

MAY 2024

# Sheep reproduction RD&A alert

## This sheep reproduction RD&A alert is an initiative of the Sheep Reproduction Strategic Partnership (SRSP).

Two Producer Demonstration Site (PDS) projects will be featured in the SRSP's June Webinar.

Sally Martin (SheepMetriX) will give an update on the [Optimising ewe lamb joining outcomes](#) project. Sally will discuss the decision making process and the learnings to date to achieve successful ewe lamb joining outcomes. Laura Broughton (Productive Livestock Systems) will highlight the benefits of [pregnancy scanning in extensive sheep flocks](#) from the recently completed PDS project of the same name.

The webinar will be held on **Tuesday 11 June 2024 from 12.30 to 1.30 pm (AEST)**. Click [here](#) to register and receive the log in details for the webinar.

The SRSP aims to help sheep producers to profitability and sustainably increase lamb production through increasing lamb survival and weaning rates and will coordinate a national approach to improving sheep reproductive performance.

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## Feature project update

### More lambs from ewe lambs through developing and extending best practice

#### Background

Mating ewes to lamb at 12 to 15 months is an effective avenue to rapidly build ewe numbers and increase lamb supply. However, the reproductive performance of ewe lambs is both lower and more variable than that achieved by mature ewes regardless of breed. The variation in performance and lack of information on the financial ramifications of joining ewe lambs has contributed to relatively poor adoption, which is estimated to be 30% of Maternal and 5% of Merino sheep producers.

#### Aim

To improve the reproductive performance of ewe lambs to address the challenge of sustaining Australian breeding ewe numbers and increasing lamb supply.

#### Project Objectives

- Identify the range in current industry recommendations, suggested best practice for mating ewe lambs to lamb at 12 to 15 months and the key barriers to adoption.
- Compile national baseline data from producers on; i. the current numbers of ewe lambs mated to lamb at 12 to 15 months, ii. the reproductive rate achieved when mating ewe lambs and iii. the mortality rates of mated ewe lambs and their lambs, and resultant marking rate.
- Identify a suite of management practices that impact on the reproductive performance of ewe lambs on commercial farms, assess their effectiveness and prioritise key gaps that require further validation.

- Test the effectiveness of the management practices at commercial scale in Australia, to provide new understanding on how to improve the performance of ewe lambs and their lambs.
- Quantify the carryover impacts of management of ewe lambs during their first pregnancy and lactation on their subsequent reproductive rate.
- Complete economic modelling and cost benefit analysis to confirm the value of various management practices and the most economic pathways to improve ewe lamb reproductive success for Maternal and Merino enterprises.
- Develop a standalone best practice guide and decision tools for reproductive success from ewe lambs.

### Current progress

Industry consultation, a national survey and a gap analysis were completed and informed the design of 50 on-farm research sites run on both commercial and seedstock sheep properties located across Victoria, New South Wales, Queensland, South Australia and Western Australia. Ewes were followed from their joining as a ewe lamb (7-10 months) through to pregnancy scanning at hogget age. At least 400 ewe lambs were joined at each research site with a range of treatments imposed at different times during the breeding cycle. The results of the on-farm research provided the basis for an economic analysis that examined a range of production decisions and on-farm feed allocation.

For more information on the more lambs from ewe lambs project contact Jason Trompf ([jason@jtagrisource.com.au](mailto:jason@jtagrisource.com.au)).

## Review paper

### Effects of melatonin implants on reproductive performance in sheep: a systematic review and meta-analysis

Ender Uzabacı ([euzabaci@gmail.com](mailto:euzabaci@gmail.com)) and Hakan Ustuner

Animal Production Science, May 2024

DOI <https://doi.org/10.1071/AN23109>

#### Abstract

**Context:** Sheep are seasonal breeding animals. Different reproduction systems exist to enhance productivity in non-breeding season. One of the methods used in enhancing reproductive performance in sheep breeding is melatonin administration.

**Aim:** This study aimed to evaluate the impact of melatonin application on reproductive performance in sheep by meta-analysis according to different factors.

**Methods:** To find eligible studies, PubMed and Web of Science databases were searched. Twenty studies published between 1991 and 2021 were included in the meta-analysis. The effect sizes of pregnancy rate, lambing rate and litter size were calculated according to breeds, production characteristics (dairy-meat breeds) and season (breeding–non-breeding). The study estimated the risk ratio for pregnancy and lambing rates, and standardized mean difference for litter size as effect size.

