

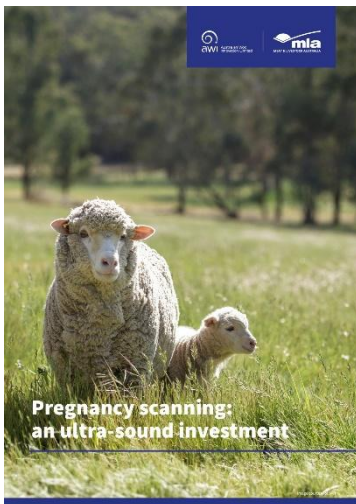
DECEMBER 2024/JANUARY 2025

Sheep reproduction RD&A alert

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

Pregnancy scanning is an essential tool for improved ewe and lamb survival. Research shows pregnancy scanning in sheep provides an average increase in profit of \$5.55/ewe scanned.

MLA and AWI have released a range of resources to help sheep producers scan and manage pregnant ewes.



The resources are the result of an MLA and AWI co-funded project that aimed to improve lamb survival and reproductive rates in the Australian sheep flock through better adoption of pregnancy scanning.

The resources include:

- [The value of pregnancy scanning](#)
- [Ewe scanning and management checklist](#)
- [Pregnancy scanning: an ultrasound investment](#)
- [Resource guide for sheep reproduction](#)
- [The value of pregnancy scanning: a benefit-cost analysis](#)

Program coordinator

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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.

Wean-a-Lamb: Reducing weaning stress by optimising weaning management strategies

MLA is seeking Full Applications from individuals, organisations or project teams with the capability to identify and evaluate non-invasive weaning management strategies which reduce weaning stress in lambs and optimise the weaning process. This proposal will encompass research, development and adoption (RD&A) activities in the Sheep Productivity sector that achieve outcomes in line with the priorities of the Red Meat Panel.

Deadline for submissions

Full proposals must be received by MLA before 5.00pm AEDT on Wednesday 12th February 2025. Late proposals will not be accepted.

Use MLA's full proposal template available [here](#), and submit proposals electronically to MLA at projectcall@mla.com.au.

Applicants should carefully review the [MLA Project Funding Application Guidelines](#) before completing their preliminary or detailed project application.

[Request for Tender – Wean-a-lamb](#)

Further information

If you have questions about these terms of reference, please contact Dr Daniel Forwood, Project Manager – Sheep and Goat Productivity (dforwood@mla.com.au).

Scientific papers

Peripartum energy metabolism of prolific ewes and their progeny in response to prepartum feeding and litter size

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Animal, Volume 19, Issue 1, January 2025 **OPEN ACCESS**

DOI <https://doi.org/10.1016/j.animal.2024.101382>

Highlights

- How prolific ewe energy metabolism is affected by litter size and dietary energy?
- Ewe intake was inversely related to litter size in the last week of gestation.
- Ewes carrying larger litters mobilized their adipose tissue more extensively.
- Higher dietary energy had positive effect on the metabolic status of prolific ewes.
- Providing better-adapted diets to the energy requirements of highly prolific ewes.

Abstract

In late gestation, the increased energy demand to support the rapid fetal growth can induce an acute negative energy balance associated with a high risk of pregnancy toxemia, especially for prolific ewes (carrying two or more fetuses). The current study was conducted to evaluate the effects of dietary energy during the last 6 weeks prepartum on the energy metabolism dynamic responses and the newborn lamb metabolic profile in prolific ewes. Forty-five crossbred (Dorset × Romanov) ewes were randomly assigned to 1 of 3 dietary energy densities: CTRL: 8.36 MJ of metabolizable energy (ME)/kg DM for weeks –6 to –3 relative to lambing, followed by 10.01 MJ ME/kg DM for weeks –2 and –1; EINCR: weekly increments from 7.99 to 12.69 MJ ME/kg DM; and EHIGH: 10.87 MJ ME/kg DM for the last 6 weeks of gestation. Dry matter intake (DMI; daily) and energy intake (MEI; daily), blood concentrations of beta-hydroxybutyrate (BHB) and glucose (every other day), as well as plasma concentrations of non-esterified fatty acids (NEFAs; weekly), BW and body condition score (BCS; twice weekly) were determined throughout the experimental period. The effect of time on DMI and MEI varied based on dietary energy densities and litter size. During the last week before lambing, DMI decreased for EHIGH and EINCR ewes, as well as for ewes carrying quadruplets. On average, during week –5 to week –2 of gestation, EHIGH promoted the highest DMI and MEI, resulting in an increase of 0.16 BCS points between the pretreatment week and week –1 prepartum. In contrast, during the same period, BCS of CTRL and EINCR ewes decreased by 0.35 and 0.19 points, respectively, which was reflected by higher NEFA concentrations compared with EHIGH ewes. The greater litter size was also associated with decreased BCS. Compared with twin-bearing ewes, for which BCS remained stable, BCS decreased for triplet-, and even more intensively for quadruplet-bearing ewes. Consequently, plasma NEFA concentrations were higher for quadruplet-bearing ewes than for twin- and triplet-bearing ewes, especially during the last week prepartum. Blood BHB concentrations increased from 0.63 to 1.13 mM over time. Regardless of dietary treatments, in the last week prepartum, blood BHB concentrations increased for quadruplet-bearing ewes, being 2.6 and 2.2 times greater than for twin- and triplet-bearing ewes,

respectively. These results suggest that dynamic responses of energy metabolism in late gestation of prolific ewes are influenced by both dietary energy level and litter size.

