The effect of whole and halved intravaginal sponges combined with either subcutaneous or intravenous administration of PMSG on synchronization of the estrous cycle of Karakul ewes

A.S. Faure, D.A. Boshoff and F.J.L. Burger
Karakul Research Station, Upington

The estrous cycles of Karakul ewes were synchronized during both the breeding (February) and nonbreeding season (October) using either whole or halved sponges, in combination with either subcutaneous or intravenous administration of PMSG. At the time of sponge withdrawal, PMSG was administered either subcutaneously or intravenously at one of 4 levels, 0; 60; 150 or 300 I.U. The interval between sponge withdrawal and the onset of estrus, as well as the number of ovulations per ewe, were recorded. Lambing percentage after using artificial insemination was determined only in the nonbreeding season.

Only the season of treatment had an effect on the percentage ewes showing estrus. The time interval between progestogen withdrawal and the onset of estrus was significantly ($P \leq 0,05$) shortened in groups synchronized with halved sponges, groups receiving PMSG intravenously and groups receiving PMSG doses higher than 60 I.U. Ovulation rate was not significantly affected by the progestogen treatments. However, there was some tendency for a higher ovulation rate with the higher doses of PMSG.

The lambing percentage of ewes synchronized with whole sponges and ewes receiving PMSG intravenously, was superior to the other treatment groups.

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Die estrussiklusse van Karakoelooie is gesinchroniseer gedurende beide die teelseisoen (Februarie) en die seisoenale anestrus (Oktober) met heel en gehalveerde 60 mg medroksi-progesteroonasetaat intravaginale sponse. Ten tye van sponsonttrekking is dragtige merrieserum gonadotrofien (DMSG) onderhuids of intraveneus teen een van 4 peile (0; 60; 150 of 300 I.E.) toegedien. Die tydsduur tussen sponsonttrekking en die voorkoms van estrus, asook die aantal ovulasies per ooi is bepaal. Lampersentasie is slegs binne die seisoenale anestrusperiode bepaal, deur gebruik te maak van K.I. na estrussinchronisasie.

Alleenlik die seisoen van behandeling het 'n effek gehad op die persentasie ooie wat estrus vertoon het. Die tydsduur tussen progestogeenonttrekking en die voorkoms van estrus was betekenisvol ($P \leq 0,05$) korter in groepe gesinkroniseer met halwe sponse, groepe waar DMSG intraveneus toegedien was en groepe wat DMSG dosisse hoër as 60 I.E. ontvang het. Ovulasietempo is nie beïnvloed deur die progestogeen behandeling nie, maar daar het 'n tendens bestaan vir 'n hoër ovulasietempo met hoër dosisse DMSG. Lampersentasie was gunstig beïnvloed in ooie gesinchroniseer met heel sponse en ooie wat DMSG intraveneus ontvang het.

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A.S. Faure*, D.A. Boshoff and F.J.L. Burger
Karakul Research Station, P.O. Box 37, Upington 8800, Republic of South Africa
*To whom correspondence should be addressed

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Introduction

The Karakul industry is one of the major small-stock enterprises in the Republic of South Africa in which intravaginal sponges are used for synchronization of estrus.

In a study with Karakul, in which intravaginal sponges, impregnated with 60 mg medroxy-progesterone acetate (MAP, Upjohn) were used, Boshoff (1978, unpublished data) found that an average of 40 mg remained after the sponge had been inserted for 15 days. The possibility therefore arises of efficient synchronization of estrus and reproduction in Karakul ewes using lower doses of progestogen and Pregnant Mare Serum Gonadotrophin (PMSG). Either intravenous or subcutaneous administration of PMSG could possibly be used to further reduce the cost of treatment.

Allison & Robinson (1970) found an increase in the incidence of estrus and ovarian response to PMSG with increasing doses (0; 10; 30 and 90 mg) of progestogen (Cronolone) impregnated in the intravaginal sponges. The increase in ovarian response was however not reflected in the lambing percentage. On the other hand, Smith (1978) found no significant difference in either conception rate or lambing percentage when using 30 and 60 mg doses of progestogen (Cronolone and MAP respectively). The same author also found no significant differences in these parameters with different doses of PMSG (375 and 750 I.U.).

Literature concerning the route of PMSG administration is scarce. Boshoff & Burger (1973) compared the intramuscular and subcutaneous administration methods of PMSG on the restriction of multiple ovulations, while Hulet & Foote (1967) studied the effect of PMSG on ovulation rate. This study primarily concerned the time of PMSG administration relative to sponge withdrawal.

Procedure

During the breeding (February) and nonbreeding season (October) Karakul ewes were randomly divided into 2 groups of 56 ewes each. One group was synchronized with whole intravaginal sponges impregnated with 60 mg medroxy-progesterone acetate (MAP, Upjohn) and the other group with halved sponges. Because of the possibility of uneven distribution of progestogen on the sponge, the quantity of progestogen on a halved sponge

was not necessarily exactly equal to half the quantity on a whole sponge.