**Key results:** The melatonin hormone increases the pregnancy rate by 1.07 times and the lambing rate by 1.36 times. The effect size (risk ratio) of the Rasa Aragonesa breed (1.15) for pregnancy rate and the Merino breed (1.65) for lambing rate was higher than the Sarda breed.

**Conclusions:** The positive effect of melatonin was found to be higher in the non-breeding season than in the breeding season for the three reproductive performance traits examined.

**Implications:** This study is a comprehensive research study examining the effect of melatonin application in sheep according to different factors.

## Scientific papers

### Lamb survival and weight at marking may be reduced in ewes lambing on forage oats after grazing lucerne during late pregnancy

Susan M. Robertson ([surobertson@csu.edu.au](mailto:surobertson@csu.edu.au)), Walter Morton, Michael A. Friend, Bruce Allworth and Marie Bhanugopan

Animal Production Science, 19 April 2024 **OPEN ACCESS**

DOI <https://doi.org/10.1071/AN23364>

#### Abstract

**Context:** Grazing of cereal forage crops is perceived as a risk for increased perinatal lamb mortality.

**Aims:** This study evaluated whether grazing oat forage during late pregnancy and/or the lambing period increased lamb mortality compared with grazing a legume (lucerne)-based pasture.

**Methods:** Merino ewes (n = 636) were allocated to two replicates of two litter sizes (singles or twins), which grazed the following three forage treatments: either legume-based pasture or oat forage (*Avena sativa*) from 42 days before and throughout a 4-week lambing period, or a legume-based pasture until 9–12 days pre-lambing before grazing oats throughout the lambing period. All groups were offered a calcium, magnesium and sodium mineral supplement to reduce the risk of deficiency.

**Key results:** Lamb survival to marking was similar for ewes grazing legumes (84.2 ± 1.94%) or oat forage (78.5 ± 1.94%) throughout, but was reduced (P = 0.022) for ewes that grazed oats only during the lambing period (71.0 ± 1.94%) compared with those that remained on legumes. The latter was associated with a greater (P = 0.016) loss of condition score in the ewes. The weight of lambs at marking age was 2 kg higher (P ≤ 0.05) when grazed on legume-based pasture during the 4 week lambing period rather than oats. Minimal ewe mortality (0.47%) occurred, no metabolic disease was observed and few ewes (1.3%) required assistance at parturition. None of the sampled ewes was subclinically deficient in calcium or magnesium.

**Conclusions:** The study indicates lamb survival was not reduced by grazing oats for an extended period throughout late pregnancy and lambing. Further research is required to determine whether the recorded reduction in lamb survival from grazing oats only during lambing occurs consistently.

**Implications:** Ewes may safely graze oat forage throughout late pregnancy and lambing when offered a calcium, magnesium and salt supplement, without this increasing perinatal lamb mortality relative to a legume-based pasture, but there may be a penalty in lamb growth rates and loss of ewe condition, and lamb survival may be reduced with an abrupt change to oats for the lambing period.

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### Climate-influenced performance and offspring development of Merino sheep in a dry temperate-cold valley

Edgar Sebastian Villagra ([villagra.sebastian@inta.gob.ar](mailto:villagra.sebastian@inta.gob.ar)), Esteban Ricardo Jockers, Víctor Hugo Medina, María Mercedes Odeón and Octavio A. Bruzzone

Journal of Thermal Biology Volume 121, April 2024

DOI <https://doi.org/10.1016/j.jtherbio.2024.103832>

#### Highlights

- Growth curves of Merino sheep in a southern Argentine valley were characterized using time series data.
- A differential equation curve linked growth to temperature, age, sex, origin, and pregnancy status.

- Relocating sheep to the valley increased average weight by 1 kg; offspring exceeded mothers by 17 kg.
- Optimal temperatures (15.7+/-0.56 °C for growth rate, 8.7+/-6.3 °C for weight) highlighted climate's role in development.

### Abstract

This study aims to explore the effects of climate on the performance and offspring development of aged Merino sheep relocated from an arid, cold environment with harsh grazing conditions to a dry, temperate-cold valley with irrigated pasture production. We utilized time series data from merino sheep in a dry temperate-cold climate in southern Argentina to characterize their growth curves, assess the impact of climate on performance, and compare offspring growth with maternal growth. Our approach involved developing a dynamic model, a non-autonomous differential equation growth curve based on the widely used Brody model. The model considered variables such as local temperature, age, sex, origin, and pregnancy status to determine the optimal combination of parameters for sheep growth in our dataset. The results have shown that moving the old sheep from the steppe to the valley resulted in an increase of an average of 1 kg in weight, but their offspring had an asymptotic weight of 65 kg, 17 kg more than their mothers. The optimum temperature for the growth rate was 15.7+/-0.56 C and 8.7+/-6.3C for the asymptotic weight.

