HSP70 and HSP90 showed a similar pattern of immunostaining, with moderate gene expression in primary and secondary follicles, increased expression in tertiary and atretic follicles with the greatest gene expression in cystic follicles. HSP were also localized in the corpus luteum, corpus albicans, interstitial tissue and tunica albuginea. The relative amount of protein in the follicular wall of small and large healthy follicles and cystic follicles as analysed by Western immunoblot was consistent with the immunohistochemical data. We speculate that altered expression of HSP genes decreases apoptosis in the follicular wall and leads to the delayed regression of cystic follicles. This study supports earlier observations

suggesting that aberrant HSP gene expression, observed in cells of the cystic follicles, is probably associated with the intra-ovarian component of COD pathogenesis. 

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Animal Reproduction Science 118 (2010) 155–162

Probability of pregnancy as affected by oestrus number and days to first oestrus in dairy cows of three breeds and parities

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An improved understanding of the animal factors that affect measures such as conception rate would contribute to solving the problem of impaired reproductive performance in modern dairy cows. A question of particular interest relates to the observed improvement in conception rates from first to second and third oestrus cycle: is the increase in conception rate related to cycle number per se or to increasing days from calving? A 5-year study using three breeds (Holstein, Jersey and Danish Red) allowed this issue to be examined. In 560 lactations, from calving until confirmed pregnancy or until 290 days after calving all cows were observed daily for signs of oestrus. Inseminations were carried out to all clear cases of oestrus after 35 days from calving until the cow was judged to be pregnant or until 290 days post-calving. Days from calving to the first oestrus was modeled using a frailty model. Danish Red cows had a significantly greater rate of occurrence of first oestrus over time. Generalized linear mixed models defined using a binomial distribution and logit link function were used to estimate probability of pregnancy as affected by: breed, parity, oestrus number and days from calving to first oestrus. In order to account for the paradox that the incidence of cows with inherently low fertility increases with oestrus number, different random components for cow were included. There was a significant increase in probability of pregnancy from first to second oestrus but no significant change in probability of pregnancy thereafter. There was a significant increase in probability of pregnancy with increasing days to first oestrus. This indicates that both oestrus number and days from calving play a role in determining the fertility of dairy cows. Correcting for inherent differences in fertility was shown to be important. 

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Animal (2010), 4:4, pp 595–603

Effect of age on spermogram of Holstein Friesian x Sahiwal crossbred bulls

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This study was conducted on 94 Frieswal (5/8 Holstein Friesian 3/8 Sahiwal) crossbred bulls of three different grades, categorized based on their semen freezability visualising Group 1 (consistently freezable semen producer bulls, N=11), Group 2 (inconsistent freezable, N=16) and Group 3 (Non freezable, N=67). Each group was further divided into two classes that is young (up to 30 months) and adult (31 to 70 months) bulls depending upon their age. Sperm morphology was studied by using the eosin-nigrosin staining technique. Bulls age significantly ($P<0.01$) affected semen quality and sperm morphology. In adult bulls, semen volume, mass activity and sperm concentration were 36%, 17.56% and 19.6%, respectively, higher than young. Initial progressive motility (%) and livability showed significant ($P<0.01$) improvement with the advancement of age (43.37+1.21 and 67.71+1.11, respectively, in young; 53.02+1.11 and 74.17+1.03, respectively, in adult). In young bulls, sperm head, mid piece, tail abnormality and total abnormal sperm percent (12.38+0.92, 4.87+0.24, 11.01+0.60 and 28.26+1.34, respectively) were 1.85, 1.27, 1.20 and 1.44 folds higher than that of their mature stage (6.69+0.64, 3.82+0.32, 9.14+0.64 and 19.66+1.31, respectively). Significant reduction ($P<0.01$) in micro cephalic sperm, free heads, bent mid piece, looped mid piece and proximal protoplasmic droplets were observed at mature age as compared with their younger stage. In bulls of consistent freezing category, abnormal sperm heads significantly decreased from 4.40+0.31% to 3.28+0.02% on maturity. Similarly, in inconsistent freezing grade bulls sperm head abnormality (9.28+0.75% to 5.13+1.20%) and total abnormal sperm percent (24.89+1.43 to 18.73+3.40) was decreased over the age. On the contrary, in non-freezing category bulls' sperm morphology did not show significant ($P>0.05$) improvement with age advancement, rather some abnormalities like long slender head, under developed/deformed head, abaxial implantation of mid piece, double mid piece, stump tail and distal protoplasmic droplets tend to increased significantly ($P<0.05$) with age of bulls. Results indicated that in potential Frieswal bulls semen quality and sperm morphology were improved from young to mature stage, where as, in poor quality (non-freezing) semen producer bulls neither the morphology nor the semen quality

showed any improvement with maturity. It was recommended that crossbred bulls producing more than 25% morphologically abnormal sperms in young age (below 30 months) along with poor progressive motility (<50%) and low sperm concentration (<1000 million/ml) need immediate culling with out any expectation of further improvement in semen quality with age advancement. 

