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REDUCING THE PARTUM-TO-MATING PERIOD IN AUTUMN LACTATING EWES THROUGH THE USE OF EXOGENOUS HORMONES

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OPSOMMING: VERKORTING VAN DIE PARTUM-TOT-DEKPERIODE IN HERFS LAKTERENDE OOIE DEUR DIE GEBRUIK VAN EKSOGENE HORMONE

'n Poging is aangewend om estrus gedurende die vroeë post partum periode by 172 Merino ooie wat gedurende herfs gelakteer het, op te wek. Behandeling het op die 15de dag post partum begin en het die volgende ingesluit: (i) 'n enkele 50 µg inspuiting van GnVH, (ii) twee 50 µg inspuitings van GnVH met 'n tussenpose van 16 dae, (iii) 600 IE DMSG plus 'n progesteroon inplanting vir 16 dae gevolg deur 'n verdere 600 IE DMSG, (iv) 600 IE DMSG en 50 µg estradiol bensoaat gevolg deur 'n progesteroon inplanting vir 16 dae en 'n finale toediening van 600 IE DMSG op die 31ste dag en (v) 'n kontrole groep. Vir estrus waarneming is vrugbare ramme by die helfte van die ooie geplaas en koggelramme by die res. In vergelyking met die onbehandelde ooie is die periode tot eerste estrus (gemiddeld 49,3 dae) betekenisvol ($P < 0,01$) verkort by al vier die hormoonbehandelde groepe, behalwe dié wat twee inspuitings van GnVH ontvang het. Estrus binne 40 dae na partus is meer effektief opgewek deur behandelings wat DMSG en 'n progesteroon inplanting ingesluit het, as GnVH inspuiting alleen (63,4 vs 36,2 persent; $P < 0,01$). In teenstelling, het die lampersentasies vir hierdie groepe die teenoorgestelde tendens getoon (56,7 vs 65,7 persent), terwyl 93,7 persent van die kontrole groep gelam het. In die geheel gesien is geen betekenisvolle verskille tussen die gemiddelde lam intervalle verkry nie en hiervan kan afgelei word dat die gebruik van eksogene hormone van min of geen waarde gedurende die herfs-dekseisoen was nie.

SUMMARY:

The induction of oestrus during the early post partum period was attempted in 172 Merino ewes which lactated during autumn. Treatment was initiated on day 15 post partum and included groups receiving (i) a single 50 µg injection of GnRH, (ii) two 50 µg injections of GnRH 16 days apart, (iii) 600 IU PMSG plus a progesterone implant for 16 days followed by a further 600 IU PMSG, (iv) 600 IU PMSG and 50 µg oestradiol benzoate (ODB) followed by a progesterone implant for 16 days and a final injection of 600 IU PMSG on day 31, and (v) a control group. Half the ewes were run with fertile rams, while the remaining ewes were associated with teaser rams to detect oestrus. Compared to untreated ewes the interval to first oestrus (mean 49,3 days) was significantly reduced ($P < 0,01$) in all of the hormonally treated groups, except those which received two injections of GnRH. Overt oestrus within 40 days after lambing was more effectively induced by treatments which included PMSG and a progesterone implant than GnRH injection only (63,4 vs 36,2 per cent; $P < 0,01$). In contrast, the lambing rates for these treatments exhibited the opposite trend (56,7 vs 65,7 per cent), while 93,7 per cent of the control group lambed. Overall, no significant differences in the mean lambing intervals were obtained, suggesting that the use of exogenous hormones was of little value during the autumn period.

Introduction

Reviews of research on the hormonal induction and/or synchronization of oestrus in farm animals (Lamond, 1964; Hunter, 1968; Wiltbank, 1970; Lamming, 1973) support the contention that few investigations have concentrated on the early post partum ewe, either lactating or dry.

To date, the most successful method of inducing oestrus in non-cycling ewes has incorporated the use of both progesterone and PMSG. Of the progestagens and methods of administration listed by Lamming (1973), oral administration is of limited value due to the difficulty of regulating intake. Similarly, intra-vaginal sponges are likely to be unsuitable during the early post partum period as the elimination of debris during uterine involution may be retarded. Recently, the potential of progesterone-impregnated capsules, implanted subcutaneously, to supplant the corpus luteum has been successfully realised by Özkoca (1972), Xenoulis, Minotakis and Tsamis (1972) and Keane (1974).