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### TMT-based quantitative proteomic analysis of serum from domestic sheep in early pregnancy

Yujun Ren, Zhunxuan Wang, Yishan Sun, Hongbin Gong, Su Xie, Ruonan Gao, Xin Chen, Qingchun Li, Shihao Lu, Tao Huang ([taohuang100@sina.com](mailto:taohuang100@sina.com)) and Min Yang ([yangmindk@163.com](mailto:yangmindk@163.com))

Animal Production Science, 1 May 2024

DOI <https://doi.org/10.1071/AN22445>

### Abstract

**Context:** Timely pregnancy diagnosis is critical for reducing non-production days and improving the reproductive efficiency of sheep flocks.

**Aims:** The aim of this study was to investigate the serum proteomic profile of ewes in different gestational stages and explore the potential of differentially expressed proteins as biomarkers for early gestation.

**Methods:** Serum samples were collected from two groups: pregnant sheep (n = 4) and non-pregnant sheep (n = 4) on Day 14 after mating. The differentially expressed proteins were detected using tandem mass-tag (TMT) labelling with liquid chromatography tandem-mass spectrometry. The differentially expressed proteins were confirmed using enzyme-linked immunosorbent assay (ELISA). Furthermore, six selected proteins were evaluated in ewes (n = 35) on Day 14 from mating by using ELISA to assess their potential as biomarkers for early pregnancy. Receiver-operating characteristic (ROC) curves were used to analyse the diagnostic accuracy of these proteins.

**Key results:** Twenty proteins, of a total of 555 proteins detected, showed differential expression between pregnant and non-pregnant sheep. From the ROC-curve data, CHI3L1 (AUC = 0.992), PSMB4 (AUC = 0.976) and LGALS3BP (AUC = 0.844) had high predictive value in the diagnosis of early pregnancy.

**Conclusions:** In this study, CHI3L1, PSMB4 and LGALS3BP were found to be differentially expressed proteins in the serum of pregnant sheep. Therefore, these three proteins carry a high probability as candidate biomarkers for early gestational embryo attachment in ewes.

**Implications:** Early pregnancy diagnosis enables timely identification of non-pregnant ewes, resulting in optimised resource allocation and enhanced economic benefits for farmers by reducing production costs.

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## A randomized control trial investigating the effectiveness of a commercial pneumonia vaccine (Part I): Pre-weaned lambs

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Small Ruminant Research, Volume 234, May 2024 **OPEN ACCESS**

DOI <https://doi.org/10.1016/j.smallrumres.2024.107268>

### Highlights

- Effectiveness of an ovine pneumonia bacterin given to pregnant ewes to increase colostral immunity in their pre-weaned lambs.
- Bacterin did not reduce pneumonia treatment rate, crude or pneumonia mortality, or improve weight gain from birth to weaning.
- Significantly higher pneumonia treatment rates, crude and pneumonia mortality rates in ram lambs compared to ewe lambs.

### Abstract

The objective of this controlled vaccine field trial was to determine the effectiveness of a commercial bacterin in increasing colostral immunity to reduce the risk of bacterial pneumonia in pre-weaned lambs in a commercial sheep operation. Pregnant ewes were randomly allocated to vaccination group (Ovipast™ Plus bacterin, n = 1807; unvaccinated, n = 1812). Ewe vaccination did not significantly ( $P > 0.05$ ) improve lamb pneumonia treatment rates, crude or pneumonia specific mortality rates, or body weight gain. Interestingly, as birth weight increased in lambs from vaccinated ewes, they gained significantly more than lambs from unvaccinated ewes ( $P = 0.01$ ). There was no difference in culture results from pneumonic lung samples for either *Mannheimia haemolytica* ( $P = 0.89$ ) or *Bibersteinia trehalosi* ( $P = 1.00$ ) between lambs from vaccinated and unvaccinated ewes. The results of this study suggest that there was no animal health and welfare benefit from vaccinating ewes with the Ovipast™ Plus bacterin prior to parturition to boost colostral immunity and improve health and growth in their lambs.

