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Technical note

Effect of two doses of progesterone on estrus response and fertility in acycling crossbred Bharat Merino ewes in a semi-arid tropical environment

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Abstract

The efficacy of two doses of progesterone (P4), i.e. 350 and 300 mg was evaluated in acycling crossbred ewes (50) during the autumn breeding season. Ewes were treated with intravaginal progesterone sponges with either 350 mg or 300 mg for 12 days. At standing estrus, ewes were hand mated (three cycles). Progesterone (350 mg) gave a better ($P<0.05$) estrus response (75%), compared to 300 mg dose (42%). Ewes treated with 350 mg P4 also showed better ($P<0.05$) synchronization response (93%) than those treated with 300 mg (56%) at 72 h after sponge removal. Lower doses of progesterone (300 mg) significantly delayed ($P<0.01$) the onset of estrus. However, dose had no significant influence($P>0.05$) on estrus length, conception rate and the proportion of ewes lambing at term. This study indicates that dose of progesterone may have an effect on estrus exhibition and response time without altering the conception rate and lambing in acycling crossbred Bharat Merino ewes during the major breeding season in a semi-arid tropical environment.

Keywords: Sheep; Progesterone; Dose; Estrus; Fertility

1. Introduction

Though Indian sheep breeds show estrus cyclicity round the year, the majority of ewes exhibit estrous activity during the autumn and spring season and the overall productivity remains low due to their poor reproductive ability. In order to improve the productivity and reproductive efficiency of the native breeds, crossbreeding is adopted in this region. Bharat Merino is a strain developed for fine wool by crossing the native ewes with imported Rambouillet/Soviet Merino rams and stabilising the population at 75% exotic inheritance. Most of the breeds of sheep in the semi-arid tract pass through a phase of temporary acyclicity because of summer (Sahni et al., 1976) and resume cyclicity during the major breeding season, i.e. autumn (July–September). Despite aseasonality, a certain population of ewes does not exhibit estrus even during the breeding season thereby limiting the farm output.

Progesterone analogues, i.e. progestagens, are commonly used to control estrus cyclicity in sheep during

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and outside the breeding season (Henderson, 1991; Gordon, 1997). Different dose levels of synthetic progestagens have been tested in several laboratories for synchronization and induction of estrus, conception and lambing response in cycling (Robinson et al., 1968; Allison and Robinson, 1970; Smith et al., 1981; Robinson, 1988; Greyling et al., 1997) as well as anoestrus ewes(Faure et al., 1983; Crosby et al., 1983; Wheaton et al., 1984; Greyling et al., 1994). However, use of natural progesterone (P4) at various dose levels is restricted mostly to cycling ewes (Gordon, 1983; MacDonnell, 1985; Crosby et al., 1991) and only to a few in anoestrus ewes (MacDonnell and Crowley, 1978; Hamra et al., 1989). Previously from this laboratory, the estrus and fertility response with natural P4 in acycling native and crossbred ewes during summer(Naqvi et al., 1996; Das et al., 1997, 1999), has been reported. To the best of our knowledge, reports on application of natural P4 in various dose levels for estrus induction and synchronization in anoestrus ewes under tropics are meagre, especially in crossbreds. The present study was, therefore, designed to examine the effect of two dose levels of P4 on the induction of estrus in acyclic crossbred ewes and their subsequent fertility response during the natural breeding season.

2. Materials and methods

This study was conducted at Avikanagar which is located at longitude 75°28′ E, latitude 26°26′N and at an altitude of 320 m above MSL in the semi-arid zone of subtropical India. The annual rainfall in this region ranges from 400 to 600 mm and its distribution is erratic between July and September. The experiment was carried out during autumn breeding season (July–September) when about 83% crossbred sheep in this tract show estrus cyclicity (Sahni et al., 1976).

2.1. Animals

Crossbred Bharat Merino ewes of mixed parity (Parous=24; Fresh=26) aged between 1.5 and 3.5 years with an average body wt. of 31.0±0.73 kg were equally distributed into two treatment groups viz. G1 and G2, of 25 ewes in each. In G1, five animals were excluded from the experiment on account of death and pregnancy while in G2, one ewe died before sponge removal. The actual number of ewes in G1 and G2 were thus 20 and 24, respectively. These ewes were dry and acycling determined on the basis of not exhibiting estrus for three consecutive cycles.

