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# Mother–young behaviours at lambing in grazing ewes: Effects of lamb sex and food restriction in pregnancy

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This study investigated whether the level of pasture allowance from before conception until late pregnancy affects ewe–lamb behaviours at birth, and if those behaviours differ according to the sex of the lambs. We performed two experiments, in which 96 ewes were assigned to one of two nutritional treatments: high native pasture allowance [10–12 kg of dry matter/100 kg of body weight (BW)/day] or low pasture allowance (5–8 kg of dry matter/100 kg of BW/day). In Experiment 1, treatments began 23 days before artificial insemination and ended at 122 days of gestation (groups HPA-1, $n = 38$; and LPA-1, $n = 25$ for high and low pasture allowance, respectively), and in Experiment 2, started 40 days before artificial insemination and ended at 105 days of gestation (groups HPA-2, $n = 22$; and LPA-2, $n = 11$ for high and low pasture allowance, respectively). Thereafter, all ewes received rice bran (200 g/animal/day) and 50 mL of crude glycerine/animal/day. Ewes' body condition score (BCS) and BW were recorded at lambing. Latency from parturition to licking her lamb, maternal behaviour score (MBS; a test that evaluates maternal attachment to the lamb), lambs' BW, and latency to stand up and suckle were recorded. In Experiment 1, HPA-1 ewes had greater BCS and BW ($2.5 \pm 0.04$ units vs. $2.25 \pm 0.05$ units and $52.7 \pm 0.4$ kg vs. $50.2 \pm 0.4$ kg, respectively; $P < 0.0001$) at lambing, and tended to lick their lambs earlier ($1.4 \pm 0.3$ min vs. $1.9 \pm 0.3$ min; $P = 0.08$) than LPA-1 ewes. Male lambs of LPA-1 ewes suckled later than female lambs ($73.3 \pm 11.7$ min vs. $43.4 \pm 13.1$; $P = 0.02$), male ($73.3 \pm 11.7$ min vs. $45.5 \pm 10.8$; $P = 0.02$) and female lambs of HPA-1 ewes ($73.3 \pm 11.7$ min vs. $49.4 \pm 10.3$; $P = 0.04$). In Experiment 2, BCS and BW at birth were similar between HPA-2 and LPA-2 ewes. In addition, behaviours of lambs and ewes, as well as MBS were not affected by nutritional treatment or sex of the lambs, and there was no interaction between nutritional treatment and sex of the lambs. In conclusion, different native pasture allowances from before conception until advanced pregnancy followed by a great increase in nutritional plane during late pregnancy, did not affect ewe–lamb behaviours at lambing. However, slight sex differences were detected when duration of food restriction during gestation was longer.



## 1. Introduction

In extensive sheep production systems the main source of nutrients are native pastures. In temperate regions pasture allowance varies in quantity and quality throughout the year, with the lowest availability of forage in winter and the greatest in spring (Ayala and Bermúdez, 2005). In seasonal sheep breeds, as those predominant in this region, conception occurs in autumn, and lambing in spring, the latter coinciding with the maximum food availability and the best climatic conditions. Pregnancy develops mainly during winter, when nutrients provided by native pastures do not cover the nutritional requirements of the growing foetus, especially during the last third of gestation, the period during which the greatest foetal growth occurs (Kenyon and Webby, 2007; Rattray et al., 2007). In this condition, ewes lose body weight (BW) (Russel et al., 1968; Thomas and Kott, 1995), foetal growth is delayed (Harding

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and Johnston, 1995) and, in severe cases, ewes develop toxaemia (Thomson and Thomson, 1949). To overcome these problems, it is recommended to improve nutrient supply during late gestation to increase ewes' and lambs' BW, and thus the probability of survival (Mukasa-Mugerwa et al., 1994; Martin et al., 2004; Dwyer, 2008).

Undernutrition during pregnancy results in lighter lambs (Kenyon, 2008), which take longer to stand up and suckle less frequently (Dwyer et al., 2003) than well-nourished animals. Those ewes spent less time licking their lambs, and had poorer attachment to their lambs than control ewes (Dwyer et al., 2003). Therefore, food restriction has negative effects on ewe–lamb behaviours at lambing (Dwyer, 2014). Also, the negative consequences on lamb behaviour at lambing are greater for male than for female offspring in ewes that mobilised more fat reserves during gestation (Dwyer, 2003). This difference may be related to the greater BW, and consequently greater energetic investment from the mother in male lambs. To the best of our knowledge there are no studies describing how ewe–lamb behaviours at lambing are affected by low food availability from conception to late pregnancy in temperate native pasture systems, or how this is influenced by sex of the lambs.

Therefore, the first aim of this study was to determine if the level of pasture allowance from before conception until late pregnancy affects ewe–lamb behaviours at lambing. In addition, a second aim was to determine if those behaviours differ according to the sex of the lambs.

## 2. Material and methods

The experimental procedures were approved by the Comisión Honoraria de Experimentación Animal (Universidad de la República, Uruguay).

### 2.1. Location, animals and general management

Two experiments were performed at Estación Experimental Bernardo Rosengurtt, Facultad de Agronomía, Universidad de la República (Cerro Largo, Uruguay; 32° S).