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Journal of Dairy Science 93, 4, April 2010, 1500

Effect of bovine somatotropin (500 mg) administered at ten-day intervals on ovulatory responses, expression of estrus, and fertility in dairy cows

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The objectives of this study were to evaluate the effect of administering 500 mg of recombinant bovine somatotropin (bST) every 10 d on ovulatory responses, estrous behavior, and fertility of lactating Holstein cows. Lactating dairy cows were assigned to 1 of 2 treatments: a control with no administration of bST (73 primiparous and 120 multiparous cows) or 6 consecutive administrations of 500 mg of bST (83 primiparous and 123 multiparous cows) given subcutaneously at 10-d intervals starting 61 ± 3 d postpartum (study d 0), concurrent with the initiation of the timed artificial insemination (AI). Blood samples were collected thrice weekly from 61 ± 3 to 124 ± 3 d in milk (DIM), and plasma samples were analyzed for concentrations of estradiol, glucose, insulin, insulin-like growth factor 1, and progesterone. The estrous cycle of cows was presynchronized with 2 injections of PGF_{2α} at 37 ± 3 and 51 ± 3 DIM, and the Ovsynch timed AI protocol was initiated at 61 ± 3 DIM. Ovaries were scanned to determine ovulatory responses during the Ovsynch protocol. Pregnancy was diagnosed at 33 and 66 d after AI. Body condition was scored on study d 0, 10, 42, and 76. Sixty-four cows were fitted with a pressure mounting sensor with radiotelemetric transmitters to monitor estrous behavior. Treatment of lactating dairy cows with 500 mg of bST at 10-d intervals increased yields of milk and milk components in the first 2 mo after treatment. Body condition of bST-treated cows remained unaltered, whereas control cows gained BCS. Treatment with bST

increased concentrations of insulin-like growth factor 1 chronically, but concentrations of insulin and glucose increased only transiently in the first 7 d after the first injection of bST. Concentrations of progesterone during and after the Ovsynch protocol remained unaltered after treatment with bST; likewise, ovulatory responses during the Ovsynch protocol were mostly unaltered by treatment. Concentration of estradiol tended to be greater for bST cows than for control cows immediately before induction of ovulation in the Ovsynch protocol. Similarly, the mean and the peak concentrations of estradiol were greater for bST cows than for control cows when monitored during spontaneous estrus. Nevertheless, duration of estrus and the median number of standing events were less for bST cows than for control cows. Pregnancies per AI after the first and second postpartum inseminations were not affected by bST treatment. Treatment of lactating dairy cows with 500 mg of bST every 10 d improved lactation performance, but it did not affect pregnancies per AI and it reduced expression of estrus.



Reproduction, Fertility and Development 22(4) 684–694

Effects of changes in the concentration of systemic progesterone on ions, amino acids and energy substrates in cattle oviduct and uterine fluid and blood


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Early embryo loss is a major factor affecting the conception rate in cattle. Up to 40% of cattle embryos die within 3 weeks of fertilisation while they are nutritionally dependent on oviduct and uterine fluids for their survival. Inadequate systemic progesterone is one of the factors contributing to this loss. We have characterised the effects of changes in systemic progesterone on amino acid, ion and energy substrate composition of oviduct and uterine fluids on Days 3 and 6, respectively, of the oestrus cycle in cattle. Oviduct and uterine fluids were collected *in situ* following infusion of progesterone. There was no effect of progesterone on oviduct fluid secretion rate; however, uterine fluid secretion rate was lowered. Progesterone increased uterine glucose, decreased oviduct sulfate and, to a lesser degree, oviduct

sodium, but had no effect on any of the ions in the uterus. The most marked effect of progesterone was on oviducal amino acid concentrations, with a twofold increase in glycine, whereas in the uterus only valine was increased. These results provide novel information on the maternal environment of the early cattle embryo and provide further evidence of progesterone regulation of oviduct amino acid concentrations in cattle. 