Short supply of high levels of guanidine acetic acid, alters ovarian artery flow and improves intraovarian blood perfusion area associated with follicular growth in sheep

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Animals, Volume 15, Issue 2 January 2025 **OPEN ACCESS**

DOI <https://doi.org/10.3390/ani15020143>

Simple Summary

AAs are crucial for various reproductive functions, including hormone synthesis and follicular development. However, their use in ruminants is limited by ruminal degradation. GAA, a precursor to creatine, offers a promising alternative as it bypasses ruminal breakdown to a significant extent. GAA has shown positive effects on growth performance and feed efficiency in cattle and sheep. While research in this area is still limited, preliminary findings suggest that GAA may improve placental vascularization in cows. Further research is needed to fully understand the effects of GAA on reproductive processes in ruminants. In this study, GAA supplementation was shown to influence ovarian function and follicular development but did not improve overall pregnancy outcomes in ewes.

Abstract

Guanidinoacetic acid (GAA), a precursor of creatine, has a recognized effect on ruminant performance when used as a dietary supplement. However, its impact on reproductive response remains to be elucidated. Therefore, this study aimed to contribute initially to this area by supplementing the diets of ewes with a high dose of GAA, evaluating its effects on reproductive response. Twenty adult sheep had their estrus synchronized using an MPA sponge, eCG, and PGF2 α . After estrus detection ewes were mated. For 10 days until mating, ewes were grouped in groups of baseline diet (BSD; n = 10) and GAA diet (GAAD; n = 10), which was the BSD with daily 0.9 g/kg DM of GAA. After the eCG + PGF2 α dose, the GAAD group exhibited an increase in the peak diastolic and pulsatility of the ovarian artery, a reduction in the systolic/diastolic peaks ratio, and a larger intraovarian blood perfusion area. A greater depletion of follicles with <3 mm was observed in the GAAD group and a higher number of follicles \geq 3 mm. No differences were observed between the diets respect to pregnancy, and twin rates. Thus, a high GAA supply before mating significantly alters ovarian vasculature and improves follicular growth in ewes but does not affect the pregnancy rate.

The economic optimum mob size at lambing for triplet-bearing Maternal and Merino ewes across southern Australia

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Animal Production Science, Volume 65, Issue 2, January 2025 **OPEN ACCESS**

DOI <https://doi.org/10.1071/AN24334>

Abstract

Context. Lambing triplet-bearing ewes in smaller mobs significantly increases lamb survival.

Aims. This paper reports economic analysis to assess the optimum mob size for triplet-bearing ewes during lambing.

Methods. The analyses considered scenarios for Merino and non-Merino (Maternal) flocks where producers subdivided lambing paddocks using permanent fencing or where ewes were re-allocated within existing paddocks on the basis of pregnancy status.

Key results. The optimum mob sizes for triplet-bearing ewes during lambing were affected by ewe breed, stocking rate, lamb price and the target return-on-investment if subdividing paddocks. The optimum mob size for triplet-bearing Maternal and Merino ewes was between 27% and 40% of the optimum for twin-bearing ewes and this was similar for scenarios where paddocks were subdivided, or where ewes were re-allocated within existing paddocks. At the standard lamb price of AUD\$7/kg carcass weight, the economic return from adjusting the relative mob size of triplet-bearing ewes was AUD\$2.05 per multiple-bearing or AUD\$14.20 per triplet-bearing Maternal ewe and AUD\$0.54 per multiple-bearing ewe or AUD\$5.70 per triplet-bearing Merino ewe.

Conclusions. Overall, these analyses demonstrated that reducing mob size at lambing can be a profitable strategy for improving survival of triplet-born lambs, depending on the current size of lambing mobs.

Implications. As reported previously for single- and twin-bearing ewes, it is difficult to provide generic recommendations to producers for the optimum mob size of triplet-bearing ewes at lambing because optimum mob size was dependent on several enterprise-specific factors.

Effects of breeding for short-tailedness in sheep on parameters of reproduction and lamb development

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Veterinary Medicine and Science, Volume 11, issue 1, January 2025 **OPEN ACCESS**

DOI <https://doi.org/10.1002/vms3.70138>

Abstract

Background. Sheep's tail docking is a widespread practice, which is banned or critically discussed in some countries to improve animal welfare.

Objective. The aim was to determine the influence of breeding for short-tailedness (ST) or long-tailedness (LT) in sheep on the development of reproduction parameters and lamb performance.

Method. One hundred forty-nine ewes were mated with four rams according to tail length. Pregnancy and pregnancy loss rates were calculated. During pregnancy, the progesterone levels (P4) of the ewes were measured. The weight and length of the 254 lambs were recorded up to 14 weeks of life. Litter size, placenta weight, sex, stillbirths, vitality, morbidity and mortality of the lambs were also documented.

Results. No significant differences were found for P4 and placental weight for the two mating groups (ST and LT). Although the pregnancy rate for ST was slightly lower (75.71%) than for LT (87.34%), there was only a low significant difference ($p = 0.07$). The sex distribution was 61 (48.80%) male and 64 (51.20%) female lambs in the ST group and 67 (51.94%) male and 62 (48.06%) female lambs in the LT group. The twinning rate was not significantly different (ST 75.20%; LT 75.97%), and no significant difference was found in the average body length and vitality of the lambs. However, LT lambs showed better weight gains that were marginally significant ($p = 0.09$).

Conclusion. This study found no evidence that reproductive parameters or lamb performance were affected by selective breeding based on tail length.

