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TIME OF OVULATION IN THE KARAKUL EWE FOLLOWING SYNCHRONIZATION OF OESTRUS

D.A. Boshoff*, C.H. van Niekerk and J.C. Morgenthal

Department of Animal Physiology, Faculty of Agriculture, University of Stellenbosch

OPSOMMING: DIE TYD VAN OVULASIE VAN KARAKULOOIE NA SINKRONISASIE VAN DIE ESTRUSSIKLUS

Die invloed van medroksi-progesteroonasetaat geïmpregneerde intravaginale sponse en dragtige merrie serum gonadotrofien (DMSG) op die lengte van die estrusperiode, die tyd vanaf sponsonttrekking tot die begin van estrus, die tyd van ovulasie en die aantal ovulasies is ondersoek. Die proef is binne en buite die teelseisoen met gusooie sowel as *post partum*-ooie gedoen. DMSG het nie die lengte van die estrusperiode beïnvloed nie, maar het wel die tyd vanaf sponsonttrekking tot die begin van estrus verkort, die tyd van ovulasie, bepaal vanaf sponsonttrekking en die begin van estrus, vervroeg en die aantal ovulasies per ooi vermeerder. Volgens die resultate wat verkry is, word kunsmatige inseminasie 36, 48 en 60 uur na sponsonttrekking aanbeveel, sonder om die begin van estrus met koggelramme vas te stel. Dieselfde tye van inseminasie geld vir gus- en *post partum* ooie, ongeag watter stadium van die teelseisoen sinkronisasie toegepas word.

SUMMARY

The influence of medroxyprogesterone acetate impregnated intravaginal sponges and pregnant mare serum (PMSG) on the length of oestrus, the length of the interval from sponge withdrawal to the beginning of oestrus, the length of the interval from the beginning of oestrus to ovulation and the number of ovulations per ewe was investigated. Barren and *post partum* ewes were used during both the breeding and non-breeding seasons. PMSG had no effect on the length of oestrus, but shortened the period from sponge withdrawal to the beginning of oestrus, advanced the time of ovulation in relation to both the beginning of oestrus and sponge withdrawal, and increased the number of ovulations per ewe. The time interval from sponge withdrawal to the beginning of oestrus was found to be shorter, and the length of oestrus longer in the normal breeding as compared to the non-breeding season. The number of ovulations per ewe, and the interval from sponge withdrawal to ovulation were not subject to seasonal influences; and no differences were apparent between barren and *post partum* ewes. Without the predetermination of the beginning of oestrus by teaser rams, artificial insemination at 36, 48 and 60 hr after sponge withdrawal is recommended irrespective of the season during which synchronization is applied.

In the ewe ovulation occurs towards the end of oestrus. Few cases are known where this happens, under natural conditions, within 24 hours of the beginning of oestrus (Anderson, 1938). Information concerning the time of ovulation following synchronization of oestrus in the ewe with progesterone impregnated sponges and pregnant mare serum gonadotrophin is limited. Van Niekerk & Belonje (1970) found that Merino ewes ovulate from 70 to 90 hours after the removal of intravaginal sponges impregnated with medroxyprogesterone acetate (MAP, Upjohn). However where fluorogestone acetate impregnated sponges (FGA, G.D. Searly & Co.) were employed in Dormer ewes, ovulation took place as early as 45 to 80 hours after sponge withdrawal, or two and a half hours after the end of oestrus (Van der Westhuizen, Van Niekerk & Hunter, 1970).

The purpose of the present study was to determine the time of ovulation in Karakul ewes after treatment with medroxyprogesterone acetate impregnated intravaginal sponges (Repromap Plus, Upjohn) and pregnant mare serum gonadotrophin in order to establish the critical time for artificial insemination following sponge withdrawal. Application of this information could then be used to exclude the need to use teaser rams for oestrus detection prior to artificial insemination.

Procedure

Both barren and *post partum* Karakul ewes were used within as well as outside the normal breeding season (which lasts from the second half of January to the first half of August) to determine (a) the period from sponge withdrawal to the beginning of oestrus, (b) the length of the oestrus period, (c) the time of ovulation and the total number of ovulations per ewe. In the case of the parturient ewes the lambs were removed within 24 hours of birth, allowing the uterus to be fully involuted by the 28th. day *post partum* (Van Wyk, Van Niekerk & Belonje, 1972), when the sponges were inserted. The allocation of experimental animals into the various groups is given in Table 1.

