MARDI Res. J. 24(1) (1996): 31–37

Resumption of postpartum ovarian activity in Malin, Dorset Horn-Malin and Long Tail ewes

(Aktiviti ovari selepas beranak bagi biri-biri Malin, Dorset Horn-Malin dan Long Tail)

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Key words: ewe, postpartum anoestrus, oestrus cycle, oestrus, progesterone

Abstrak

Aktiviti ovari selepas beranak bagi 15 ekor Malin, 15 ekor Dorset Horn-Malin (DHM) dan 10 ekor Long Tail (LT) telah dikaji berdasarkan profil progesteron dan pengesanan estrus oleh biri-biri jantan. Biri-biri pilihan mempunyai keadaan badan yang baik dan anak yang sihat. Biri-biri dikurung di petak kandang berdasarkan baka bermula dari 3 hari selepas beranak selama 90 hari. Tiga ekor biri-biri jantan divasektomi digunakan untuk mengesan estrus biri-biri betina dan digilirkan antara petak setiap minggu. Sampel darah jugular diambil dua kali seminggu untuk menentukan profil progesteron.

Kepekatan purata hormon progesteron semasa fasa folikel ialah 0.19 ng/mL bagi DHM dan LT manakala 0.26 ng/mL bagi Malin. Kepekatan purata progesteron pada fasa luteum ialah 2.94 ng/mL bagi Malin, 2.54 ng/mL bagi DHM dan 2.33 ng/mL bagi LT. Berdasarkan profil progesteron, pengovulan pertama Malin, DHM dan LT berlaku masing-masing pada 24.5 ± 2.7, 30.0 ± 2.2 dan 35.7 ±4.3 hari selepas beranak. Kitaran estrus biri-biri berbeza antara 16.3 ± 0.33 hari pada Malin hingga 17.6 ± 0.25 hari pada LT. Pengesanan estrus berdasarkan kesan krayon oleh biri-biri jantan divasektomi kurang tepat dibandingkan dengan profil progesteron. Estrus pertama Malin, DHM dan LT yang dikesan oleh biri-biri jantan masing-masing 36.5, 49.5 dan 66.7 hari selepas beranak. Berdasarkan profil progesteron, biri-biri jantan divasektomi gagal mengesan 80–90% daripada estrus pertama biri-biri betina selepas beranak. Kajian ini menunjukkan bahawa profil progesteron dalam plasma boleh digunakan untuk mengesan pengaktifan ovari biri-biri selepas beranak, lebih baik daripada menggunakan jantan biri-biri divasektomi.

Abstract

The postpartum ovarian activity of 15 Malin, 15 Dorset Horn-Malin (DHM) and 10 Long Tail (LT) ewes was studied based on the progesterone profiles and oestrus detection by rams. Selected ewes had good body condition and healthy lambs. They were kept in separate pens according to breedtype from day 3 through day 90 after lambing. Three vasectomized rams were used for oestrus detection of the ewes and were rotated at weekly intervals. Jugular blood samples

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were collected twice weekly from all ewes for 3 months to determine the postpartum progesterone profiles.

The mean progesterone concentration during the follicular phase was 0.19 ng/mL in DHM and LT while 0.26 ng/mL in Malin. The mean progesterone concentration during the luteal phase was 2.94 ng/mL in Malin, 2.54 ng/mL in DHM and 2.33 ng/mL in LT ewes. Based on the progesterone profiles, the first postpartum ovulation in Malin, DHM and LT ewes occurred 24.5 ± 2.7, 30.0 ± 2.2 and 35.7 ± 4.3 days after lambing respectively. The oestrus cycle of the ewes varied from 16.3 ± 0.33 days in Malin to 17.6 ± 0.25 days in LT. It was observed that oestrus detection, based on crayon markings made by the vasectomized rams, was inaccurate as reflected by the progesterone profiles. The first oestrus detected by the rams in Malin, DHM and LT ewes was 36.5, 49.5 and 66.7 days postpartum respectively. Based on the progesterone profiles, the vasectomized rams failed to detect 80–90% of the first ovulation in the ewes. This study indicates that the plasma progesterone profiles can be used to determine the resumption of postpartum ovarian activity of the ewes better than using vasectomized rams.