Feed conversion efficiency does not negatively affect young sheep and ewe performance

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Frontiers in Animal Science, Volume 5 2024 **OPEN ACCESS**

DOI <https://doi.org/10.3389/fanim.2024.1480928>

Abstract

Introduction: Improving the feed efficiency (FE) in ruminants offers significant potential for optimizing the use of natural feed resource while simultaneously enhancing food and wool production. However, selecting for FE and high productivity may negatively impact the robustness traits, such as reproduction, health, and fat deposition, indicating potential antagonisms. This study evaluates the relationship between residual feed intake (RFI) and the productivity of yearling and adult ewes in extensive outdoor pastoral systems of three breeds.

Methods: Conducted from 2018 to 2022, the study included three cohorts (2018, 2019, and 2020) of ewe lambs from the Merino (435), Dohne (323), and Corriedale (215) breeds. In their first year, these lambs were phenotyped for feed intake, RFI, methane emissions, body weight and body weight, body condition score, fecal egg count, wool production, rib eye area, and fat thickness. Later, as hoggets or adult ewes, their body weight, body condition score, wool production, and reproductive traits were recorded. To examine the links between FE and performance, two contrasting groups (i.e., low 25% and top 75% quartiles) for RFI were analyzed.

Results and discussion: More efficient animals had similar body weights and weight gains while consuming less feed than the less efficient ones. In addition, the wool production at 1 year of age, the resistance to gastrointestinal parasites (assessed by fecal egg count), and the daily methane emissions were unaffected by RFI group. Although no significant antagonisms were observed between yearling RFI and ewe reproduction, a trade-off with ewe fleece weight was identified. In conclusion, the more efficient animals demonstrated satisfactory performance under the evaluated conditions without compromising body weight, wool production (in yearlings), reproduction, or health.

Negative dietary cation and anion difference supplementation of twin-bearing Merino ewes grazing pasture in late gestation did not affect lamb growth or survival

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Journal of Animal Science, Volume 102 2024 **OPEN ACCESS**

DOI <https://doi.org/10.1093/jas/skae205>

Abstract

Each year in Australia, 53% of lamb mortalities are attributed to dystocia, with subclinical maternal calcium deficiencies likely contributing to dystocia rates. A negative dietary cation and anion difference (DCAD) diet has increased circulating calcium in sheep. Therefore, this study aimed to investigate the effects of supplementing twin-bearing, grazing ewes with a negative DCAD partial mixed ration (PMR) during late gestation on ewe calcium and magnesium concentrations and subsequent lamb growth and survival. On day 120 of gestation (dG), blood samples were collected from 115 twin-bearing Merino ewes and analyzed for glucose, ketone bodies, pH, ionized calcium, and serum calcium and magnesium. On dG 130, ewes were moved into lambing paddocks and placed in the following 2 treatment groups; ewes receiving a positive DCAD PMR (DCAD = 287 mEq/kg DM; n = 58) and ewes receiving a negative DCAD PMR (DCAD = -125 mEq/kg DM; n = 57) fed as a PMR. On dG 140, a blood and urine sample were collected. The urine was tested for pH. Pasture samples were taken on dG 133 and 149 and tested for DCAD and mineral content. When a lamb was 6 to 18 h old, survival, vigor score, liveweight (LW), rectal temperature, blood glucose, and body morphology

were recorded. At 10 d of age, lamb LW and survival were recorded and a milk sample was collected from ewes. At 44 d of age, lamb LW and survival were recorded. The DCAD of the pastures across the 6 paddocks ranged from 598 to 893 mEq/kg DM. There were no differences in lamb survival, weight, or viability at any timepoint ($P > 0.05$). There were no differences in mineral status, metabolic state, or acid–base balance between the positive and negative DCAD-supplemented ewes ($P > 0.05$) during supplementation (dG 140). Supplementing a negative DCAD diet to ewes grazing pasture during late gestation did not improve lamb survival. The blood and urine pH of the negative DCAD-supplemented ewes indicated a mild metabolic acidosis was not reached due to the high DCAD of the pastures. Further research needs to take careful consideration of the DCAD of pasture when designing a negative DCAD supplement in order for it to be effective.

Effects of feeding a negative dietary cation and anion difference diet to twin-bearing Merino ewes in late gestation on parturition outcomes

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Journal of Animal Science, Volume 102 2024 **OPEN ACCESS**

