noticias de Reproducción Bovina

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editorial

Estrés calórico y reproducción en el ganado lechero

Es común que las vacas lecheras en sistemas de producción intensiva, durante el verano, alcancen temperaturas rectales de 40 a 41°C. Esto se debe a que el ganado genera excesivo calor metabólico a causa de la producción de leche y por el elevado consumo de materia seca, además de que sus mecanismos de disipación del calor son ineficaces. Los efectos del estrés calórico se han agudizado en los últimos años, aun en regiones templadas, debido al incremento de la producción y a las modificaciones climáticas. El estrés calórico disminuye significativamente la fertilidad en los hatos lecheros; por ejemplo, en la región lechera de La Laguna en los estados de Durango y Coahuila, México, la fertilidad no supera el 20% durante los meses cálidos del año. El estrés calórico ocasiona que las vacas disminuyan su actividad física, por lo cual es más difícil la detección del estro; repercute también en el desarrollo folicular y en los ovocitos, disminuyendo su potencial para desarrollar un embrión viable. La exposición *in vitro* de un ovocito a 41°C durante seis horas altera su maduración y la misma exposición en los primeros cuatro días de desarrollo provoca daño en los embriones, lo que resulta en una proporción menor de embriones que alcancen la etapa de blastocisto. *In vivo,* la exposición de las vacas donadoras de embriones a una temperatura ambiental mayor a los 38°C afecta negativamente el desarrollo embrionario. Por otra parte, una consecuencia del estrés calórico no percibida en ocasiones, es el efecto residual o de largo plazo en los ovocitos, que se manifiesta después de los meses cálidos; de tal modo que, los ovocitos de las vacas que fueron expuestas a estrés calórico en agosto y son ovulados en octubre, tendrán por tanto menor potencial para desarrollar un embrión viable. También el estrés calórico disminuye el consumo de materia seca, lo que resulta en menor producción de leche. Si la disminución en el consumo ocurre durante los primeros 60 días posparto, se agudiza el balance energético negativo, comprometiéndose más la fertilidad. En los hatos lecheros se han implementado diversas estrategias para mitigar el efecto del estrés calórico sobre la reproducción y la producción, como proveer espacios con sombra, sistemas de ventilación forzada, aspersores y nebulizadores de agua, ventiladores y estanques con agua. Dichas estrategias favorecen la fertilidad, sin embargo, sigue siendo menor que la obtenida durante la temporada fresca del año. De igual manera, se han evaluado tratamientos hormonales pero hasta ahora ninguno con resultados favorables. El estrés calórico es una problemática permanente, no exclusiva del ganado lechero sino de todos los sistemas de producción animal, por lo que cabe explorar estrategias que permitan disminuir sus efectos en la reproducción.

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MANEJO REPRODUCTIVO

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Period of dominance of the ovulatory follicle influences embryo quality in lactating dairy cows

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Length of dominance of the ovulatory follicle and exposure to oestradiol (OE2) during proestrus can affect fertility. Lactating cows had their oestrous cycle pre-synchronized and were subjected to one of the four synchronization treatments. Cows in the oestrus detection (OD) treatment received GnRH on day 6 of the oestrous cycle, PGF2a 7 days later, and were inseminated at detected oestrus. The remaining cows were subjected to the Ovsynch (OVS) protocol (day 0 GnRH, day 7 PGF2a, day 9 GnRH, and timed artificial insemination (AI) 12 h later) starting on day 3 (OVS3) or day 6 (OVS6 and OVS6E) of the oestrous cycle. Cows in the OVS6E treatment received an injection of 0.5 mg oestradiol cypionate 36 h before AI. Ovaries were examined by ultrasonography and blood was sampled for progesterone and OE2 concentrations. Uteri were flushed 6 days after AI and recovered embryos–oocytes evaluated. Diameter of the ovulatory follicle at AI differed (P!0.01) among treatments, and it was the largest for OVS3 cows, which also had extended (P!0.01) length of follicular dominance. During proestrus, OD and OVS6E cows had increased (P!0.01) OE2 concentrations. Fertilization was not altered by treatments, and maximum fertilization was achieved when the number of accessory spermatozoa was O7. Proportions of viable embryos in relation to embryos and embryos–oocytes recovered were smaller for OVS3 cows (P!0.01) than the other treatments, and embryos fromOVS3 cows also had fewer (P!0.01) blastomeres and tended (PZ0.09) to have a lower proportion of live blastomeres. Extending the period of follicle dominance did not alter fertilization but reduced (P!0.001) embryo quality. Embryo quality was compromised even when the dominance of the ovulatory follicle was extended by only 1.5 days.