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## A randomized control trial investigating the effectiveness of a commercial pneumonia vaccine (Part II): Weaned lambs

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Small Ruminant Research, Volume 234, May 2024 **OPEN ACCESS**

DOI <https://doi.org/10.1016/j.smallrumres.2024.107269>

### Highlights

- Determining the effectiveness of an ovine pneumonia bacterin (Ovipast™ Plus) in reducing pneumonia in weaned lambs.
- Vaccination did not reduce pneumonia treatment rates, crude or case specific pneumonia mortality, or improve weight gain.
- Timing of vaccination should be further investigated.
- Weaning weight is an important predictor of the future health of a lamb.

### Abstract

The objective of this randomized controlled vaccine field trial was to determine the effectiveness of a commercial respiratory bacterin, Ovipast™ Plus, administered to feedlot lambs at weaning, approximately 8 wk of age, to improve animal health, growth performance, and carcass traits. Lambs were weaned, weighed, and sorted into groups by sex and the previous Ovipast™ Plus vaccination status of their mother, because this is stage 2 of that ongoing trial (Gardner et al., 2023). Lambs born to vaccinated ewes were vaccinated

with the Ovipast™ Plus bacterin and revaccinated 3–5 wk later. Lambs born to unvaccinated ewes were not vaccinated. During the growing and finishing phases of the trial, vaccination did not reduce pneumonia treatment rates, crude or pneumonia specific mortality rates, or improve growth rates. Vaccinated lambs had a lower carcass fat cover ( $P < 0.001$ ) and a 1.33 times increased odds of yielding a Grade 1 carcass compared to unvaccinated lambs ( $P = 0.01$ ). Vaccination reduced carcass fat cover and improved yield grades, but it had no beneficial effect on disease rates or growth performance, suggesting a limited economic benefit of vaccinating lambs post-weaning, which were borne from ewes vaccinated with Ovipast™ Plus during gestation.

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### The use of sodium caseinate in the freezing of sheep semen

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Reproduction in Domestic Animals, Volume 59, Issue 5 May 2024

DOI <https://doi.org/10.1111/rda.14573>

#### Abstract

The aim of this study was to assess the addition of 2% sodium caseinate in a commercial egg yolk-based medium in frozen ovine semen. Eight Dorper males were used for the study. The ejaculate was divided into two portions and frozen without (G1) or with the addition of 2% sodium caseinate (G2). Kinetic parameters were evaluated using CASA (computer-assisted sperm analysis), and membrane and acrosome integrity as well as oxidative stress were assessed using flow cytometry. After thawing, a thermoresistance test was conducted at time points T0 and T90. For the fertility test, 100 ewes were inseminated with semen from two rams selected based on in vitro parameters, one with good post-thaw quality (+70% total motility) and the other with low post-thaw quality (-55% total motility). For the fertility test, the females were divided into 4 groups for insemination: low-quality ram without caseinate (GBS = 25) and with caseinate (GBC = 25), and high-quality ram without caseinate (GAS = 25) and with caseinate (GAC = 25). Regarding the results of sperm kinetics, there was a statistically significant difference in the parameters of average path velocity (VAP) and curvilinear velocity (VCL) between the group frozen with BotuBov and the group with added caseinate. At time point T90, straight-line velocity maintained a trend ( $p < .06$ ), with BotuBov® (BB group) being superior to caseinate this time, and in the linearity parameter, caseinate was superior to BotuBov®. Flow cytometry analysis showed no difference between any of the evaluated tests. In the fertility test, there was no statistically significant difference in the pregnancy rate between the BotuBOV® group (23%, 11/48) and the sodium caseinate group (BC group) (33%, 17/52), and no differences were observed in the male versus diluent interaction ( $p = .70$ ). In conclusion, sodium caseinate supplementation did not influence sperm kinetic parameters and the fertility of sheep.

