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TIME OF OVULATION IN LACTATING KARAKUL EWES FOLLOWING SYNCHRONIZATION OF OESTRUS DURING THE BREEDING SEASON

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OPSOMMING: DIE TYD VAN OVULASIE IN LAKTERENDE KARAKOELOOIE NA ESTRUSSINKRONISASIE GEDURENDE DIE TEELSEISOEN

120 Lakterende Karakoelooie is ewekansig in 12 gelyke groepe verdeel. Twee hoofgroepe het onderskeidelik lammers gesoog totdat intravaginale sponse geïmpregneer met 60 mg medroksi-progesteroon asetaat (Repromap, Upjohn) 28, 38 en 48 dae *post partum* ingesit is (nie-lakterend) of vir 'n periode van 90 dae *post partum* (lakterend). By sponsonttrekking is 500 of 300 I.E. DMSG (Upjohn) onderhuids ingesluit. Alle ooie is vanaf 12 uur na sponsontrekking met gevasektomiseerde ramme vir die begin van estrus getoets. Vanaf 20 uur na die begin van estrus is elke ooi met vyf-uurlikse intervalle gelaparotomiseer totdat ovulasie voorgekom het. Ten einde die einde van estrus vas te stel is elke ooi voor die operasie vir bronstigheid getoets. Die estrusperiode was hoogs betekenisvol ($P < 0,01$) korter in die ooie wat vroeër *post partum* gespons is (28 vs 38 vs 48 dae) sowel as in die lakterende ooie. Die periode tussen sponsonttrekking en die begin van estrus was hoogs betekenisvol ($P < 0,01$) korter in die groepe wat vroeër *post partum* gespons is wat veroorsaak het dat die periode tussen sponsontrekking en ovulasie betekenisvol ($P < 0,05$) korter was in hierdie groepe. Die tyd van ovulasie in uur na die begin van estrus sowel as die ovulasietempo is nie betekenisvol deur die behandelings beïnvloed nie.

SUMMARY:

120 Lactating Karakul ewes were randomly divided into 12 equal groups. Two main groups nursed lambs until medroxiprogesterone acetate impregnated sponges (Repromap, Upjohn) were inserted at 28, 38 and 48 days *post partum* (non-lactating) or until 90 days *post partum* (lactating). 500 or 300 I.U. PMSG (Upjohn) were injected subcutaneously at removal of the sponges. All ewes were tested for oestrus by vasectomised rams from 12 h after sponge removal. At 20 h after commencement of oestrus each ewe was laparotomized. This was repeated at 5 h intervals until ovulation occurred. Prior to each laparotomy the ewe was tested for oestrus to determine the duration of the oestrous period. The latter was highly significantly ($P < 0,01$) shorter in the lactating groups as well as when hormone treatment started before 48 days *post partum*. Oestrous activity following sponge withdrawal commenced significantly ($P < 0,01$) later as the *post partum* period increased. This resulted in significantly ($P < 0,05$) later ovulations relative to sponge withdrawal in the groups treated during the later *post partum* periods. The time of ovulation after commencement of oestrus and the number of ovulations per ewe were not influenced.

The response of the lactating Karakul ewe to hormone treatment as far as the different time intervals between progestogen withdrawal and the commencement of oestrus as well as the occurrence of ovulation are concerned, is unknown. This information however is relevant to an artificial insemination programme based on a time interval basis after sponge removal without the use of teaser rams.

In the Merino ewe ovulation was found 70–90 h after withdrawal of medroxi-progresterone acetate (MAP, Upjohn) impregnated sponges (Van Niekerk & Belonje, 1970). Van der Westhuizen, Van Niekerk & Hunter (1970) however indicated that ovulation occurs earlier if fluorogestone acetate impregnated sponges (F.G.A. G.D. Searle) are used. According to Allen & Lamming (1960) Masnain (1964) and Morrow, Ahmed & Sorensen (1963) ovulation in the lactating ewe should not be assumed following synchronization of oestrus. Robinson & Smith (1967) however reported the time of ovulation in mature non-lactating ewes during the breeding season as "normal" following synchronization by means of F.G.A.-impregnated sponges.

An experiment was therefore carried out with lactating Karakul ewes in order to determine the occurrence and time of ovulation, the length of the oestrous period as well as the interval between sponge withdrawal and the commencement of oestrus after synchronization of oestrus.

Procedure

In a 2 x 2 x 3 factorial experiment, intravaginal sponges impregnated with 60 mg medroxi-progesterone acetate (Repromap, Upjohn) were inserted into lactating and non-lactating ewes and left *in situ* for 15 days (Le Roux, 1974). At sponge removal 500 or 300 I.U. PMSG (Upjohn) were injected subcutaneously. The sponge insertion took place at 28, 38 or 48 days *post partum*. At these stages half of the lambs were weaned (non-lactating) while the rest of the ewes nursed their lambs until 90 days *post partum* (lactating).