DOI <https://doi.org/10.1093/jas/skae266>

Abstract

In Australia, dystocia is responsible for 53% of lamb mortalities, and calcium deficiencies may be a contributing factor. A negative dietary cation–anion difference (DCAD) diet can increase calcium concentrations in sheep. Therefore, this study aimed to investigate the effects of a negative DCAD diet on metabolic state, mineral status, and parturition duration in ewes compared with those fed a positive DCAD diet. At approximately day 130 of gestation (dG), 71 twin-bearing ewes were placed in the following treatment groups; ewes receiving a positive DCAD TMR (total mixed ration; DCAD of total diet = 281.8 mEq/kg DM; $n = 35$) and twin-bearing ewes receiving a negative DCAD TMR (DCAD of total diet = -89.0 mEq/kg DM; $n = 36$). Urine and blood were sampled on dG 130, 140, and 145, and blood was also sampled at the onset of parturition and 4 h postpartum. Urine was analyzed for pH and blood was analyzed for metabolites, mineral concentration, and acid–base balance. Lambs' liveweight, rectal temperature, blood glucose and lactate, and body morphology were measured. Serum phosphate concentrations at dG 145 were significantly lower for negative DCAD ewes compared with positive DCAD ewes (1.9 ± 0.1 vs. 2.1 ± 0.1 mmol/L, $P = 0.047$). Ionized calcium ($P = 0.09$) and serum magnesium ($P = 0.09$) prepartum were marginally greater in the negative DCAD ewes (1.35 ± 0.06 and 1.06 ± 0.03 mmol/L, respectively) compared with the positive DCAD ewes (1.18 ± 0.08 and 0.98 ± 0.04 mmol/L, respectively). Urine pH was lower in the negative DCAD ewes compared with positive DCAD ewes at both dG 140 (7.38 ± 0.17 vs. 8.10 ± 0.19 , $P = 0.01$) and dG 145 (and 7.20 ± 0.19 vs. 8.25 , $P < 0.01$). The birth interval between the first the second-born lamb was shorter in the negative DCAD ewes compared with the positive DCAD ewes ($P = 0.02$), but no differences in lamb survival or lamb viability ($P > 0.05$) were seen. The negative DCAD diet reduced parturition duration, most likely due to the marginally greater ionized calcium and magnesium concentrations. Despite this improvement, the negative DCAD ewes did not reach urinary acidification, indicating that the marginally significant greater ionized calcium and serum magnesium concentrations were due to the magnesium in the diets and not metabolic acidosis. Further research testing a negative DCAD diet that can achieve the target urine pH is required to determine whether this diet can decrease parturition duration and improve lamb viability.

The effect of repeated lipopolysaccharide endotoxin challenge on immune response of breeding ewes and subsequent lamb performance

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Journal of Animal Science, Volume 102 2024

DOI <https://doi.org/10.1093/jas/skae294>

Abstract

Infectious disease caused by exposure to Gram-negative bacterial endotoxin lipopolysaccharide (LPS) is recognized to suppress female fertility. However, the effect of varying low-dose endotoxin exposure during distinct stages of follicle development on immune response, reproductive performance, and lamb performance has yet to be elucidated. Therefore, the objective of this study was to evaluate acute phase response, mRNA abundance of inflammatory markers, reproductive performance and lamb growth characteristics of ewes challenged with subclinical doses of LPS. Rambouillet ewes (n=36; 68.2 ± 1.1 kg; age 3 to 7 yr) stratified by body weight (BW) and age were assigned to treatment groups. Ewes received subcutaneous injections of saline (CON, n=12), 1.5 µg/kg BW LPS (LOW, n=12), or 3.0 µg/kg BW LPS (HIGH, n=12) on days 5, 10, and 15 of a synchronized follicular wave. Ewes were subsequently placed with a raddle-painted ram on day 16 for a 35-d breeding season. On treatment days 5 and 15, blood samples, peripheral blood leukocytes, and rectal temperature were collected before and at regular intervals for 12 h after LPS challenge. Immune response to LPS was confirmed by increased temperature and serum cortisol concentrations on days 5 and 15. Endotoxin increased circulating plasma concentration of the acute phase protein, haptoglobin by greater than 15%, in both LPS-treated groups on days 5 and 15 at 12 h compared with control (P ≤ 0.05). Pro- and anti-inflammatory mRNA gene expression demonstrated no differences in expression for tumor necrosis factor-α or peroxisome proliferator-activated receptor gamma among treatment groups (P > 0.10). Likewise, Toll-like receptor 4 (TLR4), interleukin-8 (IL-8), and superoxide dismutase 2 (SOD2) expression was similar among treatment groups on day 5. However, ewes challenged with LPS on day 15 displayed greater mRNA expression for TLR4 from 2 to 6 h (P < 0.05), a 7-fold increase for IL-8 from 1.5 to 2.5 h (P < 0.05), and 8-fold induction for SOD2 from 2 to 6 h (P < 0.05) as compared with controls. First service conception rates were 90% for control ewes and 75% for both treated groups (P = 0.84). Treated ewes demonstrated a reduction in lamb birth weight compared with controls (P ≤ 0.05) and a tendency for reduction of 60-d adjusted weaning weight (P = 0.09). Data suggest that subacute endotoxin exposure aligning with key follicle and oocyte maturation events results in detrimental growth performance of the subsequent lamb.

Divergent planes of nutrition in mature rams influences body composition, hormone and metabolite concentrations, and offspring birth measurements, but not semen characteristics or offspring growth

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Journal of Animal Science, Volume 102 2024

DOI <https://doi.org/10.1093/jas/skae207>

Abstract

Objectives of this experiment were to characterize the effects of ram plane of nutrition on body composition, concentrations of hormones and metabolites, sperm characteristics, and offspring outcomes. Mature Rambouillet rams (n = 24, BW = 82.9 ± 2.63 kg) were individually housed and randomly assigned to either a