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Amplification of Bovine Viral Diarrhoea Virus Introduced into an In Vitro Embryo Production System Via Oocytes from Persistently Infected Cattle

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The purpose of this study was to determine whether or not embryos derived from in vitro fertilization of oocytes from persistently infected (PI) cattle would contain infectious virus. Three in vitro embryo production treatment groups were assessed: 1) oocytes and uterine tubal cells (UTC) free of bovine viral diarrhoea virus (BVDV) (negative control), 2) oocytes free of BVDV fertilized and cultured in media containing UTC obtained from PI heifers, and 3) oocytes from PI heifers fertilized and cultured in media containing UTC free of BVDV. The developmental media, UTC and embryos (individual or groups of five) were assayed for virus. Virus was not isolated from any samples in treatment group 1. As shown in previous studies, a proportion of embryo samples were positive for BVDV in treatment group 2. In treatment group 3, the virus associated with the oocytes contaminated the developmental media and infected susceptible co-culture cells used during fertilization and culture. In addition, 65% (11/17) of the degenerated ova from treatment group 3 had infectious virus associated with them. While none of the ova developed into transferable embryos, the study did confirm that use of oocytes from PI cows could lead to amplification of BVDV and cross contamination during in vitro embryo production.

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Bovine viral diarrhea virus (BVDV) associated with single in vivo-derived and in vitro-produced preimplantation bovine embryos following artificial exposure

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The objective was to determine the average amount of bovine viral diarrhea virus (BVDV) associated with single in vivo-derived and in vitro-produced bovine embryos following recommended processing procedures for embryos. In vivo-derived and in vitro-produced bovine embryos at 7d post-fertilization were exposed (for 2h) to 2x10(5-7) cell culture infective dose (CCID(50))/mL of SD-1 (a noncytopathic, Type 1a strain of BVDV), and then washed according to International Embryo Transfer Society (IETS) guidelines prior to testing. Of the 87 in vivo-derived embryos tested, 27% were positive for virus by quantitative polymerase chain reaction (qPCR). The range in amount of virus associated with 99% of the contaminated embryos was </=6.62+/-1.57copies/5muL; 90% of the contaminated embryos had </=4.64+/-1.57viralcopies/5muL of embryo-associated virus, using tolerance intervals (P<0.05). The SEM was 0.33 and the mean of averages was 1.12/5muL. Of the 87 in vitro-produced embryos, 42% were positive for virus. The range in amount of virus associated with 99% of the contaminated embryos was </=3.44+/-0.89copies/5muL; 90% of the contaminated embryos had </=2.40+/-0.89viralcopies/5muL of embryo-associated virus using tolerance intervals (P<0.05; S.E.M. was 0.14 and the mean of averages was 0.55/5muL). Therefore, although many embryos were positive for virus, there were limited numbers of copies, thereby posing doubt regarding their potential for contamination following embryo transfer.

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Formation of Corpora Lutea and Central Luteal Cavities and Their Relationship with Plasma Progesterone Levels and Other Metabolic Parameters in Dairy Cattle