All ewes were tested at 2 h intervals for oestrous activity from 12 h after sponge removal. At 20 h after the commencement of oestrus each ewe was laparotomized as described by Boshoff (1972). Laparotomies were repeated at 5 h intervals until ovulation occurred. Before each laparotomy the ewes were individually tested for oestrous activity in order to determine the duration of oestrus.

The experimental animals were penned and fed 2,2 kg per ewe daily of a ration consisting pf 72% lucerne and 28% maize providing 58,9% T.D.N. and 9,8% D.P. The live masses of the experimental animals were determined weekly commencing at partus until termination of the experiment.

Results and discussion

Age and live mass (Table 1)

in oestrus can be regarded as satisfactory. All ewes not exhibiting oestrus were laparotomized 10 days following sponge withdrawal. Small *corpora lutea* were found which might have resulted from silent ovulations. Although this does not seem to be related to any of the treatments, the possibility of short oestrous periods of low intensity which were not recognised by the teaser rams, cannot be excluded.

Table 1

Mean age (months) and weekly live masses (kg) of experimental groups

Lact. / Non-lact.	I.U. PMSG	Days *Post partum*	Age	Post partum live masses at week 0	1	2	3	4	5	6	7	8	9
Lactating	500	28	53,3	48,9	47,7	50,9	50,1	48,8	49,8	49,3	48,1		
		38	57,1	49,7	50,4	48,9	49,3	49,5	50,4	50,6	50,4	50,5	
		48	60,2	49,3	50,9	50,1	50,4	51,5	51,9	52,5	52,9	50,6	51,3
	300	28	59,8	48,3	46,7	49,5	48,6	47,5	48,0	47,9	45,2		
		38	48,5	47,5	49,6	47,5	47,8	47,1	48,0	48,1	47,8	47,2	
		48	60,4	51,0	51,3	52,1	51,0	52,4	52,7	53,3	53,2	52,2	51,9
Non-lactating	500	28	62,6	50,1	48,8	52,4	50,7	49,7	50,2	50,1	49,9		
		38	63,8	49,5	50,7	48,8	49,8	49,6	50,9	48,9	50,4	51,0	
		48	56,1	49,0	50,8	49,9	49,5	50,9	51,0	51,5	51,7	50,9	51,0
	300	28	60,4	47,4	46,2	48,9	48,2	47,3	47,9	48,3	48,7		
		38	60,1	48,6	50,3	48,6	48,5	48,8	49,8	48,5	50,0	50,7	
		48	63,1	49,8	50,3	51,9	51,4	52,6	53,3	53,2	52,9	52,9	53,2

According to Table 1 the mean age of the experimental groups varied between 4 and 5 years, which coincides with the peak reproductive period of the Karakul ewe (Boshoff, Gouws & Nel, 1975). The changes in live mass recorded indicate that the nutritive requirements of the experimental animals were met. Both age and nutrition therefore could not have had any adverse effects on the results presented.

Oestrous response. In Table 2 the actual *post partum* period at sponge insertion in the 28, 38 and 48 days groups as well as the percentages ewes exhibiting oestrus is shown.

Although the mean actual *post partum* periods in the different groups were 1–2 days longer than planned in the original design, these intervals between the groups were still about 10 days. The mean percentage of ewes

Table 2

Actual days post partum *at sponge insertion and oestrous response (%) after sponge removal*

Reproductive state	I.U. PMSG	Days *post patum*	Actual days *post partum*	Percentage ewes in oestrus
Lactating	500	28	29,3	90
		38	40,9	100
		48	50,8	100
	300	28	29,5	100
		38	40,6	100
		48	50,1	80
Non-lactating	500	28	29,6	90
		38	40,5	100
		48	50,0	90
	300	28	29,5	100
		38	40,4	100
		48	50,4	100

Oestrous duration and the commencement of oestrus (Table 3)

Table 3

Duration of oestrus and interval between sponge withdrawal and commencement of oestrus (hours)

Reproductive state	I.U. PMSG	Days *post partum*	Duration of oestrus	Sponge withdrawal to oestrus
Lactating	500	28	30,3	27,1
		38	31,5	27,8
		48	32,5	32,0
	300	28	27,5	23,8
		38	33,6	29,1
		48	31,9	33,2
Non-lactating	500	28	30,3	26,7
		38	35,5	27,4
		48	36,4	29,0
	300	28	31,5	30,8
		38	35,4	29,4
		48	36,0	31,6

