

REDUCED SENSITIVITY TO OESTROGEN IN EWES CONTINUOUSLY ASSOCIATED WITH RAMS

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OPSOMMING: VERLAAGDE SENSITIVITEIT VIR ESTROGEEN BY OOIE VOORTDUREND IN KONTAK MET RAMME

Die voorkoms van bronstigheid was beduidend hoër ($P < 0,001$) na oestradiol bensoaat (ODB) behandeling van ooie wat gedurende die anestrus seisoen vir drie maande van ramme afgesonder was, as by ooie wat nie van ramme afgesonder was nie. Bronstigheid is ook na 'n korter latente periode by die afgesonderde ooie waargeneem as by die ooie wat voortdurend by ramme was. In 'n tweede proef is die eierstokke van 44 van die 84 ooie verwyder voor afsondering van, of assosiasie met ramme. Vyf maande later het die ooie progesteron vir drie, ses of 12 dae ontvang voor behandeling met ODB. Beide die totale aantal ooie bronstig en die wat binne 40 uur na ODB inspuiting estrus getoon het, was beduidend hoër by die ooie wat afgesonder was as by die wat voortdurend by ramme was. Beduidend meer ooie was binne 40 uur bronstig na ses of 12 dae van progesteronbehandeling as na drie dae. Alhoewel die latente periode tot bronstigheid korter was by die afgesonderde ooie as dié wat nie afgesonder was nie, was die verskil net by die intakte ooie betekenisvol. Die verwydering van die eierstokke het nie die resultate beduidend beïnvloed nie.

SUMMARY:

Oestradiol benzoate (ODB) injection of ewes isolated from rams for three months during the anoestrous season resulted in a significantly greater ($P < 0,001$) incidence of oestrus than in anoestrous ewes not isolated from rams. Mating was initiated after a shorter latent period in the isolated ewes than in those continuously with rams. In a second experiment 44 of the 84 ewes were ovariectomized one month prior to the commencement of either isolation from or continuous association with rams. Five months after the ovariectomies, all ewes received progesterone for three, six or twelve days prior to ODB injection. The total number of ewes exhibiting oestrus and the number which mated within 40 h after ODB injection were significantly higher among the isolated ewes than amongst those continuously with rams. Significantly more ewes exhibited oestrus after 6 or 12 d of progesterone than where progesterone was administered for 3 d. Although the latency to oestrus was shorter in the isolated ewes than in those not isolated, the difference was significant only in the ewes not ovariectomized. The presence or absence of ovaries did not influence the results significantly.

Schinckel (1954) observed that ewes which had been continuously associated with sterile rams during the non-breeding season resumed sexual activity at a later date than ewes isolated from rams during anoestrus. He therefore suggested that continuous association of the two sexes led to a deepening or lengthening anoestrus. Individual differences in the sensitivity of ewes to oestrogen have been demonstrated (Robinson, 1955a; Robinson & Moore, 1956) and it is possible that the continuous presence of the ram during the anoestrous season might modify the sensitivity of the nervous mechanisms mediating oestrous behaviour in the ewe. This experiment was conducted to examine the effect of association with rams on the response of ewes to stimuli which evoke oestrus.

Procedure

Experiment 1

On July 3, a flock of Merino ewes (two-tooth and mature) was randomly divided into two groups and one group transferred to partly-roofed pens where they were joined with vasectomized teaser rams (continuous group). The second group remained in similar pens situated approximately 1 km from the nearest ram (isolated group).

Observations for oestrus (permitted service) amongst the ewes continuously associated with rams were made by teasing at 8 h intervals and of the ewes which had

not exhibited oestrus for at least 40 d prior to the commencement of progesterone injection on September 15, 24 animals were randomly selected for inclusion in the experiment. The same number of ewes was randomly selected from the flock that had been isolated from rams.