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The corpus luteum (CL) may be looked upon as a compact or cavitary structure. A number of papers have addressed the relationship between CL type and parameters such as fertility or progesterone levels. The present study assessed the morphological and functional sequence observed in cows with different CL types, comparing pre-ovulatory follicle size, progesterone levels, luteal tissue formation and some blood biochemical parameters (calcium, albumin, inorganic phosphorus, glucose, magnesium, copper and zinc), oestrus cycle length and oestrus expression, as a function of CL type. Twenty-eight lactating dairy cows from two commercial dairy farms in southern Spain were studied. Oestrus detection was performed by monitoring daily oestrus behaviour, and artificial insemination (AI) was perfomed using the AM/PM rule. Ovaries and uterus were sonographically examined and blood samples were collected to measure progesterone and various biochemical parameters. There was a slight tendency towards the appearance of luteal cavities when pre-ovulatory follicles were larger (1.9 ± 0.2 vs 1.7 ± 03; p = 0.074). Fertility was not affected by cavity presence (cavity = 42.9% and compact = 57.1%; n.s.). Luteal tissue and function were not modified as a function of CL type. Cows with luteal cavities displayed significantly higher levels of albumin, suggesting a possible metabolic influence on the formation of these structures, although specific research is required to confirm this observation.

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Effect of Percoll volume, duration and force of centrifugation, on in vitro production and sex ratio of bovine embryos

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The objective was to evaluate the effect of Percoll volume, and duration and force of centrifugation on sperm quality characteristics, embryo development, and sex ratio of in vitro-produced (IVP) bovine embryos. Frozen-thawed semen from four bulls were submitted to three Percoll procedures: T1-4 mL of Percoll, centrifuged for 20 min at 700 g; T2-800 μL of Percoll, centrifuged for 20 min at 700 g; and T3-800 μL of Percoll, centrifuged for 5 min at 5000 g. Sperm total motility, morphology and integrity of the sperm acrosome, membrane and chromatin were determined before and after Percoll treatment, and semen was used for in vitro fertilization (IVF) of in vitro-matured oocytes. All Percoll methods increased the proportion of motile sperm ($P < 0.05$). There were no significant effects of treatment for any sperm characteristic; however, for every end point, there were significant differences among bulls. Similarly, rates of cleavage and blastocyst formation were not affected by the Percoll procedure ($P > 0.05$), but were affected by sire ($P < 0.05$). Sex ratio was similar among treatments for Bulls 2 and 3, whereas semen from Bull 1 processed by T1 yielded a greater percentage of male embryos. However, when only treatments were considered, independent of bulls, the proportion of male:female embryos did not differ significantly from an expected 1:1 ratio. In conclusion, decreasing Percoll volume, reducing duration of centrifugation, and using a higher force of centrifugation did not significantly affect sperm quality, embryo development, or sex ratio of in vitro-produced bovine embryos. © 2009 Elsevier Inc. All rights reserved.

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Effect of progesterone and/or estradiol treatments prior to induction of ovulation on subsequent luteal lifespan in anestrous Nelore cows

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Three experiments evaluated effects of estradiol (E2) and/or progesterone (P4) prior to induction of ovulation with GnRH on subsequent luteal lifespan in anestrous Nelore cows. In Experiment 1, cows (25–65 days post-partum [DPP]; n = 114) were assigned randomly to receive a 6-day treatment with an intravaginal P4 device (CIDR®) and/or 1 mg i.m. injection of 17β-E2 (4 groups; 2 × 2 factorial design) prior to ovulation. Blood samples were collected on days 0, 5, 7, 9, 12, 15 and 19 for evaluation of luteal function. Pre-treatment with P4 reduced occurrence of premature luteolysis (PL; 79.2% in non-treated vs. 13.5% in treated cows; $P < 0.01$), but there was no effect of treatment with 17β-E2 on percentage of PL. In Experiment 2, cows (30–40 DPP; n = 35) were assigned randomly to receive either 0.5 mL i.m. injection of cottonseed oil (placebo) or 1 mg i.m. injection of E2 cypionate. Blood samples were collected on days 0, 5, 9 and 15 for evaluation of luteal function. Incidence of PL (83.0% in Control Group vs. 75.0% in ECP Group; $P > 0.1$) and mean serum P4 did not differ between treatment groups. In Experiment 3, cows (30–60 DPP; n = 109) were randomly assigned to receive either a 6-day (6-d Group) or a 3-day (3-d Group) treatment with CIDR®. Blood samples were collected on days 0, 5, 7 and 9 for luteal function evaluation. Incidence of PL (5.5% in 6-day vs. 5.5% in 3-day groups; $P > 0.1$) and mean serum P4 did not differ between treatment groups. In conclusion, both 3- and 6-day treatments with P4 prior to induction of ovulation in anestrous Nelore cows increased percentage of normal luteal lifespan, while administration of 1 mg of 17β-E2 or E2 cypionate failed to prevent occurrence of PL.