Introduction

Litter size and lambing interval, which are related to postpartum (PP) anoestrus interval and service period duration, limit the annual reproductive rate (AAR) of ewes. AAR which may be defined as the number of lambs produced per ewe per year, is therefore critical to the sheep industry because it measures the economics and productivity of the sheep rearing operation. The resumption of ovarian function after parturition in temperate sheep may be influenced by breed, age, lactation, nutrition and season (Fitzgerald and Cunningham 1981; Novoa 1984; Schirar and Levasseur 1989).

The mechanism of PP anoestrus in sheep has not been clearly understood. Reduced sensitivity of the pituitary to gonadotropin releasing hormone, changes in oestradiol feedback at the hypothalamus and pituitary (Wright et al. 1981), reduced luteinizing hormone (LH) secretion (Restall et al. 1978) or capability for LH release (Wright et al. 1983) and high prolactin levels induced by suckling (Fitzgerald and Cunningham 1981) are believed to inhibit resumption of cyclic ovarian after parturition in the ewes. However, in the tropics and sub-tropics, inadequate nutrition is probably the major source of variation (Feldman et al. 1988).

Ovarian function can be determined by monitoring the level of circulatory progesterone. Oestrus detection by vasectomized rams could also provide information on ovarian cyclicity or oestrus cycle of postpartum ewes. The objective of this study was to determine the resumption of PP ovarian activity in Malin, Dorset Horn-Malin (DHM) and Long Tail (LT) ewes based on progesterone concentrations and oestrus detection by vasectomized rams.

Materials and methods

Description and management of ewes

A total of 40 mature ewes comprising Malin (n = 15), DHM (n = 15) and LT (n = 10) were used in this study at MARDI Research Station in Kluang, Johor. Only ewes with good body condition and healthy lambs were selected for the study. Selected ewes and their lambs were kept according to breedtype in three separate wooden pens with slatted floor raised above the ground, from day 3 PP until the lambs were weaned at 3 months of age. The ewes were fed cut *Panicum maximum* and *Setaria splendida* and supplemented with concentrate at 200–300 g/head daily (TDN = 76% and

CP = 12%). Water and mineral salt licks were provided ad libitum.

Progesterone assay

Jugular blood samples were taken twice weekly beginning from 3 days to 90 days PP. Plasma was separated by centrifugation and store frozen at –20 °C until assayed for progesterone concentration. Progesterone hormone was determined using antibody-coated tubes in a solid phase radioimmunoassay technique while 1^{125}-labelled progesterone used as tracer (Coat-A-Count Progesterone, Diagnostic Products Corporation, USA). The intra and inter-assay coefficient of variation were 6.33% and 13.0% respectively. The intervals between lambing and first ovulation, oestrus cycles and the number of silent ovulations (ovulatory cycles are not associated with overt oestrus) which preceded first oestrus, were estimated from plasma progesterone concentration. Ewes were assumed to have ovulated when plasma progesterone concentrations exceeded 0.8 ng/mL (Robertson 1971). The oestrus cycles of the ewes in this study were classified into single oestrus cycle (short, normal and long) and multiple oestrus cycle according to the method used by Hafez (1952).

Oestrus detection

Oestrus detection was done twice daily in the pen using three harnessed, vasectomized rams. These rams were rotated at weekly intervals between the three breedtypes. Ewes were considered in oestrus when there were crayon markings made by the rams on the rumps of the ewes.

Statistical analyses

The data were analyzed using ANOVA procedures and the differences between means were tested using the Least Squares Means.