The sponges were left *in situ* for 15 days and then removed. The 2 groups of ewes were then divided further into 7 subgroups, of 8 each. The control group received no PMSG while in the remaining 6 groups the ewes received 3 different levels of PMSG (60; 150 or 300 I.U.) either subcutaneously or intravenously (jugular vein) on withdrawal of the sponges.

After sponge withdrawal, the experimental animals were teased at 2-hourly intervals by active vasectomised rams, in order to determine the time interval between progestogen withdrawal and the onset of estrus. Four days after the cessation of estrus the ovulation rate was recorded at laparotomy.

The same treatments were repeated with an additional group of ewes (15 ewes in each PMSG group), during the nonbreeding season and the fertility rate determined after artificial insemination.

Results and Discussion

Estrus

There were no significant differences in the percentage of ewes in heat when using either whole or halved sponges, or between the 2 methods of PMSG administration, either in or out of the breeding season (Tables 1 and 2). The percentage of ewes in heat was directly affected by the season, and the level of PMSG administered in the nonbreeding season.

Interval between progestogen withdrawal and the onset of estrus

The time interval between progestogen withdrawal and the onset of estrus in both the breeding and nonbreeding season (Tables 3 and 4), was shorter when the ewes were synchronized with halved sponges and when PMSG was

Table 1 Percentage ewes exhibiting estrus after progestogen withdrawal within the breeding season and seasonally anestrus period

Dose PMSG	Site	Whole sponge		Half sponge	
		B.S.	Anestrus	B.S.	Anestrus
0	—	100,00	31,25	100,00	37,50
60	SC	100,00	75,00	100,00	87,50
	IV	87,50	75,00	100,00	57,10
150	SC	100,00	75,00	100,00	57,10
	IV	87,50	100,00	100,00	75,00
300	SC	100,00	100,00	100,00	75,00
	IV	100,00	100,00	100,00	100,00

B.S. = Breeding season.
SC = Subcutaneous.
IV = Intravenous.

Table 2 Percentage ewes exhibiting estrus after progestogen withdrawal in the breeding season and seasonally anestrus period

Treatment	Percentage ewes	
	B.S.	Anestrus
Whole sponge	96,43	77,50
Half sponge	100,00	73,08
Subcutaneous	100,00	84,13
Intravenous	95,83	87,31
PMSG I.U. 0	100,00	34,38
60	96,88	74,20
150	96,88	77,42
300	100,00	93,75

B.S. = Breeding season.

Table 3 Time interval (hours) between progestogen withdrawal and the onset of estrus in the breeding season and seasonally anestrus period

Dose PMSG	Site	Whole sponge		Half sponge	
		B.S.	Anestrus	B.S.	Anestrus
0	—	64,00 ±12,24	74,40 ±21,00	40,25 ± 5,18	58,67 ± 7,92
60	SC	60,50 ±20,89	84,34 ±24,86	42,75 ±12,05	60,58 ±17,73
	IV	45,72 ±13,07	76,00 ±19,78	52,75 ±15,86	53,00 ±10,99
150	SC	59,50 ±20,34	54,17 ±18,31	46,00 ±10,53	43,50 ±17,08
	IV	46,29 ± 9,32	66,88 ±33,20	32,00 ±10,75	51,84 ±22,30
300	SC	40,50 ±11,46	57,38 ±18,75	42,25 ± 7,74	51,00 ±10,74
	IV	41,25 ±17,95	43,50 ±14,22	29,25 ± 7,41	42,63 ±29,03

B.S. = Breeding season; S.C. = Subcutaneous; IV = Intravenous; ± = Standard deviation.

Table 4 Time interval (hours) between progestogen withdrawal and the onset of estrus within the breeding season and seasonally anestrus period

Treatment	Time interval (hours) ± SD	
	B.S.	Anestrus
Whole sponge	51,30 ± 17,56	57,73 ± 24,87
Half sponge	40,75 ± 12,39	48,25 ± 18,15
Subcutaneous	48,59 ± 16,18	57,34 ± 19,49
Intravenous	41,00 ± 14,89	48,97 ± 24,34
PMSG I.U. 0	52,13 ± 15,24	65,82 ± 16,59
60	50,58 ± 16,68	69,48 ± 21,87
150	45,94 ± 16,35	56,05 ± 25,05
300	38,32 ± 12,51	48,47 ± 19,91

B.S. = Breeding season; S.D. = Standard deviation.