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Effect of synchronisation of ovulation on ovarian profile and days open in holstein cows diagnosed as nonpregnant 26 days after timed artificial insemination.

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The objective of this study was to clarify the effects of a second protocol of ovulation synchronisation starting on day 26 after timed artificial insemination on ovarian profile and days open in dairy cows diagnosed as nonpregnant. Ninety-four Holstein-Friesian cows received intramuscular injections of a GnRH analogue (GnRH), 100 mug fertirelin, on day 0 and a prostaglandin F(2alpha) analogue (PG), 5 mg etyprostontromethamine, on day 7. GnRH was again administered 48 h after the PG injection, and timed artificial insemination was performed 16 to 20 h later (Ovsynch/TAI). Twenty-six of the 94 cows returned to oestrus within 26 days after TAI and were inseminated. Of the other 68 cows, 44 were not pregnant and were randomly allocated to undergo another Ovsynch/TAI protocol (Resynch group; n=23) or AI only after detection of oestrus (Control group; n=21). The ovarian and hormonal profiles were compared between the first and second Ovsynch protocol periods in the Resynch group. The diameter of the dominant follicle and plasma oestradiol-17beta concentration at the second GnRH injection were significantly greater than those at PG injection during the second Ovsynch period. Ovulation was synchronised in all of the animals in the second Ovsynch period. The AI submission rates, mean AI intervals and pregnancy rates of the Resynch and Control groups were 100% and 57.1%, 36.0 +/- 0.0 and 43.2 +/- 10.9 and 30.4% and 14.3%, respectively. The mean AI interval was 7 days shorter and the pregnancy rate was higher in the Resynch group than in the Control group, although no significant differences were found due to the small number of the animals. In conclusion, the Resynch protocol initiated on day 26 after TAI in the first protocol has the potential to reduce days open and increase the pregnancy rate in dairy cows.

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In Vitro Assessment of Progesterone and Prostaglandin E2 Production by the Corpus Luteum in Cattle Following Pharmacological Synchronization of Estrus

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We studied the secretory function of the corpus luteum (CL) in cows following different estrus synchronization protocols. Estrus was synchronized using one (n=4) or two injections (n=5) of prostaglandin F2α (PGF2α; dinoprost), two injections of different analogues of PGF2α (aPGF2α), luprostiol (n=5) and cloprostenol (n=5), at eleven-day intervals, a gestagen implant (norgestomet, n=5, for 10 days) or norgestomet together with a subsequent dinoprost injection on the day of implant removal (n=5). CL samples were collected by ovariectomy on Day 7-8 of the estrous cycle. Luteal strips were stimulated with LH (100 ng/ml) or prostaglandin E2 (PGE2, 10-6M) for 24 h in culture media. The progesterone (P4) and PGE2 concentrations in the media were measured by enzyme immunoassay. In the control CL (spontaneous estrus; n=5), LH and PGE2 stimulated P4 and PGE2 ($P<0.001$). The effects of both factors on P4 were reduced in the CL following dinoprost- and cloprostenol-synchronized estrus ($P<0.05$) and were absent in the luprostiol-synchronized CL ($P>0.05$). In the norgestomet-synchronized CL, the stimulatory effects of LH and PGE2 were higher compared with the CL synchronized by aPGF2α ($P<0.05$). Pharmacological manipulation of the estrous cycle using aPGF2α may cause lower P4 secretion. Estrus synchronization inhibited CL sensitivity to luteotropic factors. Therefore, attention should be focused on the estrous synchronization method in

both in vivo and in vitro studies of CL functions in cattle.