An analysis of variance on the data concerning the duration of oestrus revealed significantly ($P < 0,01$) shorter oestrous periods in the lactating (31,2 ± 5,70 h) than in the non-lactating groups (34,1 ± 4,43 h) indicating that nursing of lambs reduced the length of the oestrous period. The difference between the mean duration of oestrus in the 28d (29,9 ± 3,88), 38d (33,9 ± 5,51 h) and 48 d (34,3 ± 3,26 h) groups was proved highly significant ($P < 0,01$) as well. This shorter oestrous duration during the early *post partum* periods could have been the result of nursing lambs which resulted in more stress due to greater milk flow or a more complete involution of the uterus at 48 days *post partum*. According to Van Wyk, Van Niekerk & Belonje (1972) the uterus of the ewe is completely involuted at 28 days *post partum*. However their data did not refer to uterine involution in the lactating ewe.

The interval between sponge removal and commencement of oestrus was not significantly influenced by lactation and dose of PMSG. According to Boshoff, Van Niekerk & Morgenthal (1973) dose level of PMSG resulted in a highly significantly ($P < 0,01$) quadratic effect on this interval. In the latter study however PMSG was injected intramuscularly and it is therefore not comparable with data of the present experiment. As will be pointed out later, dose level of PMSG did not play an important role in this experiment which may result from the subcutaneous injection of PMSG. According to Boshoff & Burger (1973) this may neutralise the effect of level of PMSG.

The interval between sponge withdrawal and commencement of oestrus was highly significantly ($P < 0,01$) different in the 28 d (27,2 ± 5,04), 38 d (28,4 ± 4,03) and 48 d (31,4 ± 5,35 h) groups. This earlier oestrous response in the shorter *post partum* groups is difficult to explain as duration of oestrus was more normal at later *post partum* periods. It appears however that lactation did not adversely influence the interval between sponge withdrawal and the commencement of oestrus.

Time of ovulation and fecundity (Table 4)

Table 4

Time of ovulation (hours) and the number of ovulations per ewe

Reproductive state	I.U. PMSG	Days *post partum*	Number of ovulations/ ewe	Time of ovulation after	
				commencement oestrus	sponge withdrawal
	500	28	1,33	33,1	60,3
		38	1,60	31,5	60,6
		48	1,10	33,0	65,0
	300	28	1,44	28,0	51,3
		38	1,22	30,8	59,7
		48	1,00	31,9	66,6
	500	28	1,22	30,8	57,5
		38	1,40	33,0	60,5
		48	1,22	33,1	63,2
	300	28	1,50	31,0	61,8
		38	1,30	33,0	62,4
		48	1,40	32,0	63,6

The interval between commencement of oestrus and ovulation was not significantly influenced by any of the treatments. According to oestrous duration in Table 3 and the time of ovulation in Table 4, ovulation took place almost at the end of heat, which can be regarded as normal. Boshoff *et al* (1973) found that time of ovulation was related to dose of PMSG. These data however included numerous multi-ovulations after intramuscular injection of PMSG. It is possible that those abnormal early ovulations were related to the multi-ovulations at the higher doses of PMSG.

The interval between sponge withdrawal and ovulation was significantly ($P < 0,05$) shorter in the 28 d (57,7 ± 7,45 h) than in the 38 d (60,8 ± 6,64 h) or 48 d (64,6 ± 7,26 h) groups. This was due to the shorter interval between sponge withdrawal and commencement of oestrus in the groups treated earlier *post partum*.

Although there was a tendency for non-lactating ewes to have a higher ovulation rate (1,35 ± 0,49) than lactating ewes (1,29 ± 0,56) as well as for the 28 d (1,37 ± 0,54) 38 d (1,33 ± 0,49) and 48 d (1,19 ± 0,39) groups, these differences were not significant and are probably due to the route of injection of PMSG (Boshoff *et al* 1973).

Conclusions

It is evident that ovulation in the lactating Karakul ewe occurred from 51 to 66 h after sponge with-

drawal. Artificial insemination at 48, 60 and 72 h after sponge withdrawal is indicated, irrespective the dose of PMSG. This is some 12h later than the time of insemination advised by Boshoff (1972) for dry and 28 d *post partum* ewes. It seems advisable to start hormone treatment at 48 days *post partum* in order to eliminate the shorter oestrous periods found in this study. Provided that the nutritive requirements of the lactating ewe is met, it does not seem necessary to wean the lambs at these early stages. Studies directed at conception rates and lambing percentages however are necessary for definite conclusions regarding the weaning of lambs prior to hormone treatment.

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