In the lactating ewe progesterone therapy soon after parturition is unlikely to be followed by ovulation unless LH stimulation is provided, either from an exogenous source of gonadotropin (PMSG) or due to an artificially induced endogenous release. Thus, Falken-

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burg, Hulet and Kaltenbach (1971) increased the proportion of ewes exhibiting oestrus on the first day after progesterone implant removal by administering oestrogen (750 IU). However, the use of high levels of oestrogen to trigger the release of LH and induce oestrus is precluded in lactating animals, since Chowdhry and Forbes (1972) and Fulkerson and McDowell (1974) reported a deleterious effect on both milk yield and milk composition.

GnRH has been shown to stimulate an ovulatory surge of LH which results in ovulation in both cyclic and anoestrous ewes (Foster & Chrighton, 1973), while Louw, Lishman, Botha, Arangie, Poultney and Günter (1976) found that GnRH administration as early as day 17 post partum resulted in ovulation in lactating ewes. A question which has arisen is whether such ewes continue to cycle or revert to the anoestrous state?

The object of this experiment was to compare the response of ewes to different exogenous hormones and combinations of hormones in an attempt to reduce the number of days from parturition to first oestrus, and thereby shorten the interval to the subsequent lambing.

Procedure

Immediately after parturition lactating Merino ewes, varying in age from two to seven years were randomized according to age, date of lambing and type of birth (singles or twins) into five groups (Fig. 1) each of approximately 30 animals.

Lambing occurred from 14 March to 18 April, but the ewes were treated on an individual basis, with treatment starting on day 15 post partum. The protocol employed is illustrated in Fig. 1.

The progesterone implants (sil-estrus; Abbott) were inserted subcutaneously behind a foreleg. All injections were administered intramuscularly.

Teaser rams with marking crayons were introduced on approximately day 15, and every second day the rams were interchanged between the five treatment groups.

The ewes were separated into two groups and on day 31 fertile rams, with raddle crayons were joined with Group A ("first-flock" ewes) while Group B ("second flock" ewes) remained with vasectomized rams. These fertile rams were also changed frequently to stimulate the ewes. Animals were checked for raddle marks daily until 68 days after parturition when joining ceased in both Groups A and B. The control group was subjected to the same handling as the other animals, but received no form of hormonal treatment.

Prior to lambing the ewes were grazed on kikuyu pastures without supplementary feeding. Post partum they were confined to kikuyu paddocks and fed maize silage *(ad lib.)* plus 1,0 kg milled lucern hay and 0,5 kg of a 90:10 maize meal-carcase meal mixture per day. At approximately one month of age the lambs received a creep ration.

Normal dosing, mineral supplementation and managerial practices were followed.

Treatment group	Days post partum 15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1						Control											
2	GnRH																
3	GnRH																GnRH
4	PMSG	←		Progesterone implant													→ PMSG
5	PMSG + ODB	←		Progesterone implant													→ PMSG

GnRH – 50 μg i.m.
PMSG – 600 IU i.m.
ODB – 50 μg i.m.
Progesterone – 375 mg implant

Fig. 1 Protocol employed for the induction of oestrus in ewes lactating during autumn

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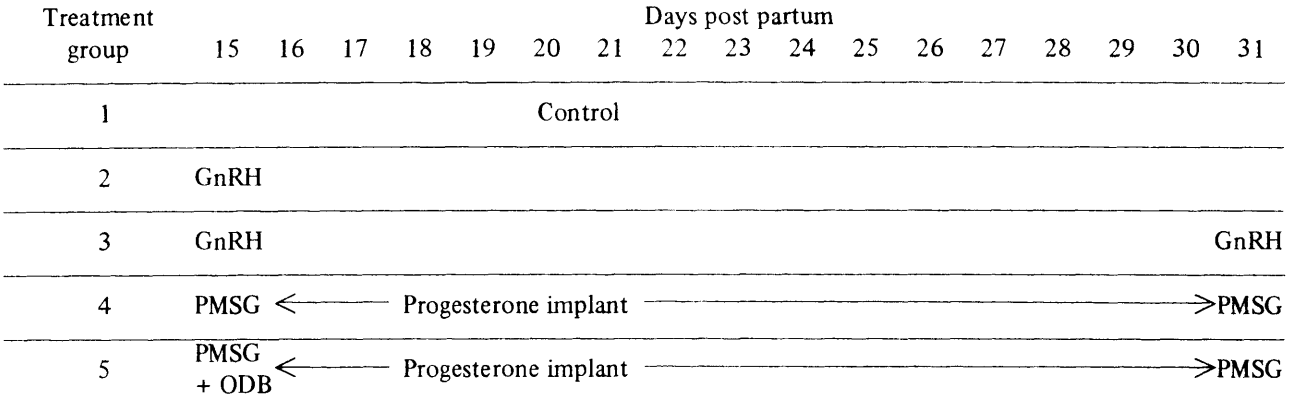