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**Journal of Dairy Science 93, 4, 1459-
Management practices associated with
conception rate and service rate of
lactating Holstein cows in large,
commercial dairy herds**

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Data from lactating Holstein cows in herds that participate in a commercial progeny testing program were analyzed to explain management factors associated with herd-average conception and service rates on large commercial dairies. On-farm herd management software was used as the source of data related to production, reproduction, culling, and milk quality for 108 herds. Also, a survey regarding management, facilities, nutrition, and labor was completed on 86 farms. A total of 41 explanatory variables related to management factors and conditions that could affect conception and service rate were considered in this study. Models explaining conception and service rates were developed using a machine learning algorithm for constructing model trees. The most important explanatory variables associated with conception rate were the percentage of repeated inseminations between 4 and 17 d post-artificial insemination, stocking density in the breeding pen, length of the voluntary waiting period, days at pregnancy examination, and somatic cell score. The most important explanatory variables associated with service rate were the number of lactating cows per breeding technician, use of a resynchronization program, utilization of soakers in the holding area during the summer, and bunk space per cow in the breeding pen. The aforementioned models explained 35% and 40% of the observed variation in conception rate and service rate, respectively, and underline the association of herd-level

management factors not strictly related to reproduction with herd reproductive performance. 

**Animal Reproduction Science 118 (2010) 140
Ovarian activity, conception and
pregnancy patterns of cows in the
semi-arid communal rangelands in the
Eastern Cape Province of South Africa**

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A study was conducted to determine the seasonal trends in ovarian activity, conception and pregnancy status of cows on communal rangelands in the Eastern Cape Province of South Africa. Ovarian activity and pregnancy status of 200 cows were determined through transrectal palpation in June, and October 2007 and January 2008. Month of conception was obtained by subtracting the estimated age of the foetus from the month when pregnancy diagnosis was performed. Body weights and body condition scores (BCS) were collected every month between March 2007 and January 2008. Although cows in the perennial grasslands had higher ($P < 0.05$) body weights and BCS than those in the annual grasslands, they had a significant weight and condition loss between March and October. More than 90% of the cows in the annual grasslands were cycling in January ($P < 0.05$). Over 60% of the cows in the perennial grasslands conceived between December and March compared to 46% in the annual grasslands. About 40% of the cows were pregnant in June in the annual and perennial grasslands. There were more cycling and pregnant cows with a BCS of 3 in the perennial grasslands in June and October compared to annual grasslands ($P < 0.05$). Odds ratio estimates of cows exhibiting ovarian activity and pregnancy in the communal areas were highest for BCS. It was concluded that most cows conceived and exhibited ovarian activity between November and March, especially in the perennial grasslands. Future research should focus on supplementary feeding using locally available feed resources to improve cow reproductive performance in the dry months, particularly in the annual grasslands. 

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Artículos de Revisión

Theriogenology 73 (2010) 758–767

Sampling techniques for oviductal and uterine luminal fluid in cattle

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Analysis of luminal fluid microenvironments in the reproductive tract is pivotal to elucidate embryo-maternal signaling mechanisms responsible for successful reproduction in mammals, including cattle. Besides facilitating production of an optimized medium for in vitro fertilization and embryo culture in assisted reproductive technologies, screening of luminal fluid constituents in the oviduct and uterus could also provide critical information for elucidation of mechanisms underlying developmental programming. A key issue in this type of research is the sampling of luminal fluids. In this review we discuss the sampling techniques available for bovine species, including a recent in situ technique developed with the Ghent device, which allows rapid recovery of measurable amounts of pure uterine luminal fluid with minimal disturbance to the donor animal. 

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Theriogenology 73 (2010) 713–722

Sperm storage in the vertebrate female reproductive tract: How does it work so well?

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The capacity for sperm storage within the female reproductive tract occurs widely across all groups of vertebrate species and is exceptionally well developed in

some reptiles (maximum duration, 7 yr) and fish (maximum duration, >1 yr). Amphibians (most salamanders and one species of frog; duration approximately 5 mo), all birds examined to date and some bats, have also evolved the ability to store spermatozoa in the female reproductive tract. Although there are many reports on both the occurrence of female sperm storage and its adaptive benefits, few studies have been directed toward explaining the mechanisms involved. Phylogenetic evidence suggests that the capacity for sperm storage has evolved independently within different taxonomic groups, and it is by no means clear whether these groups have established similar or different mechanisms or whether simple and common principles have been exploited during evolution. If the process has indeed developed by the invention of numerous different and species-specific mechanisms, it is surprising that none have yet been elucidated by technologists wishing to improve the long-term storage of fresh semen. On the other hand, if there is a simple and common solution to the problem, readily accessed by diverse groups of species, it is equally logical to suppose that the mechanism should be easily discovered in the laboratory. While recognizing that studies on wild species are usually neither practically or ethically easy to undertake, it is clear that there is a huge and largely unexplored field to be investigated. 