Treatment of each ewe consisted of daily intramuscular injections of 10 mg progesterone in 1 ml arachis oil, administered for 3 d at 08h00, followed 24 h later by injection (i.m.) of 20 μ g ODB. The length of the preliminary progesterone sensitization period was selected for a response of approximately 50% in terms of ewes exhibiting behavioural oestrus (Robinson, 1955b; Robinson, Moore & Binet, 1956) so that differences in sensitivity to oestrogen would not be obliterated. The ODB dosage of 20 μ g is equivalent to a physiological dose (Robinson, 1955b; Robinson *et al.*, 1956). The ewes that had been isolated from rams were joined with vasectomized rams 24 h after ODB injection. When observations for oestrus had been terminated the ovaries of selected ewes were examined for recent ovulations.

Experiment 2

One June 22, a group of 40 mature, entire Merino ewes and a similar group of 44 ewes which had been ovariectomized one month earlier were randomly subdivided into two groups. One group of ovariectomized and one of entire ewes were isolated from rams, and the

Table 1

Incidence of, latency to, and duration of oestrus following progesterone-oestrogen treatment and the occurrence of ovulation in ewes either isolated from, or continuously associated with rams

Association with rams	n	No. of ewes oestrus	Latency to oestrus (h)		Duration of oestrus (h)		Occurrence of ovulation:			
			Mean	S E	Mean	S E	Ewes oestrus		Ewes not oestrus	
							No. examined	No. ovulating	No. examined	No. ovulating
Continuous	24	3	45,3	±7,0	21,3	±12,2	2	1	10	9
Isolated	24	22	34,5	±1,6	26,9	± 2,4	12	6	2	2

Table 2

Incidence of oestrus in ovariectomized and entire ewes, either continuously associated with or isolated from rams and treated for varying periods with progesterone prior to oestrogen injection

Association with rams	Type of ewe	Percentage ewes oestrus following progesterone for:										All progesterone treatments	
		3 days		6 days		12 days							
		n	Oestrus within 40h	Oestrus within 80h	n	Oestrus within 40h	Oestrus within 80h	n	Oestrus within 40h	Oestrus within 80h			
Continuous	Entire	7	14,3	42,8	6	33,3	33,3	7	42,8	85,7	30,0	55,5	
	Spayed	7	0	28,6	7	50,1	50,0	6	16,7	16,7	20,0	30,0	
Isolated	Entire	7	42,8	42,8	7	85,7	100,0	6	83,3	100,0	70,0	80,0	
	Spayed	8	50,0	62,5	7	71,4	71,4	7	57,1	57,1	59,1	63,6	

Table 3

Latency to, and duration of oestrus in ovariectomized and entire ewes treated with ODB following isolation or continuous association with rams

Association with rams	Type of ewe	Latency to oestrus (h)		Duration of oestrus (h)	
		Mean	S E	Mean	S E
Continuous	Entire	37,6	±1,36	24,7	±10,58
	Spayed	35,3	±6,14	22,1	±12,16
Isolated	Entire	29,8	±2,46	23,9	± 9,36
	Spayed	26,6	±2,25	16,4	± 7,55

Table 4

Incidence of, latency to, and duration of oestrus following ODB treatment of ewes four weeks after being re-associated with rams and in ewes continuously associated with rams

Association with rams	Type of ewe	n	Ewes oestrus	Latency to oestrus (h)		Duration of oestrus (h)	
				Mean	S E	Mean	S E
Continuous	Entire	20	5	42,58	±4,84	24,38	±8,60
	Spayed	20	9	32,10	±11,04	18,78	±10,44
Isolated	Entire	20	3	36,07	±18,54	28,33	±10,60
	Spayed	21*	8	28,99	±8,26	23,88	±4,29

* One ewe died

remaining groups joined with vasectomized rams. Amongst the latter ewes observations for oestrus were made twice daily using a fresh group of vasectomized rams.

