Parity of the Dorper sheep does not influence the reproductive and productive response when they are synchronized with an “ultra-short” protocol

Abstract

The aim of the present study was to evaluate the reproductive and productive response of multiparous and primiparous Dorper sheep synchronized with an “ultra-short” protocol and a dose of 200 IU of eCG. The 100% of the sheep responded to estrus during the experiment (P<0.05), being lower in the multiparous sheep than in the primiparous. However, the time to estrus was lower (P<0.05) in multiparous compared to primiparous. Fertility, type of delivery and length of gestation were not affected by the treatment (P>0.05). On the other hand, litter size at lambing, litter weight and survival rate at 30 d were similar in both groups of sheep (P>0.05). Is concluded that the ultra-short hormonal treatment is sufficient for 100% of the sheep, regardless of their parity, to respond to estrus. Also, the productive behaviour of the sheep was not affected by the treatment.

Keywords: biotechnologies, estrus, hormones, primiparous sheep, weight, survival

Abbreviations: CIDR, intravaginal device containing progesterone; eCG, equine chorionic gonadotropin; PGF2α, prostaglandin F2α

Introduction

In sheep and goats, estrus synchronization protocols are a useful tool to improve reproductive efficiency.1,2 The classic protocols for synchronizing estrus in sheep consist in an intravaginal insertion of a sponge or an intravaginal device containing progesterone (CIDR) impregnated with flurogestone acetate or medroxyprogesterone (FGA or MAP) for 5–7 d, accompanied by an intramuscular injection of equine chorionic gonadotropin (eCG) at the end of the treatment.2 These protocols were accompanied by a dose of prostaglandin F2α (PGF2α) at the start of the treatment and a low dose of eCG (200-300 IU) upon removal of the intravaginal device. In sheep synchronized with a short protocol of FGA and low doses of eCG (100 and 200 IU) they found a high response to estrus (93 and 98%), and gestation percentage (77 and 70%).5 On the other hand, Macías-Cruz et al.5 synchronized hair sheep with a prostegestone and low doses of eCG (140 and 280 IU) and found a high response to estrus (100% vs. 100%) and fertility (70% vs. 74%). Therefore, the aim of the present study was evaluate the reproductive and productive response of multiparous and primiparous Dorper sheep synchronized with an “ultra-short” protocol and a dose of 200 IU of eCG.

Materials and methods

General

The experiment was conducted during the month of October 2017 in the ovine post “Ángeles” located in the municipality of Texcoco, state of Mexico, Mexico (coordinates: 19°30'20" north latitude and 98°52'55" west longitude). The region as a semi-dry temperate climate, with an average annual rainfall and temperature of 15.9 °C and 686 mm, respectively.8 All procedures involving animals were conducted within the guidelines of approved local official techniques of animal care in México (NOM-051-ZOO-1995: Humanitarian Care of Animals During Mobilization).

Animals and experimental design

For the study, 14 Dorper sheep of 0 and 2 lambing were used, with a live weight of 34±2.4 kg and body condition scale (BCS) of 3.5±0.08 points (1 to 5). Subsequently the live weight and BCS were recorded every 15 (Figure 1) and 30 (Figure 2) d, respectively. From the total number of females, 2 groups of 7 sheep were formed, these were balanced according to their parity (primiparous and multiparous) and BCS. In the present study there was no control group to which hormonal treatment was not applied. However, it’s known that in progestogen-based estrus synchronization protocols in sheep, the...
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Parity of the Dorper sheep does not influence the reproductive and productive response when they are synchronized with an “ultra-short” protocol. The protocol consisted in the insertion of an intravaginal device with 0.3 g of progesterone contained in an intravaginal devices (CIDR®, Intervet México S. de R.L. de C.V.), at the time of insertion of the CIDR, intramuscular injection of a dose of PGF2α (160 μg Lutalyse®), when removing the device, 200 IU of eCG (Folligon, Intervet Mexico S.A. de C.V.) were applied, and 24 h after removing the device an intramuscular injection of 200 μg of Estradiol Benzoate BE, Figure 3. The device remained in the females for 6 d. Finally, 30 h after removing the device, the females were registered with a Dorper male, and it was ensured that each sheep received two mounts to corroborate that all were mounted.

**Housing and feeding**

The sheep were housed in two open corrals circulated with cyclonic mesh and roofed with galvanized sheet, these pens were provided with drinking troughs and feeders. Ewes were placed into two pens based on parity, and feed at free access with a mixture of chopped forage (50% sudangrass hay and 50% alfalfa hay). Diet was served once a day (at 0800 h), and the water was offered *ad libitum*. The chemical composition of the diet was 895 g of dry matter (DM)/kg of mixture, 120 g of crude protein (CP)/kg of DM, and 2.1 Mcal of metabolizable energy (ME)/kg of DM, which covers the nutritional requirements specified by the National Research Council19 for sheep at the time of breeding (ME 1.9 Mcal/kg DM and CP 80 g/kg DM) and gestation (ME 1.9–2.4 kg DM and CP 85–105 g/kg DM).

**Evaluated variables**

In all the females the variables of reproductive behaviour were evaluated: At parturition, lambing date and number of lambs born were recorded individually for each ewe. Response to estrus (percentage of ewes in estrus after sponge removal), time to estrus (interval of time between sponge removal and onset of estrus), fertility (percentage of ewes lamb’d from ewes mated), prolificacy (number of lambs born per ewe lamb’d), single (percentage of ewes lamb’d with one lamb) or multiple (percentage of ewes lamb’d with two or more lambs) lambing, and gestation length (interval of time between day of mating and lambing) were determined from collected information. Additionally, size of the litter per ewe lamb (N) and survival rate per ewe lamb at 0, 30 and 60 d (Table 2).