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### Efficacy of a lidocaine-impregnated elastrator band for castration and tail docking in lambs

Steven M. Roche ([roche@uoguelph.ca](mailto:roche@uoguelph.ca)), Brenda J. Ralston, Barbara Olson, Brendan D. Sharpe, Crystal Schatz, Kendall Beaugrand, Joseph A. Ross, Madeleine A. Broomfield, Nicolas Allan and Merle Olson

Animals Volume 14, Issue 10, May 2024 **OPEN ACCESS**

DOI <https://doi.org/10.3390/ani14101403>

#### Simple Summary

Tail docking and castration are common procedures performed in lambs but are considered painful. Mitigation of the pain associated with these procedures is difficult, especially when using rubber ring

castration. The objectives of this study were to compare castration and tail docking efficacy between lidocaine-impregnated ligation bands (LLBs) and control bands (CBs) under field conditions and identify the benefits of pain control provided by LLBs. In this study, 238 male lambs were randomly assigned to receive either LLBs or CBs on both their tail and scrotum. CBs and LLBs were both 100% effective with respect to casting success of the tail and scrotum. Lambs receiving LLBs gained more weight from d -3 to 7 following application, which may be an indication of pain control during the first week following band application. However, there were no differences observed in average daily gain over the entire study period.

#### **Abstract**

The primary objective of this study was to demonstrate the non-inferiority between lidocaine-impregnated ligation bands (LLBs) and control bands (CBs) with respect to the efficacy of castration and tail docking. Secondary objectives were to compare castration and tail-docking success, evaluate local site reactions, and compare average daily gain (ADG) between the treatment groups. A total of 238 male lambs were enrolled and randomly assigned to receive LLBs or CBs on their tail and scrotum. Lambs were weighed, had a health assessment, and the band site was observed on -3, 7, 14, 21, 28, 35, and 42 days after the bands were applied. A linear regression model was built to assess average daily gain, whereas a repeated measures model was used to evaluate body weight differences at each of the measured timepoints. Furthermore, logistic regression models were used to evaluate associations with casting outcomes. Few differences were noted between treatment groups with respect to casting success for the scrotum and tail and ADG over the entire experimental period. Non-inferiority calculations demonstrated no differences in tail docking and scrotal casting success, with casting occurring for the majority of animals by d 21 and d 42 for castration and tail docking, respectively. However, lambs receiving LLBs gained more weight from d -3 to 7 (+0.03 kg/d; 95% CI: 0 to 0.07), which may be an indication of effective pain control during the first week following band application. Overall, the use of an LLB does not affect the time to successful casting of the tail and could improve short-term growth when compared to a control band. Further studies are needed to compare LLBs to multimodal methods of pain relief.

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### **Ewe culling in New Zealand: an interview study of 38 farmers**

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New Zealand Journal of Agricultural Research, Volume 67, Issue 3, June 2024 **OPEN ACCESS**

DOI <https://doi.org/10.1080/00288233.2023.2280624>

#### **Abstract**

Removal of ewes from a flock before the end of their productive life, sometimes described as ewe wastage, can potentially lead to reduced flock productivity. While the main reasons for culling ewes are largely known, their relative importance to New Zealand farmers and farmers' rationale behind their culling decisions are not. Therefore, this study involved semi-structured interviews with 38 sheep farmers from throughout New Zealand to explore their ewe culling decisions. Farmers consistently culled mixed-age and two-tooth ewes who failed to become pregnant or who had a vaginal prolapse. For other culling reasons, farmers' use of them and their rationale for doing so was diverse and varied between farmers based on ewe age-group, severity, season, perceived economic consequences and farmers' personal preference. This diversity indicates that there is scope for some farmers to carefully evaluate some of their culling decisions.

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### **The influence of the number of lambs present on the suckling behaviour of triplet-rearing ewes at pasture**

Rene A. Corner-Thomas ([r.corner@massey.ac.nz](mailto:r.corner@massey.ac.nz)), Rachel Shanks and Ngaio J. Beausoleil

DOI <https://doi.org/10.1080/00288233.2023.2277231>

### Abstract

This study examined the suckling behaviour of triplet-rearing ewes for three days post-parturition. Twenty-six ewes were enrolled with 11 being observed for the entire 3-days post-lambing. The behaviour of the ewe, number of lambs present at the end of the event and the behaviour that terminated the event were recorded for each suckling event. The mean suckling event duration increased when additional lambs were present at the end of the suckling event. Ewes that had observations across all three days showed no change in the number of suckling events over time, but suckling events tended to be shorter on day 3 than on days 1 or 2. On day 1 more suckling events were terminated by the ewe walking away from her lambs than on days 2 and 3. The odds of a ewe walking away to terminate the suckling event were greater when three lambs were present compared with two. Ewes showed more inactive behaviours when more lambs were present at the end of the suckling event. The results partially supported the hypothesis that the ewe would be more likely to terminate a suckling event when three lambs were attempting to suck compared with one or two lambs.