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Theriogenology 73 (2010) 777–785


Culture of bovine embryos in intermediate host oviducts with emphasis on the isolated mouse oviduct

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The oviduct provides the optimal environment for the transport of sperm and oocyte at the earliest stages of mammalian embryo development. During the early

postfertilization period, several major developmental events occur in the embryo including (i) the first cleavage division, (ii) activation of the embryonic genome, (iii) compaction of the morula, and (iv) formation of the blastocyst. Most of these events are initiated in the oviduct. The absence of assistance from the oviduct may compromise the developmental ability of the cattle embryo under in vitro culture conditions. The oviducts of several mammalian species, including rabbits, cow, sheep (in situ), and mice (organ culture), can sustain early bovine embryos and yield blastocysts of better quality compared with those of culture conditions in vitro, leading to normal pregnancy rates in recipient animals. This review focuses on the use of oviducts in vitro or in vivo as intermediate hosts for postfertilization culture environment of bovine in vitro-produced zygotes with emphasis on the mouse model. 

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Fisiología Reproductiva

Animal Reproduction Science 118 (2010) 148

Delivering cholesterol or cholestanol to bull sperm membranes improves cryosurvival


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This study compared the effect of adding other cholesterol conjugates, which should incorporate into and increase sperm membrane fluidity at low temperatures thereby increasing cryosurvival. Ejaculates from each of four bulls were diluted to 120 million cells/ml in a Tris diluent and used in two experiments. Each experiment contained four treatments: No additive (control); 1.5mg CLC/120 million sperm (positive control); and 1.5mg cyclodextrin pre-loaded with cholestanol or desmosterol/120 million sperm. In the first experiment, fresh sperm were treated with cyclodextrins that were pre-loaded with cholesteryl conjugates and incubated for 15 min at 22 °C to allow incorporation of the conjugates. The percentages of motile sperm after exposure to solutions ranging from 0 to 1200mOsm were used to evaluate the osmotic tolerance of the cells. The ability of treated sperm to bind to the bovine zona pellucida (ZP) and chicken egg perivitelline membrane (CEPM) was evaluated to determine if altering the sperm membrane affected the ability of sperm to bind to oocytes. In the final experiment, the cryosurvival rates of control and treated sperm were determined. Control and treated sperm were cryopreserved in a Tris diluent containing 10% egg yolk (EY) and 8% glycerol (final concentrations). Samples were thawed to determine the motility and ability of sperm to bind to the ZP and to CEPM using a CASA and epifluorescence microscope, respectively. Fresh sperm treated with CLC resulted in more binding to the ZP compared to all other treatments ($P < 0.05$). No differences were observed between ZP and CEPM binding ($P > 0.05$). The percentages of motile sperm were greater for fresh samples treated with cholesterol, cholestanol or desmosterol loaded cyclodextrin than control cells ($P < 0.05$) when the sperm were exposed to anisotonic conditions, and then returned to

isotonicity. After cryopreservation the percentages of motile sperm and number of sperm binding to each CEPM were similar for sperm treated with CLC and cholestanol compared to sperm treated with desmosterol ($P > 0.05$). All treatments provided greater motility and binding efficiency than control sperm ($P < 0.05$). Therefore, adding cholesterol or cholestanol to bull sperm membranes improved cell cryosurvival. 

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Animal Reproduction Science 118 (2010) 118–123


Dynamic progesterone responses to simulation of a natural pulse of a metabolite of prostaglandin F2 α in heifers

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The effects of prostaglandin F2 α (PGF) on circulating progesterone concentration were studied in four groups ($n = 4$) of Holstein heifers 9 d after ovulation. The progesterone response to simulation of a pulse of 13,14-dihydro-15-keto-PGF (PGFM) by a 2-h intrauterine (IU) infusion of 0.5mg of PGF was compared with the response to a PGF-bolus IU injection of 4 mg. The beginning of infusion and time of injection were designated Minute 0. Progesterone concentration did not change significantly between Minute 0 and Hour 48 in control or IU vehicle-treated groups. In the PGF-bolus group, progesterone concentration increased ($P < 0.05$) between Minutes 0 and 10 and then decreased. In the PGF-infusion group, simulation of a PGFM pulse was not associated with an initial transient increase in progesterone. The first significant decrease ($P < 0.05$) in progesterone began at Minute 20 and continued until Hour 1. The progesterone concentration then began to rebound ($P < 0.05$) at Hour 1 and peaked at Hour 3 at almost the same concentration as at the start of PGF infusion. The progesterone again decreased after Hour 3 and increased again between Hours 24 and 48. In summary: (1) an initial

transient increase in progesterone was not detected in association with an individual simulated pulse of PGF, indicating that the frequently reported pronounced transient increase after a bolus luteolytic dose of PGF is a nonphysiological response and (2) simulation of a PGFM pulse resulted in a distinct transient rebound in progesterone beginning at Hour 1 of the PGF infusion. 