As a precaution against vaginal infection each animal

*Present address: Agricultural Research Station, P.O. Box 37, Upington.

Table 1

Allocation of experimental animals

Total no. of ewes	96															
Season	Breeding								Non-breeding							
No. of ewes	48								48							
Reproductive status	Barren				Post-partum				Barren				Post Partum			
No. of ewes	24				24				24				24			
I.U. PMSG*	750	500	250	0	750	500	250	0	750	500	250	0	750	500	250	0
No. of ewes	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

*International Units of Pregnant Mare Serum Gonadotrophin

received two ml of a five per cent (w/v) dehydrostreptomycin solution (Agavin, May & Baker) intravaginally, after which sponges impregnated with 40 mg medroxyprogesterone acetate (Repromap Plus, Upjohn) were inserted into the vagina of each ewe and left *in situ* for 13 days. Thirty two hours before sponge withdrawal, pregnant mare serum gonadotrophin (PMSG, Upjohn) was administered intramuscularly at the following dosages:

Group 1: 750 International Units
Group 2: 500 International Units
Group 3: 250 International Units
Group 4: Controls.

Following sponge withdrawal the ewes were joined by teaser rams and kept under constant observation for oestrus. On exhibiting oestrus, each ewe was removed from the rams and during the breeding season, laparotomized twenty hours afterwards for visual examination of the ovaries. The laparotomies were repeated thereafter at five-hourly intervals until such time as ovulation occurred. In the part of the experiment which took place in the non-breeding season, each of the ewes concerned was laparotomized 25 hours after the observed commencement of oestrus as indicated by the teaser rams. The end of oestrus was determined in the ewes by observing their response to teaser rams which were rejoined with the ewes at 24 hours after the beginning of oestrus, and at two-hourly intervals thereafter until all the ewes had ceased to exhibit oestrus. The total number of ovulations per ewe was determined by laparotomy of each ewe eight days after the end of oestrus, when the total number of *corpora lutea* on the ovaries of each ewe was recorded.

Results and discussion

1. *Interval from sponge withdrawal to beginning of oestrus (Table 2)*

The use of PMSG highly significantly (P < 0,01) shortened the interval between sponge withdrawal and the beginning of oestrus. Furthermore, there was a highly significant (P < 0,01) linear as well as quadratic relationship between dosage of PMSG administered and the interval from sponge withdrawal to the beginning of oestrus (Fig. 1). The quadratic relationship indicates that this interval is not always directly proportional to an increase

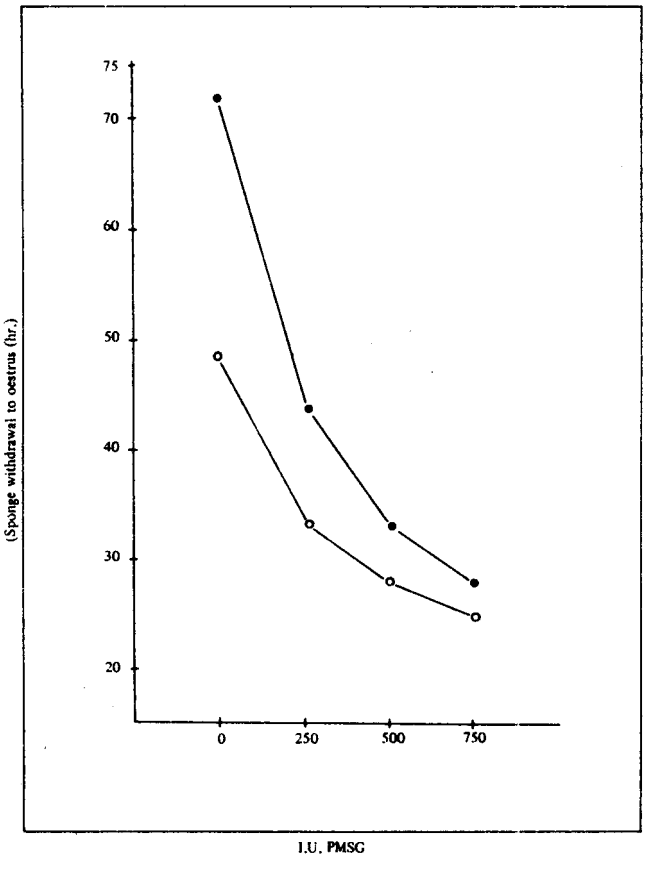

Fig. 1. – *The relationship between the dosage PMS and the interval from sponge withdrawal to the beginning of oestrus.*