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### Maternal nutrition and fetal imprinting of the male progeny

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Animal Reproduction Science, Volume 265, June 2024

DOI <https://doi.org/10.1016/j.anireprosci.2024.107470>

### Highlights

- Limited information exists on the effect of maternal nutrition on the male offspring.
- Maternal nutrition affects hypothalamus-pituitary axis, hormones, testis and semen.
- Colostrum intake and male offspring is an emerging field of research.
- Although nutritional requirements and genetic potential have been well documented for livestock species, these figures are not comprehensively defined for the laboratory animals.
- The initial stages of development of reproductive organs occur before birth in livestock species; however, part of development of reproductive organs in rodents occurs during lactation.

### Abstract

The global population as well as the demand for human food is rapidly growing worldwide, which necessitates improvement of efficiency in livestock operations. In this context, environmental factors during fetal and/or neonatal life have been observed to influence normal physical and physiological function of an individual during adulthood, and this phenomenon is called fetal or developmental programming. While numerous studies have reported the impact of maternal factors on development of the female progeny, limited information is available on the potential effects of fetal programming on reproductive function of the male offspring. Therefore, the objective for this review article was to focus on available literature regarding the impact of maternal factors, particularly maternal nutrition, on reproductive system of the male offspring. To this end, we highlighted developmental programming of the male offspring in domestic species (i.e., pig, cow and sheep) as well as laboratory species (i.e., mice and rat) during pregnancy and lactation. In this sense, we pointed out the effects of maternal nutrition on various functions of the male offspring including hypothalamic–pituitary axis, hormonal levels, testicular tissue and semen parameters.

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### Effects of short and long – term nutrition and progesterone supplementation on the success of fixed – time artificial insemination in the ewe



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Animal Reproduction Science, Volume 265, June 2024

DOI <https://doi.org/10.1016/j.anireprosci.2024.107477>

### Highlights

- Long and short - term nutrition are important causes of variability in AI programs.
- High long – term nutrition improved fertility and fecundity whilst estrus was advanced.
- High short – term nutrition during the pessary period only improved fertility.
- Pessary replacement improved synchrony but reproductive outcomes were not affected.
- Both long – term nutrition and pessary replacement affected follicle number and size.

### Abstract

The success of fixed - time artificial insemination (AI) in the ewe is variable due to poor synchrony of estrus. We examined the effects of long-term nutrition (LTN; low, medium, high - 6 months), short-term nutrition (STN; 1.0 M, 1.5 M – 14 days) and progesterone supplementation (P; single pessary, replacement on Day 9) on synchrony and reproductive outcomes. High LTN advanced ( $P < 0.05$ ) estrus, increased ( $P = 0.06$ ) pregnancy (range 71.1 – 81.1%) and improved ( $P < 0.01$ ) litter size (range 1.30 – 1.50). STN increased ( $P < 0.05$ ) pregnancy (79.0 versus 72.3%) but not litter size or timing of estrus. A LTN x STN interaction ( $P < 0.01$ ) for time of estrus indicates that the effects of LTN were moderated by STN depending on the level of LTN. Pessary replacement delayed ( $P < 0.05$ ) the onset of estrus, improved synchrony but did not affect pregnancy or litter size. High LTN increased ( $P < 0.05$ ) the number of large ( $\geq 3.8$  mm) and medium - size follicles (2.0 – 3.7 mm) but the diameter of large follicles tended to be reduced ( $P = 0.08$ ) on Day 12. STN did not affect follicle number or size whilst P reduced ( $P < 0.05$ ) the diameter of large follicles on Day 12 (4.83 versus 5.10 mm) and increased the number of medium – size follicles (3.56 versus 2.74 mm). In conclusion, both LTN and STN are major sources of variability in AI programs whilst pessary replacement has potential to reduce variability.

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## The curse of the firstborn: Effects of dam primiparity on developmental programming in ruminant offspring

Allison M. Meyer ([meyerall@missouri.edu](mailto:meyerall@missouri.edu)) and Colby A. Redifer

Animal Reproduction Science, Volume 265, June 2024

DOI <https://doi.org/10.1016/j.anireprosci.2024.107469>

### Highlights

- The first parity of ruminant females has negative effects on offspring.
- Offspring are affected in the fetal, perinatal, and pre-weaning periods.
- Offspring of first-parity dams have decreased growth and survival pre-weaning.
- More research is necessary to determine post-weaning effects of the first parity.
- First use of reproductive tissues likely contributes to the effects of primiparity.