Table 5 Ovulation rate (*corpora lutea*/ewe) after progestogen withdrawal in the breeding season and seasonally anestrus period

Dose PMSG	Site	Whole sponges		Half sponges	
		B.S.	Anestrus	B.S.	Anestrus
0	—	1,13	1,20	1,00	1,00
60	SC	1,00	1,00	1,13	1,00
	IV	1,13	1,00	1,00	1,00
150	SC	1,00	1,16	1,25	1,00
	IV	1,25	1,00	1,00	1,00
300	SC	1,15	1,00	1,25	1,16
	IV	1,50	1,25	1,50	1,12

B.S. = Breeding season; SC = Subcutaneous; IV = Intravenous.

administered intravenously ($P \leq 0,05$).

The onset of estrus was on average 10,6 hours earlier in ewes synchronized with halved sponges in both the breeding and nonbreeding season. Ewes which received PMSG intravenously exhibited estrus 7,6 and 6,6 hours earlier than ewes receiving PMSG subcutaneously in the breeding and nonbreeding season respectively.

The time interval between progestogen withdrawal and the onset of estrus was directly affected by the level of progestogen and PMSG administration in both the breeding and nonbreeding season. However, in most cases, the time interval was shorter in the breeding season than in the nonbreeding season. The same tendency as above, existed for the deviation from the mean time within the group (Standard deviation), which proves more efficient estrus synchronization in the breeding season and with increasing doses of progestogen and PMSG.

Ovulation rate

There were no significant differences in the ovulation rates in both breeding and nonbreeding seasons, irrespective of whether whole or halved sponges were used or whether PMSG was administered subcutaneously or intravenously (Table 5). However, the ovulation rate tended to increase slightly with the higher levels of PMSG.

Lambing percentages

The lambing percentages after synchronization and artificial insemination in the nonbreeding season are presented in Tables 6 and 7.

Practically, the most important factor to be considered, is the number of lambs born to the total number of ewes

Table 7 Percentage lambs born to total number of ewes after estrus synchronization and artificial insemination within the seasonally anestrus period

Treatment	Lambing percentage
Whole sponge	72,38
Half sponge	64,36
Subcutaneous	57,96
Intravenous	80,69
PMSG I.U. 0	63,34
60	56,90
150	64,41
300	86,44

Table 6 Lambing percentages achieved after estrus synchronization in the seasonally anestrus period (n = 15)

Dose PMSG	Site	Whole sponge				Half sponge			
		A	B	C	D	A	B	C	D
0	—	66,67	83,34	66,67	83,34	60,00	69,23	60,00	69,23
60	SC	46,67	70,00	46,67	70,00	42,86	54,55	42,86	54,55
	IV	80,00	92,31	80,00	92,31	50,00	63,64	57,15	72,73
150	SC	40,00	50,00	46,67	58,34	50,00	50,00	50,00	50,00
	IV	80,00	85,72	86,67	92,86	73,34	73,34	73,34	73,34
300	SC	80,00	80,00	86,67	86,67	66,67	71,43	73,34	78,58
	IV	73,34	73,34	93,34	93,34	71,43	71,43	92,86	92,86
Mean		66,67	76,39	72,39	82,41	59,19	64,81	64,23	70,19

SC = Subcutaneous; IV = Intravenous.

$$\frac{\text{Number of ewes lambed}}{\text{Total number of ewes in group}} \times \frac{100}{1} = \text{A}; \quad \frac{\text{Number of ewes lambed}}{\text{Number of ewes in estrus}} \times \frac{100}{1} = \text{B};$$

$$\frac{\text{Number of lambs born}}{\text{Number of ewes in group}} \times \frac{100}{1} = \text{C}; \quad \frac{\text{Number of lambs born}}{\text{Number of ewes in estrus}} \times \frac{100}{1} = \text{D}.$$

mated or artificially inseminated. In this respect, the figures in Tables 6 and 7 clearly show an advantage of 8,02 and 22,73 percentage units (Table 7) respectively, when whole instead of halved sponges were used and when PMSG was administered intravenously instead of subcutaneously.

From the results in Table 6, it is evident that optimum reproduction (in terms of the number of lambs born to the total number of ewes) may be achieved by using whole sponges and administering PMSG intravenously. The most favourable results were obtained when whole sponges were used in combination with the intravenous administration of 300 I.U. PMSG. Whole or halved sponges used in combination with the intravenous administration of 150 or 300 I.U. PMSG respectively also proved quite effective.

When comparing whole with halved intravaginal sponges combined with either the intravenous or subcutaneous administration of different levels of PMSG for estrus synchronization of Karakul ewes, in terms of reproduction in the nonbreeding season, the results may be summarized as follows:

1 Whole sponges produced better results than halved sponges.
2 Levels of PMSG lower than 300 I.U. were less effective.
3 The intravenous administration of PMSG produced better results than subcutaneous administration.

It may therefore be concluded that, in terms of the number of lambs born to the total number of ewes, optimum reproduction may be achieved by using whole sponges combined with the intravenous administration of 300 I.U. of PMSG.

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