Results and discussion

The intervals between lambings and first PP ovulations averaged 24.5 ± 2.7 days, 30.0 ± 2.2 days and 35.7 ± 4.3 days for Malin, DHM and LT ewes respectively *(Table 1)* and ranged from 10 to 50 days in Malin, 18 to 44 days in DHM and 16 to 63 days in LT ewes. Malin ewes had a significantly shorter interval (p <0.05) than LT ewes, a result which was similar to previous report for other breeds such as Dorset, Ramboullet and Finnish Landrace under temperate conditions (Quirke et al. 1983). The short PP interval from lambing to first ovulation in Malin ewes is an invaluable trait because it may be exploited to have an earlier conception and therefore a shorter lambing interval compared with DHM and LT ewes. The progesterone profiles indicated that 41% of Malin as well as 20% of DHM and LT ovulated during the first 3 weeks PP *(Table 2)*. About 60% of the LT ewes ovulated 6 weeks after lambing compared with 13% of Malin and 20% of DHM.

Table 1. Postpartum interval from lambing to the resumption of ovarian activity and characteristics of oestrus cycles of Malin, Dorset Horn-Malin and Long Tail ewes based on progesterone profiles

Variable	Malin	Dorset Horn-Malin	Long Tail
Days to 1st postpartum ovulation *ø	24.5 ± 2.7a	30.0 ± 2.2ab	35.7 ± 4.3b
Length of oestrus cycle (days) *ø	16.3 ± 0.33a	16.6 ± 0.54ab	17.6 ± 0.25b
No. of small peaks	5	5	3
No. of short cycles, <14 days	6	4	0
No. of normal cycles, 15–19 days	51	41	20
No. of long cycles, 20–26 days	6	12	9

*Means ± SE within the same row with different letters are different at p <0.05
øBased on progesterone level ≥0.8 ng/mL

Table 2. Incidence of first postpartum ovulation in three ewe breedtypes based on progesterone profiles

Breedtype	Incidence of ovulation in weeks postpartum						
	2	3	4	5	6	7	8
Malin	2 (13.3)	4 (26.7)	6 (40.0)	1 (6.7)	0	1 (6.7)	1 (6.7)
Dorset Horn-Malin	0	3 (20.0)	5 (33.0)	4 (26.7)	2 (13.3)	1 (6.7)	0
Long Tail	0	2 (20.0)	1 (10.0)	1 (10.0)	3 (30.0)	2 (20.0)	1 (10.0)

Values in brackets denote percentage of occurrence

Table 3. Oestrus detection of three ewe breedtypes by vasectomized rams

Variable	Malin	Dorset Horn-Malin	Long Tail
No. of observations	15	15	10
Lambing to 1st oestrus (days)	36.5	49.5	66.7
Length of oestrus cycle (days)	26.8	30.8	35.5
No. ewes with detected 1st oestrus	3 (20.0)	2 (14.0)	1 (10.0)
No. ewes with detected 2nd oestrus	6 (40.0)	5 (33.0)	1 (10.0)
No. ewes with detected 3rd oestrus	10 (66.7)	11 (73.3)	5 (50.0)
No. ewes with detected 4th oestrus	4 (26.0)	11 (73.3)	4 (40.0)

Values in brackets denote percentages of occurrence

Although some of the ewes ovulated during 3 weeks PP, they would not normally conceive should they be mated. This is because the uterine environment is not yet conducive to the presence of an embryo as the involution of the uterus takes about 3–4 weeks to complete (Van Wyk et al. 1972). Conception would normally take place at the second ovulation. This study indicated that it is possible to breed ewes, especially Malin, less than 3 months after lambing. Malin ewes could lamb twice a year if they could be bred within 30–40 days after lambing. Early conception in ewes would be profitable provided lamb mortality is kept low. The higher incidence of early PP ovulation in Malin ewes is an important trait that should be exploited to achieve two lambings per year.