Fig. 1 Protocol employed for the induction of oestrus in ewes lactating during autumn

Table 1

Reproductive performance of lactating ewes following hormonal therapy during autumn

	Treatment				
	Control Group 1	GnRH Group 2	GnRH + GnRH Group 3	PMSG + Progesterone + PMSG Group 4	PMSG + ODB + Progesterone + PMSG Group 5
Number of ewes	32	36	33	33	38
Oestrus by 40 days post partum (%)	$28,1^{c}$	$44,4^{b}$ Mean = $36,2^{c}$	$27,3^{c}$	$66,7^{a}$ Mean = $63,4^{d}$	$60,5^{a}$
Not oestrus by 68 days post partum (%)	0^{b}	$13,9^{a}$	$15,1^{a}$	0^{b}	$13,1^{a}$
Mean days to first oestrus	$49,3^{b} \pm 1,8$	$40,6^{a} \pm 1,8$	$48,1^{b} \pm 1,9$	$40,4^{a} \pm 1,7$	$39,7^{a} \pm 1,7$
Number exposed to fertile rams	16	17	18	19	18
Conceiving to first oestrus (%)	$87,5^{a}$	$70,6^{a}$	$83,3^{a}$	$47,4^{b}$	$57,6^{a}$
Number lambing (%)	$93,7^{a}$	$76,5^{a}$ Mean = $65,7^{a}$	$55,5^{a}$	$57,9^{a}$ Mean = $56,7^{a}$	$55,5^{a}$
Mean lambing interval (days)	$197,1^{a} \pm 2,0$	$198,5^{a} \pm 2,0$	$204,6^{a} \pm 2,2$	$196,9^{a} \pm 2,0$	$195,4^{a} \pm 2,0$

a, b, c Values bearing the same superscript do not differ significantly

$a > b > c$

Table 2

Number of oestrous cycles exhibited by ewes not exposed to fertile rams following induction of oestrus

Treatment	Group	n	% Exhibiting oestrus: once only	% Exhibiting oestrus: >once
Control	1	16	68,7	31,2
GnRH	2	14	71,4	28,6
GnRH + GnRH	3	10	90,0	10,0
PMSG + Progesterone + PMSG	4	14	64,3	35,7
PMSG + ODB + Progesterone + PMSG	5	15	60,0	40,0

Results

Occurrence of oestrus

The most favourable response in terms of (i) proportion of treated ewes showing oestrus within both 40 and 68 days after lambing and (ii) interval to first oestrus was achieved by the use of a combination of PMSG and progestagen (Table 1). The inclusion of an injection of oestradiol prior to insertion of the progesterone implants appeared to be of no additional value.

Only where GnRH treatment was limited to a single injection was the number of ewes exhibiting oestrus by 40 days post partum increased, and the interval to first oestrus decreased (Group 2, Table 1).

Amongst the "first flock" ewes (not joined with fertile rams) there were no significant differences between treatments as regards the number of oestrous cycles exhibited during the 68-day observation period or the proportion of ewes showing one or more cycles (Table 2). The difference in the number of cycles

was not due to the ewes lapsing into anoestrus. The data reflects the fact that certain treatments were followed by oestrus after a relatively short delay (Table 1). Consequently, more time was available for oestrus to be repeated before observations ceased.

All the ewes which failed to cycle had been subjected to hormonal therapy.