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Development of Procedures for Sex-sorting Frozen–Thawed Bovine Spermatozoa

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Dairy bull sperm may be sex-sorted, frozen and used to artificially inseminate heifers with acceptable fertility if the herd is well-managed. One drawback to the technology is that donor bulls must be located within a short distance of the sorting facility in order to collect semen, which limits the number of bulls from which sorted sperm are available. A successful method used to overcome this limitation in sheep is sex-sorting from frozen–thawed semen and refreezing for artificial insemination. This technique is attractive to the dairy industry, and therefore a series of three experiments was designed to investigate the optimal methods to prepare, sex-sort and re-freeze frozen–thawed bovine sperm. Sperm were prepared for sorting by density gradient separation in either PureSperm® or BoviPure™, followed by staining in one of three diluents (Androhep®, Bovine Sheath Fluid + 0.3% BSA or TALP buffer). Sperm were sorted and collected into Test yolk buffer, and frozen in an extender containing 0, 0.25, 0.375 or 0.5% Equex STM Paste. Frozen–thawed sperm were better orientated ($p = 0.006$) and had fewer damaged membranes ($8.7 \pm 0.6\%$ vs $19.5 \pm 2.4\%$; $p = 0.003$) after centrifugation in PureSperm® rather than BoviPure™ gradients. Sperm orientation ($p < 0.05$) and motility (69.9 ± 3.0 vs 55.6 ± 4.0; $p < 0.001$) were highest after staining in Androhep® rather than in TALP buffer. Sperm were more motile (58.2 ± 4.7 vs 38.7 ± 3.5; $p < 0.001$) and had better acrosome integrity (74.3 ± 2.9 vs 66.8 ± 2.0; $p < 0.001$) after freezing in an extender containing 0.375% Equex STM Paste than in extender without Equex. Hence, a protocol has been developed to allow frozen–thawed bull sperm to be sex-sorted with high resolution between the sexes, then re-frozen and thawed with retention of motility and acrosome integrity.

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Classification of Bovine Follicles Based on the Concentrations of Steroids, Glucose and Lactate in Follicular Fluid and the Status of Accompanying Follicles

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A simple and clear means to identify the physiological status of follicles is essential for study of follicular biology. In the present study, we verified a novel classification procedure based on analysis of the follicular population and glucose concentration in follicular fluid (FF) as an alternative method to classify bovine follicles. Paired ovaries were collected from heifers, and the number of follicles and stage of the CL were recorded. Follicles were initially divided into the following 3 groups according to diameter and the ratio of E2 and P4 (E/P): E2 active (E-A: $E/P \geq 1$), E2 inactive (E-I: $E/P < 1$, ≥ 8.5 mm) and small follicles ($E/P < 1$, < 8.5 mm). E-A follicles were easily identified as E2-rich dominant follicles and were further classified according to diameter and stage of the CL as early dominant (EDF: < 8.5 mm), dominant (DF: ≥ 8.5 mm, stages I-III) or preovulatory follicles (POF: ≥ 8.5 mm, stage IV). E-I follicles were classified as follows based on the status of the accompanying follicles: early atretic (EAF: without an E-A follicle), mid-atretic (MAF: with an EDF or DF) and late atretic follicles (LAF: with an EAF or POF). The follicular P4 concentrations of the MAF and LAF were significantly higher compared with that of the

EAF, while follicular glucose concentration of the LAF was lower compared with those of EAF and MAF, indicating that this classification can be used to distinguish early atretic follicles from more advanced atretic follicles. Small follicles were classified as growing (GF: without E-A follicles) and suppressed small follicles (SSF: with E-A follicles). The SSF was easily identifiable by this procedure, but some GF populations likely contained SSF. To identify true GF, the ratio of E2 in the GF and accompanying EAF may be used. In conclusion, analysis of the follicular population in conjunction with biochemical indices such as steroid and glucose concentrations in FF provides a simple and accurate means of classifying bovine follicles.