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Animal Reproduction Science 118 (2010) 124

Spontaneous myometrial contractility in cows suffering from endometritis-Influence of localisation, smooth muscle layer and cycle phase. An in vitro study


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Contractility of the healthy bovine myometrium depends on the reproductive state. Furthermore, contractility is influenced by localisation and the direction of smooth muscle strips. However, little is known about the contractile behaviour of the uterus when affected by endometritis. In our study, myometrial specimens from the larger horn (near the corpus and near the tip) in cows suffering from endometritis in estrus (n = 8) or diestrus (n = 8) were collected after slaughter. Two strips were prepared from each region corresponding to the circular and the longitudinal muscle layers, respectively. The spontaneous contractility of these strips was recorded in an organ bath. To analyse the results, the 2.5 h recordings were divided into five periods of 30 min each. The variables area under curve (AUC) and maximal (A_{max}) and minimal amplitude (A_{min}) were calculated separately for each period, and the results were analysed using a non-parametric model regarding the influence of cycle phase (estrus vs. diestrus), region (corpus vs. tip) and muscle layer (circular vs. longitudinal). The values of both AUC and A_{max} increased significantly over time. Muscle layer had a significant effect on AUC (corpus, tip) and A_{max} (tip): the values of circular layers were increased compared to longitudinal layers. Dividing the data into subgroups allowed us to analyse them additionally according to muscle layer: In longitudinal layers, A_{max} was increased at the corpus as compared with the tip. In this model, the factor cycle phase did not produce any significant difference in spontaneous myometrial activity. However, data of all

variables showed non-significant higher values in estrus than in diestrus samples. 

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Sperm morphology of beef bulls evaluated by two different methods


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The objectives of this study were to compare two different methods of evaluating bull sperm morphology, bright-field (BF) microscopy of eosin–nigrosin (EN) stained dry-mount semen smears and differential interference phase contrast (DIC) microscopy of wet-mount semen ‘fixed’ in isotonic formal saline, both at 1000 \times . Ejaculates (n = 72) were evaluated, representing both pre- and post-breeding season ejaculates collected from 40 2-yr-old beef bulls via electro-ejaculation. For both methods, 200 sperm were counted in random fields with defects categorized as major (MAD) and minor (MID). Sperm abnormalities were also placed into two other categories: those considered to be most influenced by process (wet or dry, METHDEF) and those with depictions that could be influenced by optics (BF or DIC, OPTIDEF). Differences (P < 0.05) occurred between DIC and BF methods respectively: MAD 23.3/16.1, MID 7.6/13.4, acrosome 3.8/1.1, midpiece 9.2/11.7, tail 2.0/4.7, droplets 8.3/4.2, METHDEF 14.2/21.4 and OPTIDEF 13.0/5.5, but not (P > 0.05) in percent normal sperm 69.1/70.4 or sperm head defects 7.5/8.3. Acrosome, tail and droplet defects were observed in 98.2/80.5, 86.1/100 and 98.2/94.4 percent of bulls for DIC and BF, respectively (P < 0.05). As percent normal sperm did not differ between methods, bright-field microscopy assessment of EN preparations was considered to be a satisfactory method to categorize breeding soundness of bulls. However, DIC was more effective in visualizing major defects, while BF (which included stained smear preparation) was considered to cause more minor defects. Thus DIC was considered to be the preferred method of semen assessment for accurate assessment of sperm morphology in bulls. 


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J. Anim Sci. 2010. 88:1314-1320