2.2. Management and nutrition

The experimental flock was maintained under standard farm management practices. The ewes were grazed daily for 8–10 h on *Cenchrus ciliaris* pastures interspersed with seasonal shrubs and fobs. Average biomass yield of pasture plot ranged from 12–15 qtn/ha. In addition, the ewes received 200 gms concentrate (barley 65%, groundnut cake 32%, mineral mixture 2% and common salts 1%) /head/day during the entire period of study.

2.3. Treatment

Progesterone (P4, CDH(P) Ltd, New Delhi, India) impregnated sponges were prepared in our laboratory (Naqvi et al., 1996) and placed in-situ for 12 days. Ewes in G1 were treated with P4 350 mg/ ewe and in G2 with P4 300 mg/ ewe.

2.4. Estrus detection

Estrus was detected by using aproned ram (ram:ewe=1:10) of proven sexual vigour. Detection was done at 6 h interval, commencing 24 h after sponge removal upto 6 days.

2.5. Breeding

Ewes that exhibited behavioural estrus were hand mated twice at standing estrus, i.e. at 12 h interval, with a ram of proven fertility. Mated ewes which returned to estrus and those which responded in the second and third cycle post treatment were also similarly hand mated.

Onset of estrus was defined as first detection of behavioural estrus following sponge removal while the duration of estrus was calculated by the difference in time between first and last detected estrus. Ewes which did not return to estrus at least for three consecutive cycles were considered as conceived.

Table 1
Incidence, onset and duration of estrus after treatment with different doses of progesterone[a]

Dose(s) of progesterone (mg)	Ewes treated (*n*)	Ewes in estrus *n*(%)	Estrus response (Mean±S.E.)	
			Onset (h)	Duration (h)
350	20	15 (75)[a]	47.6[c]±6.64 (Range=24–120)	18.8[e]±2.67 (Range=6–42)
300	24	10 (42)[b]	75.3[d]±12.37 (Range=24–132)	24.0[e]±5.20 (Range=6–48)

[a] Values with different superscripts (column wise) are significantly different (a:b=$P<0.05$; c:d=$P<0.01$).

2.6. Statistical analyses

Data pertaining to estrus response and fertility were analyzed by using '*Z*-test' (Values in proportions) and 'Student-*t* test' (Mean values) at 5% and 1% level of significance(Snedecor and Cochran, 1967).

3. Results

The results pertaining to estrous response are shown in Table 1. The proportion of ewes which responded to progesterone treatment was significantly ($P<0.05$) higher in G1 (75%) than in G2 (42%). Though low doses of progesterone significantly ($P<0.01$) delayed the onset of estrus, it did not influence the length of estrus (Table 1). Ewes treated with 350 mg progesterone showed better ($P<0.05$) synchronization response (93%) as compared to 300 mg (56%) at 72 h of sponge removal (Fig. 1).

The number of ewes conceiving and lambing after breeding for one, two, or three cycles and in total are presented in Table 2. Between groups, the difference in proportion of ewes conceived either in one cycle or on overall basis, did not approach to any statistical significance ($P>0.05$). The ewes in group G2 had a tendency for better lambing performance even though the difference between the proportion of ewes lambed in G1 and G2 failed to show significance ($P>0.05$).

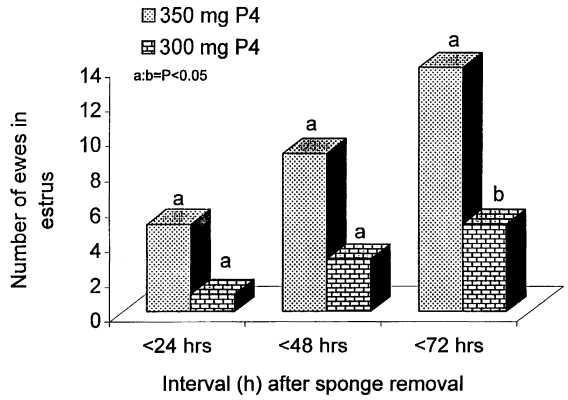

Fig. 1. Distribution of esturs ewes synchronized at different hours interval.