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ARTÍCULOS DE REVISIÓN

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GnRH signaling in intrauterine tissues

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Type I GnRH (GnRH-I, GNRH1) and type II GnRH (GnRH-II, GNRH2), each encoded by separate genes, have been identified in humans. The tissue distribution and functional regulation of GnRH-I and GnRH-II clearly differ despite their comparable cDNA and genomic structures. These hormones exert their effects by binding to cell surface transmembrane G protein coupled receptors and stimulating the Gq/11 subfamily of G proteins. The hypothalamus and pituitary are the main origin and target sites of GnRH, but numerous studies have demonstrated that extra-hypothalamic GnRH and extra-pituitary GnRH receptors exist in different reproductive tissues such as the ovary, endometrium, placenta, and endometrial cancer cells. In addition to endocrine regulation, GnRH is also known to act in an autocrine and paracrine manner to suppress cell proliferation and activate apoptosis in the endometrium and endometrial cancer cells through several mechanisms. Both GnRH-I and GnRH-II exhibit regulatory roles in tissue remodelling during embryo implantation and placentation, which suggests that these hormones may have important roles in embryo implantation and early pregnancy. The presence of varied GnRH and GnRH receptor systems demonstrate their different roles in distinct tissues using dissimilar mechanisms. These may result in the generation of new GnRH analogues used for several hormone-related diseases.

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Factors Affecting Dystocia in Cattle

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The paper reviews the various factors affecting dystocia in cattle. It is based mainly on the recent studies found in the literature of the subject but refers occasionally to some older papers as well. The factors are grouped into four main categories: direct factors, phenotypic factors related to calf and cow, non-genetic and genetic factors. The first group includes malpresentations and uterine torsion. The second one includes: calf birth weight, multiple calvings, perinatal mortality, cow pelvic area, cow body weight and body condition at calving, gestation length. The non-genetic factors are: cow age and parity, year and season of calving, place of calving, maintenance practises, disorders, calf sex and nutrition. Other

non-genetic factors are the level of hormones in the periparturient period, in vitro production of embryos and embryo cloning. Finally, the genotypes of cow, bull and calf, inbreeding, muscular hypertrophy, selection and quantitative trait loci form the fourth group of genetic factors.

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Involvement of growth hormone (GH) and insulin-like growth factor (IGF) system in ovarian folliculogenesis

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During the last decade, involvement of growth hormone (GH), insulin-like growth factors (IGFs) and IGF binding proteins (IGFBPs) in ovarian folliculogenesis has been extensively studied. This review provides an update on the GH, IGF system and their role in ovarian follicular development. In vitro studies and knockout experiments demonstrated an important role of GH in preantral follicle growth and differentiation through their binding with GH receptors, which are located both in the oocyte and follicular somatic tissues. Furthermore, GH stimulates the development of small antral follicles to gonadotrophin-dependent stages, as well as maturation of oocytes. With regard to the IGF system, IGF-I has no effects on primordial follicle development, but both IGF-I and IGF-II stimulate growth of secondary follicles. Depending on the species studies and method used, these proteins have been detected in oocytes and/or somatic cells. In antral follicles, these IGFs stimulate granulosa cell proliferation and steroidogenesis in most mammals. The bioavailability of IGFs is regulated by a family of intrafollicular expressed IGF binding proteins (IGFBPs). Facilitation of IGF can be increased through the activity of specific IGFBP proteases, which degrade the IGF/IGFBP complex, resulting in the production of IGFBP fragments and release of attached IGF.

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FISIOLOGÍA REPRODUCTIVA

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The Genome Sequence of Taurine Cattle: A Window to Ruminant Biology and Evolution

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To understand the biology and evolution of ruminants, the cattle genome was sequenced to about sevenfold coverage. The cattle genome contains a minimum of 22,000 genes, with a core set of 14,345 orthologs shared among seven mammalian species of which 1217 are absent or undetected in noneutherian (marsupial or monotreme) genomes. Cattle-specific evolutionary breakpoint regions in chromosomes have a higher density of segmental duplications, enrichment of repetitive elements, and species-specific variations in genes associated with lactation and immune responsiveness. Genes involved in metabolism are generally highly conserved, although five metabolic genes are deleted or extensively diverged from their human orthologs. The cattle genome sequence thus provides a resource for understanding mammalian evolution and accelerating livestock genetic improvement for milk and meat production.