### Abstract

The first parity, or first pregnancy, of ruminant females has negative effects on offspring during fetal, perinatal, and pre-weaning periods which ultimately lead to diminished pre-weaning productivity. Offspring born to primiparous ruminant females can have decreased fetal and pre-weaning growth, resulting in lower body weights at birth and weaning in cattle, sheep, and goats. Moreover, mortality is greater during both neonatal and pre-weaning periods. Insults during these critical developmental windows likely also have long-

term consequences on first-parity offspring through developmental programming, but less research has been done to investigate effects in the post-weaning period. Many potential physiological, metabolic, and behavioral mechanisms exist for the outcomes of dam primiparity. Although competition for nutrient partitioning between maternal and fetal growth or lactation is often cited as a major contributor, we hypothesize that the most important mechanism causing most first-parity outcomes is the relative physiological inexperience of reproductive tissues such as the uterus and mammary gland during the first pregnancy and lactation, or a “first use theory” of tissues. More research is necessary to explore these areas, as well as if primiparous dams respond differently to stressors than multiparous dams, and if stress during the first parity affects subsequent parities.

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### Foetal programming in sheep: Reproductive and productive implications

Júlio Otávio Jardim Barcellos ([julio.barcellos@ufrgs.br](mailto:julio.barcellos@ufrgs.br)), Daniele Zago, Helena Xavier Fagundes, Gabriel Ribas Pereira and Everton Dezordi Sartori

Animal Reproduction Science, Volume 265, June 2024

DOI <https://doi.org/10.1016/j.anireprosci.2024.107494>

#### Highlights

- The formation of meat and wool in the fetal period of sheep is susceptible to changes imposed in the uterine environment.
- Maternal nutrition is known as one of the main factors influencing fetal growth and postnatal development.
- Both maternal malnutrition and excessive nutrition are harmful to fetal development.
- The mechanisms of change in the fetus are mainly the arrival of nutrients via the placenta and epigenetics.

#### Abstract

The aim of this study was to evaluate the effects of pregnant ewe nutrition on the performance of offspring in terms of meat, wool production, and reproduction. Foetal programming in sheep has focused on several aspects related to foetal growth, postnatal production, behaviour, and immunological performance. Currently, significant efforts are being made to understand the endocrine, metabolic, and epigenetic mechanisms involved in offspring development. Current studies have not only evaluated the foetal period, despite the pre-conception parental nutrition has demonstrated an effect on the foetal, embryonic, and pre-implantation periods and can generate permanent effects in the foetal and postnatal phases. The performance of offspring is the result of interactions between the genome, epigenome, and environmental interventions during conception. Several factors influence the expression of phenotypic characteristics in progenies; however, this study focused on presenting data on the effect of pregnant ewe nutrition alone on foetal growth and the productive aspects of their offspring.

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### Changes on corpus luteum structure and progesterone synthesis pathway after hCG or GnRH treatment during the early luteal phase in sheep

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Animal Reproduction Science, Volume 265, June 2024

DOI <https://doi.org/10.1016/j.anireprosci.2024.107474>

## Highlights

- GnRH or hCG treatments generate CL with different histo-functional characteristics.
- The serum P4 concentration increased in ewes treated with hCG that generated an accessory CL.
- hCG treatment generated an accessory CL with greater number of large luteal cells.
- 3  $\beta$ -HSD, STAR and Cyt- P450 were higher in accessory CL of ewes treated with hCG.

## Abstract

This study investigated the effect of hCG or GnRH on structural changes of the corpora lutea (CL) and the regulation of the expression of steroidogenic enzymes involved in P4 secretion in post-ovulatory (po-CL) and accessory CL (acc-CL). Sixty-four ewes were assigned to three groups receiving: 300 IU of hCG (hCG) or 4  $\mu$ g Buserelin (GnRH) or 1 mL of saline solution (Control) on Day (d) 4 post artificial insemination (FTAI). Laparoscopic ovarian were performed on d 4, 14 and, 21 post-FTAI to determine the numbers of CL. Blood samples were collected for serum LH and P4 analysis. On d 14 post-FTAI, both CL were removed from the ovary to determine large luteal cell (LLC) number and to evaluate the expression of steroidogenic enzymes (HSD3B1, STAR, CYP11A1). Only hCG and GnRH treated ewes generated acc-CL. The LLC in both po- and acc-CL were significantly greater in the hCG group compared to GnRH and Control groups ( $P < 0.05$ ). Overall, hCG group showed the greatest immunodetection of HSD3B1 and STAR in both po- and acc-CL ( $P < 0.05$ ). mRNA expression of HSD3B1, STAR and CYP11A1 in the acc-CL tended to be greater in hCG group than in GnRH group ( $P < 0.1$ ). The LH concentration was increased in GnRH group ( $P < 0.05$ ) and P4 concentration was greater in hCG group compared to the other groups ( $P < 0.05$ ). In conclusion, administration of hCG has a notably impact on acc-CL development and the expression of steroidogenic enzymes compared to GnRH treatment in ewes. This leads to elevated P4 concentration and improved luteal function.