positive (POS; n = 8), maintenance (MAINT; n = 8), or negative (NEG; n = 8) plane of nutrition for an 84-day feeding period. Rams were fed a common diet, with daily feed allocations adjusted weekly based on body weight (BW) to achieve the targeted weight gain or loss (approximately 12% of initial BW). On 0, 28, 56, and 84-d, body condition score (BCS) and scrotal circumference (SC) were recorded, and blood and semen were collected. Following the feeding period, rams were placed in pens with 10 ewes each for a 28-d breeding period. Ewes were managed similarly throughout gestation and body weight and measurements were recorded at birth and weaning. Data were analyzed as repeated measures in time where appropriate with the mixed procedure of SAS, and individual ram was the experimental unit for all analysis. Ram BW was influenced by a treatment × day interaction ($P < 0.001$), with POS (0.12 ± 0.01 kg) having greater daily weight change than MAINT (0.1 ± 0.01 kg), which was greater than NEG (-0.12 ± 0.01 kg). Ram BCS and SC were influenced by treatment × day interactions ($P \leq 0.01$), being similar on day 0 but POS being greater than NEG by day 56. Concentrations of triiodothyronine (T3) and T3:T4 ratio exhibited treatment × day interactions ($P \leq 0.02$), as POS had greater values than NEG by day 84 ($P \leq 0.02$). Concentration of insulin-like growth factor-1 was greater in POS than MAINT and NEG ($P \leq 0.02$), and non-esterified fatty acids and thyroxine (T4) were influenced by a day effect ($P \leq 0.01$), but testosterone was unaffected ($P \geq 0.09$). Minimal differences in semen volume, sperm concentration, motility, or morphology were observed among treatments ($P \geq 0.31$). A similar proportion of ewes bred by rams in the respective treatments lambled and weaned lambs ($P \geq 0.54$). Birth weight, chest circumference, and shoulder-hip length were greater ($P \leq 0.05$) in NEG lambs compared with POS and MAINT; however, no differences were detected in weaning weight and weaning body measurements ($P \geq 0.40$). Findings suggest paternal nutrition during the period of sperm development may influence offspring outcomes, potentially as a result of in-utero programming of paternal origin.

Effects of poor maternal diet during gestation are detected in F2 offspring

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Translational Animal Science, Volume 8, 2024 **OPEN ACCESS**

DOI <https://doi.org/10.1093/tas/txae055>

Abstract

Poor maternal nutrition of F0 ewes impairs F1 offspring growth, with minimal differences in glucose tolerance or select metabolic circulating factors, and independent of differences in residual feed intake (RFI). To determine if poor maternal nutrition in F0 ewes alters F2 offspring growth, circulating leptin, feed efficiency, or glucose tolerance, F0 ewes (n = 46) pregnant with twins were fed 100% (control), 60% (restricted), or 140% (over) of National Research Council requirements from days 30 ± 0.02 of gestation until parturition. At 16 to 19 mo of age, female F1 (n = 36) offspring were bred to generate F2 offspring [CON-F2 (n = 12 ewes; 6 rams), RES-F2 (n = 7 ewes; 13 rams), or OVER-F2 (n = 13 ewes; 9 rams) corresponding to diets of the granddam (F0)]. Lamb body weights (BW) and blood samples were collected weekly from days 0 to 28 and every 14 d until day 252 of age. Circulating leptin was measured in serum at days 0, 7, 14, 56, 210, and 252. An intravenous glucose tolerance test was performed at days 133 ± 0.28 . At days 167 ± 0.33 , individual daily intake was recorded over a 77-d feeding period to determine RFI. Rams were euthanized at days 285 ± 0.93 , and body morphometrics, loin eye area (LEA), back fat thickness, and organ weights were collected and bone mineral density (BMD) and length were determined in the right hind leg. During gestation, OVER-F1 ewes tended to be 8.6% smaller than CON-F1 ewes ($P \leq 0.06$). F2 offspring were of similar BW from birth to day 70 ($P \geq 0.20$). However, from days 84 to 252, RES-F2 offspring tended to be 7.3% smaller than CON-F2 ($P \leq 0.10$). Granddam diet did not influence F2 ram body morphometrics, organ or muscle weights, LEA, adipose deposition, or leg BMD ($P \geq 0.84$). RES-F2 (-0.20) and CON-F2 (-0.45) rams tended to be more feed efficient than CON-F2 ewes (0.31 ; $P \leq 0.08$). No effects of granddam diet were observed on glucose or insulin average or baseline

concentrations, area under the curve, first-phase response, or ratio ($P \geq 0.52$). However, CON-F2 rams ($297 \text{ mg/dL} \pm 16.5$) had a greater glucose peak compared with RES-F2 rams ($239 \text{ mg/dL} \pm 11.2$; $P = 0.05$). Peak insulin concentrations were not influenced by granddam diet ($P = 0.75$). At d 56, RES-F2 and OVER-F2 offspring had 53.5% and 61.8% less leptin compared with CON-F2 offspring, respectively ($P \leq 0.02$). These data indicate that poor maternal nutrition impacts offspring growth into the second generation with minimal impacts on offspring RFI, glucose tolerance, and circulating leptin.

Effect of melatonin treatment of pregnant Sarda ewes on lactation and lamb development

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Reproduction, Fertility and Development Volume 36, Issue 18 December 2024 **OPEN ACCESS**

DOI <https://doi.org/10.1071/RD24048>

Abstract

Context. Melatonin administration during pregnancy can influence fetal development and lactation.

Aims. This study aimed to verify whether melatonin treatment of pregnant Sarda ewes in spring improved lamb weight at birth, 7 and 21 days of age, time to first colostrum intake, birth behavior and survival. Additionally, we examined melatonin's effect on milk yield and composition.

Methods. On 18 April, 200 ewes were assigned to two groups of 100 each, based on lambing date, body condition score, parity, age and milk yield. One group received melatonin implants on 20 April, 4 July and 17 September; the other served as control. Rams (12 per group) were introduced on 25 May and removed after 40 days. Lamb weight was recorded at birth, 7 and 21 days, while milk yield and composition were assessed bi-weekly from day 30 of lactation.