Conception rates

The conception rates at the first overt oestrus showed a trend which was virtually the opposite of that noted for the incidence of oestrus (Table 1). Thus, more ewes returned to oestrus one cycle later when treated with PMSG and progesterone (Group 4, $\chi^2 = 4{,}55$, $P < 0{,}05$; Group 5, $\chi^2 = 3{,}09$, $P < 0{,}01$) than in the untreated control group. A total of 77,1 per cent of the ewes treated with GnRH (Group 2 + Group 3) conceived.

Inter-lambing interval

Multiple regression analysis showed that the lambing interval (Table 1) was not influenced by age of the ewe, initial mass, change in mass or by lactational status (twins versus singles). Despite the earlier onset of oestrus in three of the groups treated with exogenous hormones (Groups 2, 4 and 5) the mean lambing interval was not reduced significantly (Table 1).

Discussion

The ewes which were not subjected to exogenous hormonal therapy (control group) all exhibited oestrus, during the course of the experiment with a mean interval from lambing to oestrus of 49,3 days. This interval agrees closely with that obtained by Lishman, Stielau and Botha (1974). In contrast, 15 of the ewes which were treated to induce early onset of oestrous activity in fact did not cycle within 68 days after lambing. The possibility thus exists that the hormonal treatments, in addition to failing to induce oestrus and ovulation, could also have affected the reproductive system deleteriously. Treatments which induced release of LH may have depleted the pituitary of available reserves of gonadotropins and thereby delayed the resumption of oestrous cycles. This explanation would follow the claim by Chamley, Brown, Cerini, Cumming, Goding, Obst, Williams and Winfield (1973) that the decline in response to GnRH administration during pregnancy was possibly due to the depletion of pituitary LH. The suggestion that pituitary reserves of FSH might be lower in lactating than in cyclic animals was originally made by Robertson and Hutchinson (1962) and this has been confirmed by Mallampati, Pope and Casida (1971). Recently, Jenkin, Heape and Symons (1977) demonstrated that pituitary LH concentrations declined as pregnancy progressed, but by the tenth week post partum the hypophysial LH levels did not differ significantly from cyclic or anoestrous ewes.

The ability of the hormone treatments to reduce the interval to first oestrus (Table 1) contrasts with the failure of similar methods in autumn-lambing Karakul ewes (Sefidbakht & Farid, 1977). The latter study was however characterised by an interval of only 21,16 days to first oestrus in untreated ewes. In both the Karakul and Merino ewes (present study) it was not possible to reduce the interval between lambings and the lambing percentages were disappointing. Whereas Sefidbakht and Farid (1977) concluded that the progesterone implants did not reduce the conception rates the results of the present study are less favourable.

From the work on the influence of progestagens on sperm transport (Hawk & Conley, 1972) and ovum transport (McDonald & Bellve, 1969) the reduced conception in ewes subjected to progesterone treatment was not unexpected. However, Gordon (1958) ascribed the poor conception of ewes induced to ovulate by means of progesterone and PMSG to the fact that the ewes were lactating at the time of mating. This hypothesis is supported by the high embryonic mortality observed when ova were transferred to lactating ewes (Cognie, Hernandez-Barreto & Saumande, 1975).

In the present experiment oestrus was relatively well synchronized in the ewes which received progesterone. Due to the fact that each ewe was treated according to the day on which she lambed it is highly unlikely that the ram's interest in "preferent ewes" and overwork of the ram (Jennings & Crowley, 1970) could account for the reduced conceptions.

The results reported here lead to the conclusion that progesterone therapy still constitutes an integral part of treatments designed to initiate early re-breeding in lactating ewes. However, the associated reduction in conception rates does not permit such treatments to reduce the interlambing interval of ewes which lamb in autumn.

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References

CHAMLEY, W.A., BROWN, J.M., CERINI, M.E., CUMMING, I.A., GODING, J.R., OBST, J.N., WILLIAMS, A. & WINFIELD, C., 1973. An explanation for absence of post parturient ovulation in the ewe. *J. Reprod. Fert.* 32, 334.

CHOWDHRY, M.S. & FORBES, J.M., 1972. Effects of 17β-Oestradiol on milk secretion in goats. *J. Endocr.* 54, 521.

COGNIE, Y., HERNANDEZ-BARRETO, M. & SAUMANDE, J., 1975. Low fertility in nursing ewes during the non-breeding season. *Ann. Biol. Anim. Bioch. Biophys.* 15, 329.