A new approach to sperm preservation based on bioenergetic theory¹

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To date, attempts to preserve chicken sperm have been based on a trial-and-error experimental approach. The present work outlines the development of an alternative approach based on empiricism and bioenergetic theory. In previous work, we found fowl sperm motility to be dependent on mitochondrial calcium cycling, phospholipase A₂, and long-chain fatty acids as an endogenous energy source. It is noteworthy that fowl sperm reside within the sperm storage tubules (SST) of the oviduct over an interval of days to weeks after insemination. In this regard, a model for *in vivo* sperm storage was developed and tested in additional previous research. Sperm penetration of the SST, sperm residence within the SST, and sperm egress from the SST can be explained in terms mitochondrial function. Understanding sperm function and longevity in terms of bioenergetics presented the possibility that sperm could be inactivated by disrupting mitochondrial calcium cycling and could thereby be preserved. However, this possibility also posed a problem: maintenance of the inner membrane potential of the mitochondrion within inactivated sperm. This report describes a series of experiments in which fowl sperm were inactivated by treatment with the calcium chelator tetrasodium 1,2-bis-(*o*-aminophenoxy)ethane-*N,N,N',N'*-tetraacetic acid, and then reactivated by treatment with calcium ions. The effect of tetrasodium 1,2-bis-(*o*-aminophenoxy)ethane-*N,N,N',N'*-tetraacetic acid on mitochondrial calcium cycling was confirmed by flow cytometry and confocal microscopy. When treated sperm were cooled to 10°C, inactivated sperm could be reactivated throughout a 5-h storage interval. When stored sperm were held for 3 h before reactivation and insemination, fertility was 88% of the control. Storage did not affect hatchability. In summary, short-term storage was realized by manipulating mitochondrial function. We propose that 1) complex V consumes ATP within inactivated sperm and, by doing so, maintains the inner membrane potential of the mitochondrion, 2) ATP is regenerated within inactivated sperm by the action of creatine kinase on phosphocreatine, and 3) necrosis follows depletion of intracellular phosphocreatine. Therefore, future attempts to preserve chicken sperm can be based on a theory that encompasses regulation of energy production, a biological context in which sperm cells are motile, and the consequences of mitochondrial failure. 

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Reproduction, Fertility and Development 22(4) 597


Developmental potential of bovine oocytes following IVM in the presence of glutathione ethyl ester

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Glutathione (GSH) is synthesised during oocyte maturation and represents the oocyte's main non-enzymatic defence against oxidative stress. Inadequate defence against oxidative stress may be related to poor embryo quality and viability. In the present study, bovine oocytes were matured *in vitro* in the presence of GSH ethyl ester (GSH-OEt), a cell permeable GSH donor, and its effects on subsequent fertilisation and embryo development were assessed. GSH-OEt significantly increased the GSH content of IVM oocytes without affecting fertilisation or Day 3 cleavage rates. Maturation in the presence of GSH-OEt did not significantly increase the blastocyst rate compared with control oocytes. However, 5 mM GSH-OEt treatment resulted in significantly higher blastocyst total cell number. The GSH level of IVM oocytes was significantly decreased in the absence of cumulus cells and when cumulus-oocyte complexes were cultured in the presence of buthionine sulfoximine (BSO), an inhibitor of GSH synthesis. The addition of GSH-OEt to cumulus-denuded or BSO-treated oocytes increased the GSH content of bovine oocytes and restored the rate of normal fertilisation, but not embryo development, to levels seen in control oocytes. Thus, GSH-OEt represents a novel approach for effective *in vitro* elevation of bovine oocyte GSH and improvement in blastocyst cell number. 

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Reproduction (2010) 139 705-715

Endogenous folates and single-carbon metabolism in the ovarian follicle, oocyte and pre-implantation embryo

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Maternal B-vitamin status at conception can affect fertility and

the health of offspring. This study details transcript expression for genes encoding key enzymes in the linked methionine/folate cycles in the bovine oocyte, somatic cells of the ovarian follicle and pre-implantation embryo. Transcripts for all 12 enzymes that were studied and for the two folate receptors (FOLR1 and FOLR2) and reduced folate carrier (SLC19A1) were expressed in liver cells, but transcripts for betaine-homocysteine methyltransferase and methionine adenosyl transferase 1A were absent in all ovarian cells, and transcripts for FOLR2 were absent in embryonic cells. Transcripts for glycine methyltransferase were also absent/weak in cumulus and granulosa cells. The absence of these enzymes could have a profound effect on single-carbon metabolism within the ovary and pre-implantation embryo. Immunocytochemical analysis revealed SLC19A1 protein expression on the plasma and basal-lateral membranes of the pre-implantation embryo. The folate antagonist methotrexate (MTX) enters the cell via SLC19A1, and in the current study, MTX inclusion in bovine/ovine culture media at either 1 or 10 μM from the 1-cell stage inhibited embryo development beyond the 8-cell stage. Hypoxanthine and thymidine (100 μM) increased the proportion of embryos that developed to blastocysts, but the cell number was reduced by 20%. The reduced uptake of [^{35}S] methionine into intracellular S-adenosylmethionine and S-adenosylhomocysteine pools, together with reduced uptake of glutamate and tryptophan, was consistent with depleted intra-cellular pools of reduced folates. These data provide an insight into the importance of maternal dietary folate/B-vitamin status during the peri-conceptual period. 