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## Cooling rate modifies the location of aquaporin 3 in spermatozoa of sheep and goat

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Theriogenology, Volume 223, 15 July 2024 **OPEN ACCESS**

DOI <https://doi.org/10.1016/j.theriogenology.2024.04.008>

## Highlights

- This is the first study identifying AQP3 in spermatozoa of goat.
- Cooling rate modifies the location of AQP3 in spermatozoa of sheep and goat.
- Changes in the location of AQP3 appears to be related to sperm cryosurvival.

## Abstract

The freeze-thawing process induces osmotic changes that may affect the membrane domain location of aquaporins' (AQP) in spermatozoa. Recent studies suggest that changes in AQP3 localization allows better sperm osmo-adaptation, improving the cryoresistance. Ultra-rapid freezing is an alternative cryopreservation technique that requires less equipment than conventional freezing, and it is faster, simpler and can be used in the field. This study aimed to determine the influence of freezing-thawing rates (slow (control) vs. ultra-rapid) on AQP3 expression and location in the spermatozoa from small ruminants (sheep and goats) and its relationship with sperm cryo-damage. Spermatozoa were collected from 10 Merino rams and 10 Murciano-Granadina bucks. The presence and distribution of AQP3 were assessed by Western blotting and immunocytochemistry (ICC), employing a commercial rabbit polyclonal antibody. Sperm motility was CASA system-analyzed, and membrane and acrosome integrity assessed by fluorescence (PI/PNA-FITC). Western blotting did not detect a significant effect of freezing-thawing rate on the amount of AQP3 while ICC found freezing-thawing rate affecting AQP3 location ( $P < 0.05$ ). In both species, the percentages of spermatozoa

showing AQP3 in the post-acrosome region, mid-piece, and principal piece of the tail were greater in samples cryopreserved by slow freezing-thawing (control) than ultra-rapid freezing-thawing rates ( $P < 0.05$ ). Spermatozoa cryopreserved using ultra-rapid freezing-thawing showed decrease motility, plasma membrane, and acrosome integrity ( $P < 0.05$ ), which might be related, at least in part, to a lower expression of AQP3. In conclusion, the cooling rate modifies the location of AQP3 in spermatozoa of sheep and goat, which might be associated with sperm cryosurvival.

## Upcoming events

Date	Event	Location
5 June 2024	<a href="#">Managing the late break</a> Agriculture Victoria	Edenhope, Vic
5 June 2024	<a href="#">MerinoLink 2024 Conference</a> MerinoLink	Bathurst, NSW
11 June 2024	<a href="#">Optimising ewe lamb outcomes and Preg scanning in extensive sheep flocks</a> MA SRSP & PDS Program	Webinar
12 June 2024	<a href="#">Maidens, Measurement &amp; Merch Field Day</a> MLA & QDAF	Ilfracombe, Qld
13 June 2024	<a href="#">EIDs for sheep – and what you need to do to comply</a> AWI Extension NSW	Webinar
19 June 2024	<a href="#">BestWool/Best Lamb and Better Beef Conference</a> Agriculture Victoria, AWI Extension Vic	Ballarat, Vic
19 June 2024	<a href="#">EID – does it really add value?</a> MLA Productivity & profitability Webinar Series	Webinar
25 & 26 June 2024	<a href="#">Livestock Advisor Essentials – Building blocks of business</a> MLA	Sydney, NSW
25 June 2024	<a href="#">Working on Worm: sheep parasite management workshop – pilot</a> ParaBoss	Clare, SA
26 June 2024	<a href="#">Livestock Matters</a> WALRC	Kojonup, WA
5 July 2024	<a href="#">BredWell FedWell Sheep workshop</a> MLA	Cootamundra, NSW