Key results. Lambs born to melatonin-treated ewes were heavier at birth (3.54 vs 2.89 kg), and at 7 (5.21 vs 4.40 kg) and 21 days of age (11.3 vs 10.1 kg) and reached colostrum intake sooner than lambs from untreated ewes (55.5 ± 5.3 vs 69.4 ± 5.6 min). Milk yield was higher in melatonin-treated ewes, with somatic cell counts decreasing in treated animals and increasing in controls over the five samplings. Milk fat was higher in treated ewes than controls during early lactation, although protein and lactose levels remained similar between groups.

Conclusion. Melatonin treatment throughout pregnancy improved lamb growth and milk production and quality, suggesting a potential management advantage for sheep.

Influence of sire plane of nutrition and targeted body weight gain on ewe lamb growth, glucose metabolism, and ovarian reserve.

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Journal of Animal Science, Volume 102

DOI <https://doi.org/10.1093/jas/skae301>

Abstract

Rambouillet rams were managed on either a positive (POS; gain 12% body weight [BW]; $n = 8$), maintenance (MAINT; maintain BW; $n = 8$), or negative (NEG; lose 12% BW; $n = 8$) plane of nutrition before breeding. Rams were bred to ewes ($n = 10$ per ram) that were managed similarly throughout gestation, and lambs were fed a common diet postnatally. Two ewe lambs (7.6 ± 0.02 mo of age, $\text{BW} = 47.1 \pm 1.17$ kg) from each sire were selected and within-pair, randomly assigned to be managed for a moderate (MOD, 0.11 kg/d; $n = 23$) or accelerated (ACC, 0.20 kg/d; $n = 22$) rate of gain for 56 d. Ewe lamb BW was recorded on a weekly basis and blood was collected on days 0, 28, and 56 for analysis of insulin-like growth factor 1 (IGF-1), triiodothyronine

(T3), thyroxine (T4), glucose, blood urea nitrogen (BUN), and non-esterified fatty acids (NEFA). Intravenous glucose tolerance tests (IVGTT) were conducted from days -7 to -4 and days 57 to 64. A unilateral ovariectomy was performed and ovarian follicles were staged and counted macro and microscopically. Sire treatment × day and ewe treatment × day interactions were present for BW ($P \leq 0.05$), where POS had slower growth than MAINT and NEG, and tended ($P = 0.10$) to have reduced average daily gain (ADG) when managed at an accelerated rate of gain. By design, ACC had greater BW and ADG than MOD ($P < 0.05$). Concentrations of IGF-1 and T4 were greater in ACC than MOD ($P \leq 0.05$), and NEG tended to have greater concentrations of IGF-1 than POS and MAINT ($P = 0.08$). At the first IVGTT, the concentration of insulin was influenced by a sire treatment × time interaction ($P \leq 0.05$), suggesting impaired secretion in NEG-sires ewes, but no differences in area under the curve (AUC) for glucose, insulin, or their ratio ($P \geq 0.11$). No interactive effects of sire and ewe treatment ($P \geq 0.52$) were observed at the second IVGTT, but insulin and insulin:glucose ratio were influenced by sire treatment × time ($P \leq 0.02$), as NEG had greater insulin concentration at 60 min than MAINT ($P = 0.03$) and greater AUC than POS and MAINT ($P \leq 0.04$). No differences in ovary size, weight, or total counts of macro and microscopic follicles were observed ($P \geq 0.23$). Ewes-fed ACC had a greater number of small surface follicles ($P = 0.02$), whereas MOD tended to have a greater number of large surface follicles and tertiary follicles ($P < 0.06$). These findings suggest that the paternal plane of nutrition influences female offspring physiology, particularly at varying growth rates.

Maternal undernutrition effect on pregnancy-associated glycoprotein (PAG) concentration in sheep carrying single and multiple fetuses

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Simple Summary

The placenta serves as the vital interface between maternal and fetal circulation, playing a pivotal role in ensuring the fetus's nutrition and oxygenation. It is, in fact, a highly sophisticated and multifaceted organ, capable of integrating signals from both the mother and the fetus with remarkable efficiency. PAG levels are indicative of the number of fetal cotyledons in the placenta and, consequently, the size of the placenta. This provides insight into placental development and fetal-placental well-being. However, to the best of our knowledge, the effect of maternal undernutrition on PAG secretion has not been extensively investigated in ruminant species. Starting from this premise, this study aimed to determine whether undernutrition might exert an influence on the production of this glycoprotein, with subsequent implications for embryonic and fetal well-being.

Abstract

To the best of our knowledge, no studies in the literature have reported on the relationship between the pregnancy-associated glycoprotein (PAG) concentration and undernutrition during pregnancy in sheep. Therefore, the aim of this study was to investigate the effects of undernutrition on the blood concentration of PAGs in pregnant ewes carrying single and multiple fetuses, undergoing either dietary energy restriction or receiving 100% of their energy requirements during the period of maximal placenta growth. From d 24 to 100 of pregnancy, the ewes were fed ryegrass hay and two different iso-proteic concentrates, fulfilling either 100% of the ewes' energy requirements (control group; $n = 30$, 14 singleton pregnancies, 16 multiple pregnancies) or only 50% (feed-restricted group; $n = 29$; 11 singleton pregnancies, 18 multiple pregnancies). Blood samples were collected from all the ewes the day before intravaginal sponge insertion (T0) and, thereafter, every 30 days starting from d 24 of gestation (T1) until d 30 after parturition (T6), to determine

the PAG, progesterone, NEFA, total protein, and glucose concentrations. Our results showed that PAG concentrations are not only influenced by the number of fetuses, but also by the ewe's diet. In particular, the PAG marginal means were higher in the feed-restricted group than in the control group (7.8 ± 0.6 and 10.8 ± 0.9 ng/mL for the control and feed-restricted groups, respectively; $p = 0.040$). This finding confirms that a dietary restriction between d 24 and d 100 of gestation leads to a growth in placental functions as inferred from the increase in the concentration of the PAG levels. Therefore, the measurement of PAG concentrations, in addition to serving as a marker of pregnancy, can also serve as a marker of placental functionality.

