S. Afr. J. Anim. Sci. 5, 33–36 (1975)

TIME-DOSE RELATIONSHIPS OF PMSG AND MAP-INTRAVAGINAL SPONGES AND ITS EFFECT ON EMBRYONIC MORTALITY IN KARAKUL EWES

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Receipt of MS 26 7.74

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OPSOMMING: TYD-DOSIS INTERAKSIES VAN DMSG EN MAP-INTRAVAGINALE SPONSE EN DIE EFFEK DAARVAN OP EMBRIONALE VERLIESE

Die invloed van medroksi-progesteroonasetaat geimpregneerde intra-vaginale sponse en dragtige merrie serum gonadotrofien (DMSG)in verskillende tyd-dosis van toediening kombinasies, op die voorkoms van embrionale verliese, is by Karakoelooie binne sowel as buite die teelseisoen ondersoek. Daar is vasgestel dat 'n dosis van 300 I.E. DMSG wat twee dae voor sponsonttrekking buite die teelseisoen en met onttrekking in die teelseisoen, binnespiers toegedien word, die beste resultate lewer. Die komponent van totale verliese wat onderskeidelik aan onvermoe om te bevrug en degenerasie van bevrugte ova toegeskryf kan word, het ongeveer in gelyke mate tot die totale verlies van gemiddeld 53,7%vir die herfs- en 50%vir die lente behandelings bygedra.

SUMMARY

Different dosage levels of pregnant mare serum gonadotrophin (PMSG) were applied in conjunction with medroxyprogesterone acetate impregnated intravaginal sponges at different times in relation to sponge removal. The object of the study was to find the most economical dose level and the correct time of application which would result in the least variability as far as ovarian response and embryonic failure was concerned. The lower dosage levels of PMSG (300 I.U.) injected intramuscularly, two days prior to sponge removal for out of season and on removal for the breeding season treatments, gave the most consistent ovulatory response as well as the lowest incidence of wastage of ova. Losses due to fertilization failure and embryonic death were more or less equally proportioned within the overall loss of potential ova of 50%and 53,7% recorded respectively for out of season and breeding season treatments.

Since Dutt (1953) reported that the injection of progesterone for a period preceding pregnant mare serum (PMSG) administration resulted in increased oestrous and ovulatory response in ewes, it has been generally accepted that PMSG-progesterone time-dose relationships are important. In the Karakul, where restricted multiples is the ideal, this relationship becomes even more important.

One of the major problems associated with the use of PMSG to induce multi-ovulation is the marked individual variation in response to standard dose levels. Excessive responses are frequently associated with fertilization failure, embryonic loss and even with loss of the whole pregnancy (Moore, 1968). Apart from work by Boshoff & Burger (1973) on ovulation rates of Karakul ewes treated with different time-dose combinations of MAP–PMSG, no standard procedure which would limit embryonic wastage and ensure a good lambing percentage, has been formulated for application in the Karakul. Consequently this paper reports on the effect of MAP–PMSG-time-dose relationships on fertilization failure and embryonic mortality during different seasons in the Karakul.

Procedure

Two hundred and fifty-six parous Karakul ewes were randomly allotted to treatment in a factorial design incorporating the following factors (n = 32; N = 256):

2 levels of PMSG	300 cf 600 I.U.
2 times of application of PMSG relative to sponge withdrawal	Days 13 cf 15
2 seasons of treatment	Spring cf. autumn

Oestrus was synchronised by sponges impregnated with medroxyprogesterone acetate (MAP), inserted intravaginally for 15 days. For out of season (spring) treatment 40mg and breeding season (autumn) treatment 60 mg MAP sponges were used. Ewes were teased twice daily and handmated 8 to 10 h after standing heat and again 12 h later. In every subgroup 20 ewes were allowed to go to term whereas 6 were laparatomised on Day 5 subsequent to sponge removal and 6 slaughtered on Day 25 subsequent to mating.

The ovaries were examined for fresh ovulation points and/or *corpora lutea* and the number of viable and degenerating embryos were recorded. The criteria for classification of the embryos were the colour of the allantoic and amniotic fluids as well as the general appearance, colour and size of the embryo (Dolling & Nicholson, 1967). Fertilization failure was expressed as the difference between total ovulations and total embryos as a percentage of the first. In addition, an estimate of total loss of potential ova was computed by expressing the difference between the number of lambs eventually born and the mean ovulation rate as a ratio of the latter.

Results and Discussion

Table 1 shows the mean ovulatory response and the mean number of viable embryos as well as lambing rates and total loss of potential ova.