Multiparous single-lambing Corriedale ewes (3–4 years old) and their lambs were used in both experiments. At the beginning of the study the ewes weighed 48.6 ± 0.5 kg (mean ± sem) and had a body condition score (BCS) of 2.7 ± 0.03 (scale 1–5, where 1 = emaciated and 5 = obese; Russel et al., 1969). Ewes grazed on native pastures under extensive conditions and had free access to water.

Oestrus was synchronised with two doses of a PGF2α analogue (10 mg, Dinoprost tromethamine, Lutalyse, Pfizer, Kalamazoo, MI, USA), given 10 days apart. Oestrus was detected twice daily with vasectomised rams painted on the chest (ram:ewe ratio 1:10). Ewes were inseminated with fresh semen from one of three rams 12 h after oestrus detection (day 0). Those ewes that came into oestrus again, 15–19 days later were artificially inseminated once more with fresh semen from the same rams. Only ewes diagnosed by transrectal ultrasound as carrying only one foetus 30 days after oestrus were included in the experiments.

Ewes that were pregnant in the first and in the second oestrus were managed as a single flock throughout the study; therefore, the management and nutritional treatments were applied simultaneously (see Section 2.2; Fig. 1). As ewes were not randomly assigned to each conception period, they were considered as two different experiments. Thus, ewes that became pregnant in first oestrus were allocated in Experiment 1, while ewes that became pregnant in the second oestrus were allocated to Experiment 2.

### 2.2. Experimental design and treatments

Ninety-six ewes were assigned to one of two treatments that consisted of high (BW: 48.6 ± 0.8 kg; BC: 2.7 ± 0.04) or low (BW: 48.2 ± 0.8 kg; BC: 2.7 ± 0.05) native pasture allowances (HPA and LPA, respectively). In both experiments, ewes in HPA and LPA treatments grazed on 10–12 kg or 5–8 kg of dry matter (DM)/100 kg of BW/day, respectively. Pasture allowance was adjusted every month based on the measurements of pasture mass and BW of all the ewes (see Section 2.3), and including or removing "put-and-take" ewes. These ewes were from the same flock, age and physiological status of the experimental ewes but were not included in the experiments. Once removed, "put-and-take" ewes were housed in adjacent paddocks with similar conditions of the experimental ones. In Experiment 1, HPA and LPA treatments were applied from 23 days before artificial insemination until 122 days of gestation (groups HPA-1, $n$ = 38 and LPA-1, $n$ = 25), and in Experiment 2, from 40 days before artificial insemination until 105 days of gestation (groups HPA-2, $n$ = 22 and LPA-2, $n$ = 11). In each experiment, there were three replications per treatment; therefore, HPA had 20 ewes in each replication, and LPA had 12 ewes in each replication. Each replication was managed in one of three separate paddocks of approximately 11 ha each, separated by electric fences. In the HPA treatment replication HPA-1 group had 15, 12 and 11 ewes, and HPA-2 group had five, eight and nine ewes; in the LPA treatment, LPA-1 group had 10, seven and eight ewes, and LPA-2 group had, two, five and four ewes in each replication. Nutritional treatments of each experiment and general nutritional management are summarised in Fig. 1.

All ewes were shorn on days 123–124 or 106–107 of gestation for Experiments 1 and 2, respectively. All ewes received rice bran (200 g/animal/day) and 50 mL of crude glycerine/animal/day (77% of glycerol), beginning 7–8 days before being shorn until the end of the experiments. After shearing, ewes grazed on *Festuca arundinacea* (14 kg of DM/100 kg of BW/day). From 3 days before lambing date until lambing (day 148), ewes remained in paddocks of approximately 1 ha grazing on native pastures with unlimited availability (12–15 kg of DM/100 kg BW/day) until parturition.

### 2.3. Pasture mass determination

Pasture mass (kg/ha of DM) was estimated and adjusted monthly using a direct visual estimation double-sampling technique with a 1–5 scale point (Haydock and Shaw, 1975), which was defined according to general heterogeneity of the pasture in each paddock, based in their density and height. When the quantity of scale points per paddock was established (generally 3–5 scale points were used), fresh samples were taken and weighed using 50 cm × 20 cm quadrants, with three repetitions of each scale point. Height of pasture was also determined on each quadrant (three points were measured in diagonal line) thereafter the pasture was cut at ground level (Webby and Pengelly, 1986). In each paddock 80–100 determinations of scale points and height of pasture were performed using 50 cm × 20 cm quadrants. Each fresh pasture sample was dried in a forced-air oven at 60 °C for 48 h to determine the amount of DM. Then, pasture allowance/ha of each sample was calculated by extrapolating the proportion of the quadrants. Each scale point and the mean height measured on each quadrant were separately related to kg/ha of DM, and the linear equation with greater coefficient of determination was used to estimate kg/ha of DM of each paddock. In all determinations the relationship between the mean scale point of pasture and the kg/ha of DM had the greater coefficient of determination, and therefore was used to estimate accurately the kg/ha of DM of the paddock with the linear equation. Then, the kg/ha of DM/100 kg of BW/day were adjusted using total BW of the experimental ewes, adding or moving "put-and-take" ewes to adjust the total BW to the pasture availability.