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Reproduction 2010;139:685


The pivotal role of glucose metabolism in determining oocyte developmental competence

Melanie Sutton-McDowall, Rob Gilchrist and Jeremy Thompson

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The environment the cumulus oocyte complex (COC) is exposed to during either in vivo or in vitro maturation can have profound effects on the success of fertilisation and

subsequent embryo development. Glucose is a pivotal metabolite for the COC and is metabolised by glycolysis, the pentose phosphate pathway (PPP), the hexosamine biosynthesis pathway (HBP) and the polyol pathway. Over the course of oocyte maturation, a large proportion of total glucose is metabolised via the glycolytic pathway to provide substrates such as pyruvate for energy production. Glucose is also the substrate for many cellular functions during oocyte maturation, including regulation of nuclear maturation and redox state via the PPP and for the synthesis of substrates of extra cellular matrices (cumulus expansion) and O-linked glycosylation (cell signalling) via the HBP. However, the oocyte is susceptible to glucose concentration dependent perturbations in nuclear and cytoplasmic maturation, leading to poor embryonic development post-fertilisation. For example, glucose concentrations either too high or too low result in precocious resumption of nuclear maturation. This review will discuss the relevant pathways of glucose metabolism by COCs during in vivo and in vitro maturation, including the relative contribution of the somatic and gamete compartments of the COC to glucose metabolism. The consequences of exposing COCs to abnormal glucose concentrations will also be examined, either during in vitro maturation or by altered maternal environments, such as during hyperglycaemia induced by diabetes and obesity. 

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J. Anim Sci. 2010. 88:1321-1331

Mammalian glutathione peroxidases control acquisition and maintenance of spermatozoa integrity¹

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In mammals, posttesticular epididymal sperm maturation is considered an essential step in the transformation of immature testicular gametes to mature spermatozoa capable of fertilization. Reactive oxygen species (ROS) have been shown to be key actors in this maturation process, and it is now clear that ROS are central for sperm physiology in processes such as sperm maturation and capacitation. However, during epididymal maturation and storage and until the onset of fertilization, oxidative damage is a threat spermatozoa must face more than any other cells. Spermatozoa were found to be extremely sensitive to oxidative attacks correlated with lipid peroxidation, DNA

damage, and impaired sperm motility, all affecting fertilization. To control the quantity of H_2O_2 in the vicinity of male gametes, mammalian epididymis uses a panel of nonenzymatic and enzymatic scavengers, among which the glutathione peroxidase (GPx) family is largely represented. Among the various GPx proteins expressed in the mammalian epididymis, GPx4 and GPx5 occupy unique positions and functions that are reviewed in this paper. This paper underlines the importance of the GPx protein family in determining the fertilizing potential of mammalian spermatozoa. This is particularly relevant in the field of mammalian fertility and infertility as well as in the development of assisted medical procreation technologies and male gamete preservation techniques that are extensively used in human and animal reproduction programs. 

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Eventos Próximos



UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO
FACULTAD DE MEDICINA VETERINARIA Y ZOOTECNIA
SECRETARÍA DE EDUCACIÓN CONTINUA Y TECNOLOGÍA
DEPARTAMENTO DE REPRODUCCIÓN



XII

CURSO INTERNACIONAL DE REPRODUCCIÓN BOVINA

Del 19 al 21 de mayo de 2010

Sede: Auditorio Pablo Zierold Reyes de la FMVZ, UNAM



Conferenciantes:
Dr. Manoel De Sá Filho
Universidade de São Paulo Brasil.
Dr. Carlos Gutiérrez
FMVZ-UNAM
Dra. Ana Maria Rosales
UAM- Xochimilco
Dr. Carlos Galina
FMVZ-UNAM
Mariana Pederna
FMVZ-UNAM
Dr. Héctor Jiménez
INIFAP
Dr. Alejandro Ramírez
Universidad Autónoma de Chihuahua
Dr. Javier Valencia
FMVZ-UNAM

Dr. Francisco Suárez
FMVZ-UNAM
Dra. María Alejandra Ayanegui
FES Cuautitlán-UNAM
Dr. Fernando Cavazos
ABS-México
Dr. Miguel Angel Lammoglia
Universidad Veracruzana
Dr. Oscar Ortiz
Alpura
Dr. Jorge Ávila
FMVZ-UNAM
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PROGRAMA DEL XII CURSO INTERNACIONAL DE REPRODUCCIÓN BOVINA

MIERCOLES 19 DE MAYO DE 2010.

08:00-09:00 Inscripciones

09:00-09:15 Inauguración

09:30-10:20

Producción y transferencia de embriones: Experiencia Brasileña.

Manoel de Sá Filho

Universidad de Sao Paulo, Brasil

10:20-11:10

Nuevos protocolos para la superovulación y sincronización de receptoras de embriones.

Miguel Lammoglia Villagómez

FCBA - Universidad Veracruzana

11:10-12:00

Uso de tratamientos hormonales para aumentar la eficiencia reproductiva.