Perinatal lamb survival was not reduced by grazing forage oats

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Abstract

Context. Grazing forage oats (*Avena sativa*) is perceived as a risk to perinatal lamb survival and grazing oats only during the lambing period has reduced lamb survival.

Aims. This study assessed whether perinatal lamb mortality differed for ewes grazing a legume-based pasture throughout the lambing period compared with those grazing oat forage during lambing.

Methods. A randomised design used two replicates each of two litter sizes (singles or twins) in two forage treatments. Mature Merino ewes were used ($n = 424$; 53 per group) and all groups grazed legume-based pasture from 6 weeks prior to the start of the lambing period. Control ewes remained on legume pastures, whereas Oat groups were moved to forage oats 9–11 days before lambing. A calcium, magnesium and sodium loose lick supplement was offered to all groups.

Key results. Ewe mortality was 1.2%, mainly in twin-bearing ewes and similar among treatments. Lamb birthweights were similar; however liveweight at marking was greater for lambs that were born on the legume pastures than for those born on the oats (13.1 ± 0.19 and 12.5 ± 0.18 kg; $P = 0.041$). Lamb survival did not differ ($P = 0.192$) between ewes grazing oats ($87.3 \pm 3.4\%$) and those grazing legume pasture ($78.1 \pm 3.4\%$), and resulted in 1.28 versus 1.14 ($P = 0.143$) lambs marked/ewe. Lamb survival was similar ($P = 0.102$) for singles ($89.2 \pm 3.2\%$) and twin lambs ($76.2 \pm 3.2\%$). Loss in condition score during the lambing period was reduced ($P < 0.001$) by grazing oats (-0.2 ± 0.06) compared with legume pasture (-0.6 ± 0.06).

Conclusions. Lamb survival was not reduced by grazing oats rather than legume pasture during the lambing period, although further replication is needed, given the large numerical difference. Any difference in survival between oats and a legume-based pasture when ewes are offered a calcium, magnesium and sodium supplement may depend on the capacity of forage to meet the energy requirements of ewes, although taller oats potentially provide shelter from wind chill.

Implications. Grazing forage oats during the lambing period has variable effects on lamb survival associated with the relative ability of alternative pasture to provide adequate nutrition, with positive impacts possible.

Effects of varying light durations on sperm quality in rams

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Simple Summary

In this study, 25 rams were randomly divided into five groups to investigate the effects of different photoperiods on the ram sperm. The control group was exposed to 12 h of light, while the experimental groups were exposed to 14, 16, 18, and 20 h of light. The results showed that compared to the control group, the group exposed to 16 h of light had significantly improved sperm motilities, sperm concentrations, ejaculate volumes, total sperm counts, sperm abnormalities, acrosome integrities, and membrane integrities ($p < 0.05$). Additionally, we identified 345 different metabolites between the control and 16 h light group, with 273 upregulated and 72 downregulated. The amino acid content of the seminal plasma was significantly higher in the 16 h light group compared to the control ($p < 0.05$). Furthermore, compared to the control group, the 16 h light group exhibited significantly higher levels of seminal plasma testosterone, serum follicle-stimulating hormone (FSH), and luteinizing hormone (LH) ($p < 0.05$). In terms of the sperm antioxidant capacity, the catalase (CAT) activity was the highest in the 16 h light group. Additionally, prolonged light exposure between 14 and 18 h increased the glutathione (GSH) levels ($p < 0.05$), and the malondialdehyde (MDA) levels reached their lowest point at 16 h of light exposure ($p < 0.05$) but increased again with 20 h of light. Overall, the artificial extension of the photoperiod to 16 h had a positive effect on the ram sperm quality.

Abstract

This investigation aimed to study the effects of varying light exposure durations on ram sperm. A total of 25 rams were randomly divided into five groups. The control group was exposed to light durations of 12 h, while the experimental groups were exposed to light durations of 14, 16, 18, and 20 h. After three months of rearing, semen was collected from each ram four times using the artificial vagina method. The sperm motility parameters, sperm abnormality, sperm concentration, acrosome integrity, membrane integrity, semen volume, and total sperm number were measured. Thereafter, the metabolome, amino acid level, testosterone content, plasma follicle-stimulating hormone (FSH) and luteinizing hormone (LH) levels, and sperm antioxidant capacity were measured. The results showed that the sperm motility, sperm concentration, ejaculation volume, total sperm number, acrosome integrity, and membrane integrity in the 16 h light group were significantly improved compared to the control ($p < 0.05$), meanwhile the sperm abnormality was decreased. Moreover, we found 345 different metabolites between the control and 16 h light group. Among these, 273 were upregulated and 72 were downregulated. Furthermore, the amino acid content of the seminal plasma in the 16 h light group was significantly increased ($p < 0.05$) compared to the control. Interestingly, the seminal plasma testosterone content and the levels of FSH and LH in the serum in the 16 h light group were significantly increased ($p < 0.05$) compared to the control. In terms of the sperm antioxidant capacity, it was observed that the CAT activity was the highest in the group exposed to 16 h of light and decreased at 18 h of light exposure when compared to the control group; however, the CAT activity at 20 h was not different from the control. Additionally, within the 14 to 18 h light exposure range, prolonged light exposure increased the GSH content ($p < 0.05$), whereas 20 h of light exposure reduced the GSH content. The MDA levels decreased with prolonged light exposure, reaching the lowest point at 16 h ($p < 0.05$), but increased again at 20 h of light exposure. KEGG analysis indicated that the differential metabolites were mainly involved in metabolic and synthetic activities. Based on the results of this study, we can conclude that the artificial extension of the light duration for 16 h has a positive effect on ram sperm quality.