4. Discussion

This study indicates that the dose of progesterone affects the exhibition of estrus without interfering with

Table 2
Conception and lambing after treatment with two doses of progesterone

Dose(s) of progesterone (mg)	No. of ewes conceived/cycle(s)				No. of ewes lambed/cycle(s)			
	One (%)	Two	Three	Overall (%)	One (%)	Two	Three	Overall (%)
350	8/14(57)	2/5	1/2	11/14(79)	4/14(29)	2/5	1/2	7/14(50)
300	6/10(60)	1/3	1/1	8/10(80)	5/10(50)	1/3	1/1	7/10(70)

fertility response in acycling crossbred Bharat Merino ewes during the major breeding season in this region. Further, lower dose of progesterone (300 mg) prolongs the response time as compared to higher dose (350 mg). In this laboratory, it has been previously reported that progesterone at a dose of 350 mg could induce estrus during summer in all (100%) of the acycling native ewes (Das et al., 1997), but in only 50% of acycling crossbred and native breeds of sheep (Naqvi et al., 1996). In the present study, the same dose level (350 mg) produced a better estrus response (75%) in acycling crossbred ewes. This is similar to what we have obtained (76%) in cycling native ewes (Das et al, unpubl.). Better estrus response may be because of the favourable season (autumn) of the year when majority of the crossbred sheep (83%) in this region show estrus activity (Sahni et al., 1976). Further when the dose of P4 was reduced from 350 to 300 mg, the response decreased from 75 to 42%. This declining trend in estrous response after dose reduction is in accordance with the results of MacDonnell and Crowley (1978), who reported better results with higher doses of P4 (800–1200 mg). Allison and Robinson (1970) reported an increase in the incidence of estrus and ovarian response when the dose of progestagen was increased. The present finding, however, differs from the reports of Faure et al. (1983), Walker et al. (1989), Crosby et al. (1991) and Greyling et al. (1994, 1997) who did not find any difference in estrous response for different types and doses of progestagens. Perhaps the drug, breed of sheep, physiological stage, season of the year and agroclimatic region contributed to the variation in synchronization response reported under various studies.

Greyling et al. (1994) reported that dose of progesterone exerted no effect on the estrus response time in ewes synchronized outside the normal breeding season. However, Faure et al. (1983), Greyling et al. (1997) obtained shorter time intervals between withdrawal to onset of estrus by using halved sponges during the breeding season. On the contrary, lower dose of progesterone (300 mg) in this study prolonged the onset of estrus in acycling ewes. This indicates that P4 given at 300 mg may not be sufficient for inducing estrus in acycling ewes since the dose of progestagen needed for efficient feedback on the hypothalamus should be in excess in the sponges during the breeding season (Greyling et al., 1997). Hence, P4 administered at a dose of 350 mg gave a relatively higher estrus response in this study.

The response time recorded in G1 ewes in our study is quite similar to that of Greyling et al. (1994), who reported an interval of 43 h in ewes treated with 60 mg MAP outside the breeding season, which is in conformity with our earlier findings reported in native acycling ewes during summer (Das et al., 1997) and native cycling ewes during autumn season (Das et al., unpubl.). However, the values recorded for onset of estrus with 350 mg P4 seem to be much higher than that of our previous observations in acycling crossbred ewes during summer (Anon, 1996–1997). Moreover, decreasing dose of P4 during breeding season further increased the time to onset of estrus in the present study. This indicates that in acycling crossbred ewes a higher P4 sensitivity is needed by hypothalamus even during the breeding season (Greyling et al., 1997).

Dose of P4 did not have any effect on the duration of induced estrus in this study but the duration recorded was slightly longer than that we observed in anoestrus crossbred ewes treated with 350 mg during summer (Anon, 1996–1997). The relatively longer estrus duration in G2 group as compared to G1 group is not clear, although the difference was not significant. Similar trend of response was reported in ewes outside the breeding season (Greyling et al, 1994) and during the breeding season (Greyling et al., 1997) using progestagen.

Dose of progesterone has no effect on conception rate in this study and shows similarity with reports in other breeds of sheep (Smith, 1978; Greyling et al., 1994). Similarly the dose did not have any marked influence on lambing percentage in our study. This is in accordance with the observation of Smith (1978), but, differs with that of Faure et al. (1983) who recorded optimal fertility in synchronized sheep treated with minimal doses of progesterone. However, lower dose tended to translate into a higher number of ewes which lambed at term, compared to ewes treated with relatively higher dose of P4 in the present study.

In conclusion, the present study suggests that 350 mg progesterone is better than 300 mg for bringing acycling ewes into estrus. Progesterone used at these two dose levels had little influence on conception rate and lambing performance, although the lower dose gave a better lambing response.

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