CROKER, K.P. & SHELTON, J.N., 1973. Influence of stage of cycle, progestagen treatment and dose of oestrogen on uterine motility in the ewe. *J. Reprod. Fert.* 32, 521.

FALKENBURG, J.A., HULET, C.V. & KALTENBACH, C.C., 1971. Effects of hormone combinations on oestrus, ovulation and fertility in ewes. *J. Anim. Sci.* 32, 1206.

FOSTER, J.P. & CRIGHTON, D.B., 1973. Preliminary observations on the administration of a synthetic preparation of GnRF to cyclic and anoestrous ewes. *J. Endocr.* 57, xxv.

FULKERSON, W.J. & McDOWELL, G.H., 1974. Effect of oestrogen administration in early or late lactation on the yield and composition of milk in sheep. *J. Endocr.* 63, 175.

GORDON, I., 1958. The use of progesterone and serum gonadotropin (PMS) in the control of fertility in sheep. II Studies in the extra-seasonal production of lambs. *J. agric. Sci., Camb.* 50, 152.

HAWK, H.W. & CONLEY, H.H., 1972. Investigation of sperm transport failures in ewes administered synthetic progestagen. *J. Anim. Sci.* 34, 609.

HUNTER, G.L., 1968. Increasing the frequency of pregnancy in sheep. I. Some factors affecting rebreeding during the post-partum period. *Anim. Breed. Abstr.* 36, 347.

JENKIN, G., HEAP, R.B. & SYMONS, D.B.A., 1977. Pituitary responsiveness to synthetic LH-RH and pituitary LH content at various reproductive stages in the sheep. *J. Reprod. Fert.* 49, 207.

JENNINGS, J.J. & CROWLEY, J.P., 1970. The mating of hormone treated sheep. *Anim. Prod.* 12, 357.

KEANE, M.G., 1974. Effect of progestagen – PMS hormone treatment on reproduction in ewe lambs. *Irish J. Agric. Res.* 13, 39.

LAMMING, G.E., 1973. Progress with the control of oestrus and ovulation in farm livestock. *S. Afr. J. Anim. Sci.* 3, 133.

LAMOND, D.R., 1964. Synchronisation of ovarian cycles in sheep and cattle. *Anim. Breed. Abstr.* 32, 269.

LISHMAN, A.W., STIELAU, W.J., BOTHA, W.A., 1974. Reproduction in the ewe in relation to plane of nutrition, bodymass and change of bodymass. I. The incidence of oestrus between lambing and reconception. *Agroanimalia* 6, 25.

LOUW, B.P., LISHMAN, A.W., BOTHA, W.A., ARANGIE, P.A.R., POULTNEY, B.G., & GÜNTER, M.J., 1976. The release of luteinizing hormone (LH) in ewes deprived of prolactin during lactation. *S. Afr. J. Anim. Sci.* 6, 87.

MALLAMPATI, R.S., POPE, A.L. & CASIDA, L.E., 1971. Effect of suckling on post partum anestrus in ewes lambing in different seasons of the year. *J. Anim. Sci.* 32, 673.

McDONALD, M.F. & BELLVE, A.R., 1969. Influence of oestrogen and progesterone on flow of fluid from the fallopian tube in ovariectomized ewe. *J. Reprod. Fert.* 20, 51.

ÖZKOCA, A., 1972. Oestrus synchronization in ewes by means of silestrus implants. *Turk. vet. Hekim. dern. Derg.*, 41, 33. *Anim. Breed. Abstr.* 40, 4707.

ROBERTSON, H.A. & HUTCHINSON, J.S.M., 1962. The levels of FSH and LH in the pituitary of the ewe in relation to follicular growth and ovulation. *J. Endocr.* 24, 143.

SEFIDBAKHT, N. & FARID, A., 1977. Effect of early weaning and hormone treatments on induction of oestrus, conception and lambing of fall-lambing Karakul ewes. *J. Anim. Sci.* 45, 311.

WILTBANK, J.N., 1970. Research needs in beef cattle reproduction. *J. Anim. Sci.* 31, 755.

XENOULIS, P.C., MINOTAKIS, C.S. & TSAMIS, C., 1972. The evaluation of progesterone implants and MAP-impregnated sponges for the advancement of the breeding season in ewes. *VIIth Int. Congr. Anim. Reprod. Artif. Insem. Munich*, 1972, 182.