Ovulatory response was improved by the higher dosage levels of PMSG. The number of live embryos recovered, on the other hand, indicated a negative reaction of dosage level with time of application also affecting response. At the higher dosage levels of PMSG more em-

Table 1

Mean ovulation rate and total and live embryos recovered from MAP-PMSG-treated Karakul ewes

Season	Spring				Total ± SE	Autumn				Total ± SE
Time of PMSG	13		15			13		15		
Dose PMSG	300	600	300	600		300	600	300	600	
Ovulation Rate ± SE	2,0[a] ± 0,21	3,25[b] ± 0,43	1,17[a] ± 0,11	1,50[a] ± 0,15	1,98 ± 0,17	2,67[bc] ± 0,43	2,92[b] ± 0,48	1,67[a] ± 0,14	1,92[ac] ± 0,29	2,27 ± 0,19
Live Embryos ± SE	1,83[a] ± 0,31	1,67[a] ± 0,33	1,00[b] ± 0	1,33[ab] ± 0,17	1,42 ± 0,13	2,50[c] ± 0,62	2,17[bc] ± 0,48	1,33[ab] ± 0,21	1,17[ab] ± 0,17	1,79 ± 0,23
Lambing %	120[a]	77[b]	79[b]	121[a]	100	112[a]	81[b]	125[a]	105[a]	105
% Total Loss (Ovulation Rate – Lambing Rate)	40,0	76,3	32,5	19,3	50,0	58,1	72,3	25,2	45,3	53,7

Figures with the same superscript do not differ significantly.

bryos degenerated ($P < 0,05$) whereas PMSG when applied prior to sponge removal also resulted in more nonviable embryos. This was also reflected in the higher lambing percentages recorded after application of PMSG at the lower levels. A chi-square analysis of the pooled data is given in Table 2 and indicates an overall significant effect of dosage level of PMSG on the incidence of degenerating embryos with the higher dosage levels again resulting in the greatest wastage (31,2% cf 12,4%, $P < 0,01$).

Apparently the advantage of greater ovulation rates was offset by greater fertilization failure and embryonic mortality at the higher dosage levels of PMSG. In addition the time of PMSG application affected lambing rates through better conception when given at sponge withdrawal (39,3% cf 9,5%; $P < 0,01$).

According to Giles (1969) the basal embryonic loss in sheep is of the order of 30%, with the greater proportion due to fertilization failure. In the present study however after hormone treatment, losses due to these components were more or less equally proportioned with an overall loss of 50% for out of season and 53,7% for breeding season treatment.

Table 2

Ova wastage due to treatment of Karakul ewes with MAP–PMSG

Factors	% Loss due to		Total
	Embryonic Failure	Fertilization Failure	
Dose PMSG			
300	12,4	26,5	38,9
600	31,2	22,1	53,3
$X^2_{(1)}$	$P < 0,01$	NS	$P < 0,05$
Time of Application			
13	22,3	39,3	61,6
15	21,3	9,5	30,8
$X^2_{(1)}$	NS	$P < 0,01$	$P < 0,01$
Season			
Spring	28,3	21,7	50,0
Autumn	21,2	32,5	53,7
$X^2_{(1)}$	NS	NS	NS

The interactions between the different factors and their effect on total wastage are illustrated in the form of response curves in Fig. 1.

The relationship between dosage level and time of application of PMSG ($P < 0,05$) clearly indicates the importance of this particular time-dose relationship. It would appear that PMSG when given at the lower dosage level (300 I.U.) prior to sponge withdrawal for out of season and at withdrawal for breeding season treatment, resulted in satisfactory ovulation, fertilization and embryo survival rates. The success of this particular method of PMSG application is contrary to the hypothesis that it should be applied either at or after sponge withdrawal when blood progesterone is at a low level (Moore & Holst, 1967; Newton, Denehy & Betts, 1972). It would thus appear that a certian amount of interaction between progesterone and PMSG is necessary, particularly at the lower dosage levels of PMSG as used in this experiment.

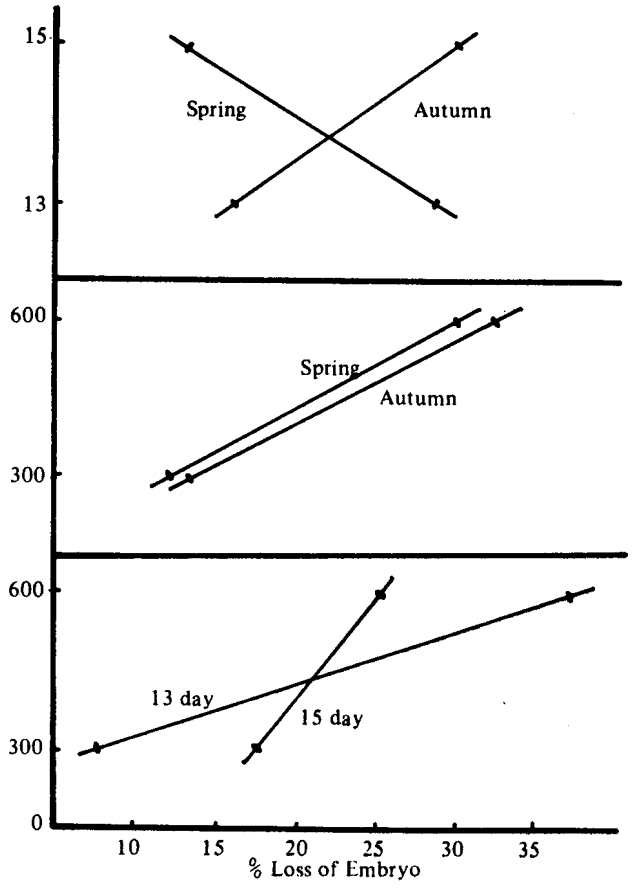

Fig. 1 *Interactions involving dosage level, season and time of application of PMSG on embryonic loss*

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