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Genome-Wide Survey of SNP Variation Uncovers the Genetic Structure of Cattle Breeds

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The imprints of domestication and breed development on the genomes of livestock likely differ from those of companion animals. A deep draft sequence assembly of shotgun reads from a single Hereford female and comparative sequences sampled from six additional breeds were used to develop probes to interrogate 37,470 single-nucleotide polymorphisms (SNPs) in 497 cattle from 19 geographically and biologically diverse breeds. These data show that cattle have undergone a rapid recent decrease in effective population size from a very large ancestral population, possibly due to bottlenecks associated with domestication, selection, and breed formation. Domestication and artificial selection appear to have left detectable signatures of selection within the cattle genome, yet the current levels of diversity within breeds are at least as great as exists within humans.

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Acute Changes in Circulating Concentrations of Progesterone and Nitric Oxide and Partial Pressure of Oxygen During Prostaglandin F(2alpha)-induced Luteolysis in Cattle.

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To examine whether oxygen (O(2)) and nitric oxide (NO) are temporally associated with the acute changes in luteal function during luteolysis, we determined the real-time changes in the circulating concentrations of progesterone (P4) and nitrite/nitrate (the stable metabolites of NO) and the partial pressure of oxygen (pO(2)) during prostaglandin F(2alpha) (PGF(2alpha))-induced luteolysis in cattle. Catheters for frequent blood sample collection were inserted into the ovarian vein (OV), jugular vein (JV) and aorta abdominalis (AA) in 12 cows on Day 9 of the oestrous cycle (oestrus=Day 0). On Day 10, the cows were randomly divided into two groups and treated with a luteolytic dose of a PGF(2alpha) analogue or saline solution (control). Blood samples were collected at -2, -1, 0, 0.25, 0.5, 0.75, 1 and 2 h and then at 2-h intervals until 12 h after treatment (0 h). Injection of a PGF(2alpha) induced a significant decrease in the concentrations of P4 in OV plasma within 2 h. The decrease in P4 concentrations was preceded by an increase in the NO concentrations in the blood collected from OV, JV and AA. Basal pO(2) was significantly higher in OV blood than in JV blood ($P<0.05$). PGF(2alpha) injection increased pO(2) in OV blood between 0.5 and 2 h. These results demonstrate that PGF(2alpha) induced an acute increase in pO(2) and NO in the ovarian circulation and suggest that O(2) and NO are involved in the early events of CL regression, including inhibition of P4 secretion and output, in cattle.

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SITIOS DE INTERÉS

Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación
http://www.sagarpa.gob.mx

Confederación Nacional de Organizaciones Ganaderas
http://www.cnog.com.mx

Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias
http://www.inifap.gob.mx

Facultad de Medicina Veterinaria y Zootecnia
http://www.fmvz.unam.mx

Academia Veterinaria Mexicana, A.C.
http://www.academiaveterinaria.org

Asociación Mexicana de Médicos Veterinarios Especialistas en Bovinos, A.C.
http://www.AMMVEB.net

Federación de Colegios y Asociaciones de Médicos Veterinarios Zootecnistas de México, A.C.
www.fedmvz.com

Organización de las Naciones Unidas para la Agricultura y la Alimentación
www.fao.org

Organización Panamericana de la Salud.
www.cinu.org.mx/onu/estructura/mexico/org/ops.htm

Revista Veterinaria México
http://www.fmvz.unam.mx/fmvz/revvetmex/revvetmex.htm

Dirección General de Salud Animal
http://senasicaw.senasica.sagarpa.gob.mx/portal/html/salud_animal/introduccion/introduccion.html

American Dairy Science Association (ADSA)
http://www.adsa.org/

Dairy and Animal Science (The Pennsylvania State University)
http://www.das.psu.edu/

College of Agriculture. Animal & Food Sciences (University Of Kentucki)
http://www.uky.edu/Ag/AnimalSciences/index.html

Electronic Zoo (NetVet Vterinary Resources –Cows Sites)
http://netvet.wustl.edu/cows.htm#dairy

Dairy Cattle Nutrition UW-Extension (University of Wisconsin)
http://www.uwex.edu/ces/dairynutrition/

Fundación Española para el Desarrollo de la Nutrición Animal
http://www.etsia.upm.es/fedna/introtablaf.htm

JOHNE´s Infomation Center (University of Wisconsin)
http://www.johnes.org/

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