**Data analysis**

The data was analyzed with the statistical program SYSTAT19 under a randomized design. The variables of sexual behaviour were analyzed with the Chi-square test. On the other hand, the productive variables, mothers-offspring weights and body condition were subjected to one-way analysis of variance. The mean comparisons were made with the student t test.

**Results and discussion**

**Sexual response of the sheep**

The 100% of the sheep responded to estrus during the experiment, regardless of parity. However, the time to estrus was affected by the treatment (P<0.05), being lower in the multiparous than in the primiparous sheep. On the other hand, the length of estrus was similar (P>0.05) between both groups of sheep (22.6±0.2 vs. 22.8±0.02 h). Finally, fertility, single birth, multiple birth and length of gestation were not affected (P>0.05) by the treatment (Table 1). The application of eCG to a protocol of synchronization of oestrus with progestagens improves the degree of induction and synchronization of endocrine and physiological events, which is reflected in an estrous behaviour where the interval to estrus post-withdrawal from CIDR is shorter.20 Indeed, in the present study the onset to estrus was shorter (36 h) in multiparous sheep than previously reported in hair sheep (up to 48 h).21-22 Similar results were reported by Menchaca and Rubianes20 in goats subjected to an estrus synchronization protocol for 5 d. These results indicate that the release of progesterone during the first days is sufficient in small ruminants to stimulate the first follicular wave and the estrous response. The same pattern in the elevation of the profiles of said hormone was observed in heifers synchronized with a progestogen.22 On the other hand, the response to sheep estrus in the present study was similar to that reported by Macías-Cruz et al.1 in hair sheep (100% estrus) synchronized with a synthetic progestogen;
but different (92% estrus) from those recorded by Quintero-Elisea et al. The high estrous response reported by these authors is likely due to appropriate follicle stimulation and sufficient estradiol release for the females to show signs of estrus in a shorter time.

Table 1 Effect of low doses of eCG on the reproductive efficiency of multiparous and primiparous hair sheep

| Treated sheep, N | Primiparous | Multiparous |
|------------------|-------------|-------------|
| Lambs, n         | 5/7         | 7/7         |
| Response to estrus, % | 100a (7/7) | 100a (7/7) |
| Time to estrus, h | 41.6±0.9a   | 36.6±0.8b   |
| Fertility, %     | 71 (5/7)a   | 70 (5/7)a   |
| Single lambing, %| 80 (4/5)a   | 71 (5/7)a   |
| Multiple lambing, %| 20 (1/5)a | 28 (2/7)a   |

| Gestation length, (d) | 150.25±1.13a | 148.00±1.13a |

Table 2 Effect of low doses of eCG on the productive behaviour in multiparous and primiparous hair sheep

| Size of the litter per ewe lamb (N) | Primiparous | Multiparous |
|------------------------------------|-------------|-------------|
| 0 d                                | 1.8±0.53    | 2.0±0.06    |
| 30 d                               | 1.47±0.38   | 1.58±0.53   |
| 60 d                               | 1.28±0.34   | 1.42±0.56   |

| Survival rate per ewe lamb | Primiparous | Multiparous |
|----------------------------|-------------|-------------|
| 0 d                        | 92±0.1      | 79±0.1      |
| 30 d                       | 89±0.2      | 76±0.1      |

Regarding the weight of the litter at birth, it didn’t change in the present study. In this sense Sánchez-Dávila et al.,21 mention in their study that the parity of the sheep affected the weight of the litter, being lower in primiparous ewes (3.01±0.1 kg) than those that were from the second to the fifth lambing (3.16±0.15 kg). On the other hand, Macías-Cruz et al.,1 found a weight of the litter in Dorper lambs inferior (3.57±0.12 offspring) to the one found in the present study; they also observed that the weight of the litter decreased while the number of offspring increased per ewe lamb. The survival rate was not affected by the parity of the female. Consistently with this result Macías-Cruz et al.,1 found a lower weaning survival rate (82±0.03 offspring) than that found in the present study (89±0.2 offspring). It’s known that the high percentage of mortality (15%) in lambs is due to some factors such as: dead births, diarrhea, malnutrition and pneumonia mainly;22 but this percentage increases (23%) when the mother raises more than 2 lambs.1,23 Productivity is related to birth weight, growth, maternal ability and mother’s milk production. Low weights at birth influence the reduction of the litter survival rate in the first days of life, which directly impacts on a reduction in litter size and body weight during the pre-weaning period.24 Additionally, if the sheep have low maternal skill and their level of milk production is also low or insufficient to maintain the entire litter, the growth of the offspring is negatively affected, often producing the death of the offspring.25 These results are probably due to the fact that both groups of sheep conserved the weight and body condition from the breeding until delivery.

Conclusion

The synchronization of estrus in multiparous and primiparous sheep with a protocol “ultra-short” based on a progestogen and a dose of 200 IU of eCG is enough for 100% of females to respond to estrus and this is more short in multiparous than in primiparous sheep. Also, the productive behaviour of the sheep was not affected by the parity of the females and the application of a dose of eCG lower than that recommended in hair sheep.

Acknowledgements

None.

Conflict of interest

The author declares that there is no conflict of interest.

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Citation: García y GEC. Macías CU, Avendaño RL, et al. Parity of the Dorper sheep does not influence the reproductive and productive response when they are synchronized with an "ultra-short" protocol. Open Access J Sci. 2018;2(3):193–196. DOI: 10.15406/oajs,2018,02.00069
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