Multiple mating enhances luteogenesis increasing corpus luteum perfusion area and progesterone production in ewes

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Abstract

Multiple matings in ewes reduce estrus length and induce a greater secretion of LH during the preovulatory surge. This study aimed to determine if multiple matings enhance corpus luteum (CL) development and functionality in ewes. Estrous cycles of 20 ewes were synchronized, and the onset of estrus was monitored every 3 h with rams without allowing mating. At the onset of estrus, ewes were assigned to two groups (n=10/group), allowing a ram to mate ewes every 3 h until the end of estrus (Mated group, 9.6 ± 1.0 matings, during receptive period) or not (Control group). To determine CL presence, size, and its blood perfusion, ovaries were scanned by transrectal ultrasonography, using B and color-Doppler modes, every 12 h until ovulation, and daily thereafter until 5 days after ovulation. Blood samples were collected every 24 h to analyze serum progesterone concentration. In the Mated ewes, estrus was about 11 h longer (37.2 ± 2.7 h vs. 26.4 ± 2.7 h; $P=0.01$) and the ovulatory follicle was larger (5.97 ± 0.01 mm vs. 5.08 ± 0.08 mm; $P=0.02$), than in the Control ewes. During the 5 days after ovulation, in the Mated ewes, CL perfusion (14.9 ± 3.1 % vs. 9.5 ± 3.1 %; $P=0.0002$) and serum progesterone concentrations (0.66 ± 0.11 ng/mL vs. 0.42 ± 0.11 ng/mL; $P=0.02$) were greater than in the Control ewes. Multiple matings with penis penetration and ejaculation modified the preovulatory process, enhanced luteogenesis and CL quality.

Improving the efficacy of progesterone pessary treatment for synchrony of estrus in the sheep

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Highlights

- Progesterone treatment adversely affects the quality of the ovulatory follicle.
- Despite treatment, synchrony is affected by season, nutrition and cyclicity.
- Strategies to overcome these problems are discussed.
- Strengths/weaknesses of long and short-term treatments examined.

Abstract

Treatment with intra-vaginal progesterone pessaries for synchrony of estrus is essential in fixed-time artificial insemination (AI) of sheep. Globally, the conventional 14-day pessary treatment is the mainstay of commercial AI programs. It has remained largely unchanged for many decades even though it is associated with variable patterns of estrus and often disappointing pregnancy rates. Until recently, an understanding of this variability has been elusive. Here we review research of the last 25 years and conclude that synchronising estrus and obtaining satisfactory pregnancy rates (≥ 75 %) following AI is more challenging than expected from the original research of the 1960s. In particular, conventional pessary treatment is unable to control the time of emergence of the ovulatory follicle and the resultant variability in follicle age affects fertility. Additionally, the pessary is unable to mitigate the effects of season, nutrition and cyclical status of the ewe on the timing of estrus. It is concluded that the inability of pessary treatment to produce a uniform synchrony together with the adverse effects on follicle quality are primarily responsible for variable pregnancy rates. However, there are strategies to improve AI success rates. The first involves controlling the time of emergence of the ovulatory follicle so that it occurs primarily during the most fertile period of pessary treatment (Days 7–9 of a 14-day treatment). The second involves improving the synchrony of estrus by enhancing circulating levels of progesterone late (Day 9) in the treatment period. The third involves the use of short-term pessary treatments (5–7 days) that avoid some of the abnormalities associated with conventional treatment. Finally, given the variability in the timing of estrus, we address the challenge of optimising the time of insemination, an essential requirement of successful AI programs.

Upcoming events

Date	Event	Location
4 Feb 2025	Sticky Beak Day AWI Extension SA	Mount Cooper, SA
5 Feb 2025	Sticky Beak Day AWI Extension SA	Booleroo Centre, SA
6 Feb 2025	Managing sheep in variable seasons with the use of containment areas AWI Extension SNW & Hume Landcare	Walbundrie, NSW
6 Feb 2025	Sticky Beak Day AWI Extension SA	Karoonda, SA
7 Feb 2025	Sticky Beak Day AWI Extension SA	Fox/Conmurra, SA
12 Feb 2025	BredWell FedWell - setting your breeding flock up for success	Webinar
27 Feb 2025	MLA Productivity and profitability media series: AWI Repro Masterclass AWI Extension Tas	Campbelltown, Tas
11 Mar 2025	AWI Repro Masterclass AWI Extension NSW	Goulburn, NSW
12 Mar 2025	AWI Repro Masterclass AWI Extension NSW	Young, NSW
13 Mar 2025	AWI Repro Masterclass AWI Extension NSW	Narromine, NSW

Funding calls

Program	Open	Close
Wean-a-Lamb: Reducing weaning stress by optimising weaning management strategies	19-Dec-24	12-Feb-25