Table 2

Average period (hr.) from sponge withdrawal to beginning of oestrus

I.U. PMSG	Breeding season	Non-breeding season
0	48,9	72,1
250	33,8	43,8
500	27,1	33,6
750	25,1	27,4

*International Units of Pregnant Mare Serum Gonadotrophin

in PMSG levels; it will not be shortened by merely increasing the PMSG dosage. In accordance with the results of Holst (1969), the interval from sponge withdrawal to the beginning of oestrus was found to be significantly shorter within the breeding season than without (Table 2).

2. *The duration of oestrus*

The average length of oestrus induced during the non-breeding season (29,0 ± 0,56 hr) was highly significantly (P < 0,01) than among ewes treated within the breeding season (35,58 ± 0,56 hr) which is in accordance with the observations of Lamond (1962) and Lamond & Bindon (1962). PMSG at the levels used in this study, did not influence the length of oestrus, and no notable differences were observed in this respect between barren and *post partum* ewes.

3. *The interval from the beginning of oestrus to ovulation (Table 3)*

The time of ovulation relative to the beginning of oestrus was highly significantly (P < 0,01) and linearly shortened by PMSG in both barren and *post partum* ewes, between which no notable difference could be detected. However, seasonal influences were important as exemplified by the fact that ovulation occurred significantly earlier in both barren and *post partum* ewes during the non-breeding season again without differences between the two groups. In addition a highly significant (P < 0,01) interaction occurred between breeding season on the one hand and the reproductive status of the ewes, (barren and *post partum*) on the other.

4. *The interval between sponge withdrawal and ovulation (Table 3)*

PMSG highly significantly (P < 0,01) decreased the time from sponge withdrawal to ovulation, and a highly significant (P < 0,01), linear as well as quadratic relationship was found to occur between the level of PMSG administered and the time of ovulation (Fig. 2). In contrast to the seasonal effect on the interval between the beginning of oestrus and ovulation as described above, it was noted that the time between sponge withdrawal and ovulation did not differ within or without the breeding season. In view of the lack of any perceptible difference between barren and *post partum* ewes, the results of the two groups were combined, and from this it is evident that the groups to which 0; 250; 500 and 750 I.U. PMSG were administered respectively ovulated on the average 96,69; 71,88; 59,73 and 51,63 hours after sponge withdrawal.

Table 3

The average time of ovulation

		Time of ovulation (hr.)							
		After beginning of oestrus				After sponge withdrawal			
I.U. PMSG*		750	500	250	0	750	500	250	0
During breeding season	B	23,3	30,0	32,5	38,3	46,8	56,3	62,8	88,1
	P	31,7	25,8	38,3	40,0	58,3	63,8	75,4	87,8
During non-breeding season	B	23,3	26,7	33,3	34,8	50,5	60,0	79,8	95,4
	P	23,3	25,0	28,3	32,5	50,9	58,0	69,5	115,5