On October 22, each sub-group was again subdivided into three groups and progesterone administered daily at 08h00 for 12, 6 or 3 d prior to ODB injection. Twenty-four hours after the last progesterone injection each ewe received 20 µg ODB and 24 h later the isolated ewes were joined with vasectomized rams. Continuous observations for oestrus were initiated 12 h later and ceased after 80 h. During this period fresh rams were introduced at intervals of 4 h. Commencing on November 26 the ewes were subjected to a uniform treatment consisting of progesterone for 6 d followed by 20 µg ODB. Observations for oestrus were made as before.

General management of ewes

The ewes were fed a daily ration of 1 kg milled lucerne hay, 110 g maize and unmilled grass hay *ad lib.* A mineral lick was available at all times. The ewes were weighed at regular intervals as a check on adequate nutrition.

Results

Experiment 1

The proportion of isolated ewes which exhibited oestrus was significantly greater ($P < 0,001$) than in the continuous group (Table 1). Furthermore, among the isolated ewes the interval between ODB injection and the commencement of oestrus was significantly shorter than for the continuous group. The duration of oestrus showed marked variation and the differences observed (Table 1) were not significant.

An examination of the ovaries failed to account for the low incidence of oestrus amongst the ewes not isolated from rams (Table 1).

Experiment 2

A significantly greater proportion of the ewes which had been isolated from rams exhibited oestrus both within 40 h ($P < 0,001$) and within 80 h ($P < 0,01$) after ODB injection than amongst the ewes continuously associated with rams (Table 2). There was no significant difference between the entire and ovariectomized ewes. Compared to pre-treatment for three days, the progesterone sensitization periods of six and 12 days significantly increased the response observed within 40 h after ODB injection.

Due to the great variation between individuals, most differences in the latency to and duration of oestrus were not significant. Continuous presence of the ram significantly increased the latent period amongst the entire ewes ($P = 0,05$).

When re-tested four weeks later the increased sensitivity of the isolated ewes to ODB was no longer significant (Table 4), although the results obtained for the entire ewes were remarkably similar to those recorded in Experiment 1.

Discussion

It has been clearly demonstrated that the presence of the ram, especially during the anoestrous season, is necessary to maintain oestrous activity in ewes (Lishman & Hunter, 1966; 1967; Lishman, 1969). This contradicts the hypothesis of a deepened anoestrus when ewes are continuously associated with rams (Schinckel, 1954). In contrast, the present findings support Schinckel, since they suggest that when ewes are subjected to the mating stimulus for several months, adaptation to this stimulus occurs. Such females apparently became less sensitive to stimuli which induce overt oestrus. The finding that 17% of the ewes continuously associated with rams exhibited oestrus later than the average onset of breeding (Radford & Watson, 1957) agrees with this conclusion. These findings support the contention that in order to induce a high incidence of oestrus, where the mating period is timed to commence at the onset of the breeding season (spring), the ewes should be isolated from the rams during the anoestrous period.

At this stage, only speculation is possible on the mechanisms whereby continuous association with rams reduces the sensitivity to oestrogen. The observation that the ovary is not required for the effect of continued presence of the male to be mediated, favours the conclusions that the anterior hypothalamic centres controlling oestrous behaviour are involved. In considering the components of the total "ram stimulus" it has generally been assumed that the factors of sight, sound and smell are of prime importance and that where ewes are to be isolated from the ram stimulus these factors should be precluded from influencing the ewes. However, the recent observation (Louw, unpublished) of almost complete anoestrus in a group of ewes separated from rams by a single pen (4 m wide) containing weaned lambs, suggests that none of the components listed is effective in producing the ram stimulus. It is suggested therefore that the mating behaviour of the ram must be directed toward the ewe in order to produce the stimulus. This agrees with the hypothesis suggested by Parsons & Hunter (1967) to account for the reduced duration of oestrus in ewes frequently exposed to the mating stimulus during oestrus.

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