Manoel de Sá Filho

Universidad de Sao Paulo, Brasil

12:00-12:30 **Receso**

12:30-13:20

Fertilidad en programas de inseminación a tiempo fijo *versus* estro observado en sistemas de producción de carne y doble propósito en el trópico.

Carlos Galina Hidalgo

FMVZ-UNAM

13:20-14:10

Factores que influyen en la respuesta en los programas de sincronización de estros en sistemas de producción de carne y doble propósito en el trópico.

Héctor Basurto Camberos

FMVZ-UNAM

14:10-15:00

Uso y abuso de los programas de sincronización de la ovulación en los hatos lecheros.

Oscar Ortiz González

ALPURA

JUEVES 20 DE MAYO DE 2010.

09:00-09:50

Factores que afectan la fertilidad en los programas de inseminación con semen sexado.

Javier Valencia Méndez

FMVZ-UNAM

09:50-10:40

Uso de semen sexado en *Bos indicus* y *Bos taurus*.

Manoel de Sá Filho

Universidad de Sao Paulo, Brasil.

10:40-11:30

Control neuroendocrino de la conducta sexual en el macho.

Héctor Jiménez Severiano

INIFAP

11:30-12:00 **Receso**

12:00-12:50

Experiencias en la evaluación de la salud reproductiva de los toros.

Alejandro Ramírez Godínez

Universidad Autónoma de Chihuahua

12:50-13:40

La tasa de preñez como medida de la eficiencia reproductiva en ganado lechero.

Fernando Cavazos García

ABS-México

13:40-14:30

El periodo voluntario de espera y la fertilidad de la vaca lechera.

Jorge Ávila García

FMVZ-UNAM

VIERNES 21 DE MAYO DE 2010.

09:00-09:50

Efecto de la nutrición en la función ovárica de la vaca.

Carlos G. Gutiérrez Aguilar

FMVZ-UNAM

09:50-10:40

Balance energético y reproducción en vacas altas productoras manejadas en pastoreo.

Mariana Pedrera Romano

FMVZ-UNAM

10:40-11:30

Participación del factor de crecimiento endotelio vascular (VEGF) en el desarrollo folicular y la función del cuerpo lúteo.

Ana María Rosales Torres

UAM-Xochimilco

11:30-12:00 **Receso**

12:00-12:50

Control de la Brucelosis en hatos bovinos.

Francisco Suárez Güemes

FMVZ-UNAM

12:50-13:40

Interpretación diagnóstica de la leptospirosis en bovinos basada en la epidemiología reconocida en rumiantes.

María Alejandra Ayanegui Alcérreca

FES-UNAM

Sitios de Interés

- Agrociencia
<http://www.colpos.mx/agrocien/agrociencia.htm>
- Animal
<http://www.animal-journal.eu/>
- Animal Reproduction
<http://www.cbpa.org.br/publicacoes/animalreproduction/issues.do>
- Animal Reproduction Science
<http://www.sciencedirect.com/science/journal/03784320>
- Biology of Reproduction
<http://www.biolreprod.org/>
- Ciencia
<http://www.revistaciencia.amc.edu.mx/>
- Journal of Animal Science
<http://jas.fass.org/>
- Journal of Dairy Science
<http://jds.fass.org>
- Journal of Reproduction and Development
<http://www.jstage.jst.go.jp/browse/jrd>
- Livestock Science
<http://www.sciencedirect.com/science/journal/18711413>
- Manejo lechero
<http://www.manejolechero.com/>
- Nature
<http://www.nature.com/nature/index.html>
- Physiological . Reviews
<http://physrev.physiology.org/>
- Proceedings of the National Academy of Sciences of the United States of America
<http://www.pnas.org/>
- Reproduction
<http://www.reproduction-online.org/>

- Reproduction in Domestic Animals
<http://www.wiley.com/bw/journal.asp?ref=0936-6768>
- Reproduction, Fertility and Development
<http://www.publish.csiro.au/nid/44.htm>
- Revista Mexicana de Ciencias Pecuarias
<http://www.tecnicapecuaria.org.mx/index2.php>
- Science
<http://www.sciencemag.org/>
- The American Association of Bovine Practitioners
<http://www.aabp.org/>
- The Dairy Cattle Reproduction Council (DCRC)
<http://www.drcouncil.org/index.html>
- The Veterinary Record
<http://veterinaryrecord.bvapublications.com/>
- Theriogenology
<http://www.sciencedirect.com/science/journal/0093691X>
- Veterinary Clinics of North America: Food Animal Practice
<http://www.vetfood.theclinics.com/>
- Veterinaria México
<http://www.fmvz.unam.mx/fmvz/revvetmex/revvetmex.htm>



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