*International Units of Pregnant Mare Serum Gonadotrophin

B = Barren ewes

P = Post partum ewes

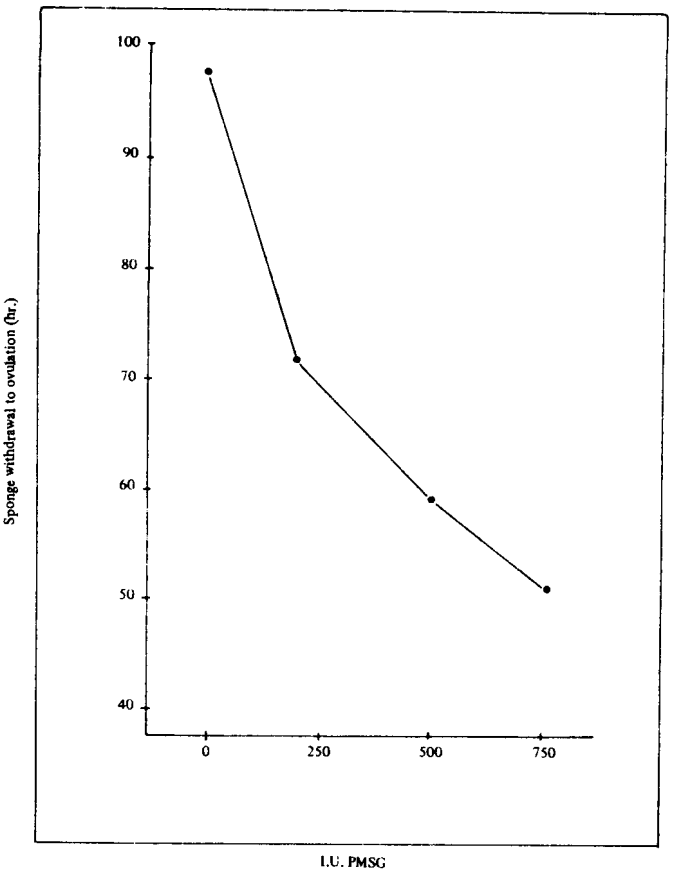

Fig. 2. – *The time of ovulation in hours after sponge withdrawal*

5. *The number of ovulations per ewe*

The total number of ovulations per ewe was directly related to the dosage levels of PMSG administered. In the 0; 250; 500 and 750 I.U. PMSG groups the average number of ovulations per ewe were respectively, 1,12; 1,44; 2,66 and 4,88; this relationship between dosage of PMSG and ovulations per ewe was found to be linear and highly significant ($P < 0,01$) and it was not influenced by season or by the reproductive status of the ewe. Fifty five per cent of ovulations occurred on the right ovary as against 45% on the left.

Since laparotomies were not continued from when the first ovulations had been recorded until the establishment of the total number of ovulations per ewe (i.e. eight days later) the period during which multi-ovulations had occurred is not known. However, it is possible to state that this could not have been much longer than the 12 hr. described by Killeen & Moore (1966), for the number of ovulations per ewe recorded at the first instance did not vary much from the number of *corpora lutea* found in each ewe eight days later. In the 750 I.U. PMSG-groups it was found for example that the total number of *corpora lutea* between the two laparotomies were 108 and 117 respectively.

Triplets are undesirable in the Karakul industry in view of the smaller, less valuable pelts produced by such lambs. In this study the average number of ovulations in groups having received 250 I.U. PMSG was found to be 1,44; and it would seem highly unlikely that this could have resulted in significant numbers of multiple births. Even a dosage of 500 I.U. PMSG, which resulted in an average of 2,66 ovulations per ewe, should not have produced too many twins if the observations of Van Rensburg (1964) – who indicated that the loss of ova could be of the order of 47% – are taken into account. The possibility that triplets would ensue from the treatment at these dosages, is thus very small and even the number of twins should not pose any particular problem.

While environmental factors could perhaps exert an influence, it is evident from this study that the number of ovulations per ewe is not affected by seasonal differences. Therefore, the same dosages of PMSG could be used irrespective of whether synchronisation is applied within the breeding season or not. During the breeding season it would be advisable – at least in the Karakul – to administer PMSG at a shorter time prior to sponge withdrawal than at other times of the year thereby, according to Hulet & Foote (1967), averting multi-ovulations. It would not be advisable for this purpose to decrease the dosage of PMSG as this would tend to decrease the efficiency of synchronization.

6. *The application of artificial insemination of synchronized ewes without the use of teaser rams for the predetermination of oestrus*

The respective groups of ewes which received 500 I.U. PMSG ovulated between 45 and 75 hr. after sponge withdrawal during the non-breeding season, and between 45 and 80 hr. in the breeding season. Therefore, three inseminations at 12 hourly intervals beginning 36 hr. after sponge withdrawal should be sufficient irrespective of the season. Teaser rams may be useful at the third insemination, when only those ewes still in oestrus are inseminated. Although such a recommendation should be practicable under farming conditions, further investigations are required in order to decrease the number of inseminations from three to two.

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