The PP anoestrus of the ewes is reflected by the duration of low progesterone concentrations. Oestrus signs can be seen 27–72 h prior to ovulation (Robertson 1977). Thus, ovulation, could be estimated by oestrus detection other than progesterone concentration. The first PP oestrus was detected by the vasectomized rams in Malin, DHM and LT ewes about 36.5, 49.5 and 66.7 days after lambing respectively *(Table 3)*. These values do not tally with the first PP ovulations as determined by the progesterone profiles in *Table 1*. The present results showed that the vasectomized rams failed to detect 80–90% of the first ovulation-related oestrus in the ewes. Only 20% of Malin, 14% of DHM and 10% of LT ewes exhibited oestrus prior to the first PP ovulation *(Table 3)*. However, the percentage increased in the second and subsequent oestrus. This could possibly be due to the fact that the early PP ovulation was preceded by silent oestrus and thus, not detected by the rams. Silent oestrus in ewes was reported in earlier works by Hafez (1952).

Based on the progesterone profiles, the Malin, DHM and LT ewes should have had 3–4 PP oestrus accompanied by ovulation and that some ewes were mounted by the rams although they should not be in oestrus as indicated by the low progesterone levels. The LT ewes which had higher incidence of silent ovulations in this study, may require more ovarian cycles and endocrine priming than Malin and DHM ewes before behavioural oestrus is expressed.

The vasectomized rams also failed to detect early pp oestrus as reported by

Table 4. Postpartum progesterone concentration of three ewe breedtypes

Breedtype	Progesterone concentration (ng/mL)		
	Follicular	Oestrus	Luteal
Malin	0.26 (0.05–0.79)	0.20	2.94 (0.80–6.81)
Dorset Horn-Malin	0.19 (0.05–0.75)	0.16	2.54 (0.82–5.78)
Long Tail	0.19 (0.05–0.73)	0.20	2.33 (0.82–4.81)

Values in brackets denote range

Robertson (1977) to occur in 5–15% of the ewes which exhibit a postpartum oestrus within 36 h of lambing. The trigger for the induction of behavioural oestrus was thought to be not directly from the oestrogen from the ovaries, but rather from the preparturition rise of oestrogen superimposed upon a declining progesterone concentration. Quirke et al. (1983) reported that at this time there are no signs of follicular development in the ovaries and that this oestrus is not associated with the first PP ovulation.

The PP anoestrus in Malin and DHM was observed to be shorter than those for some temperate breeds, viz. Finnish Landrace, Dorset and Ramboullet ewes which were reported to have an interval of more than 49 days (Quirke et al. 1983). Duration of anoestrus of the three ewe breeds in this study, which suckled their lambs, was shorter than that reported for the non-suckling ewes (Robertson 1977; Fitzgerald and Cunningham 1981). Thus, there is little evidence to suggest that lactation has any delaying effect on the first PP ovulation. The PP anoestrus in sheep appears to be less influenced by lactation than in dairy cow which usually ovulate until 30–50 days PP (Wheeler et al. 1982). Although some reports (Baker and Wiggins 1964; Whiteman et al. 1972) indicated that lactation may lengthen the postpartum interval to first PP oestrus when parturition does not coincide with the breeding season, there is little evidence within this study to suggest the effect of lactation on the occurrence of first ovulation. However, the shorter PP anoestrus in this study could be influenced by poor milk production of the three ewe breedtypes. Ewes may have prevented their lambs from suckling sooner after parturition due to low milk yield. The removal of suckling stimulus would hasten the onset of oestrus in the ewes.

The PP progesterone levels of Malin, DHM and LT ewes are shown in *Table 4*. The mean progesterone concentration during the follicular phase (pro-oestrus and oestrus) of the three breedtypes varied from 0.19 ng/mL in DHM and LT to 0.26 ng/mL in Malin. These values were slightly higher than a previously reported value of 0.15 ng/mL (Anon. 1984) but in agreement with the suggested value of less than 1.0 ng/mL for sheep by Diagnostic Products Corporation, USA. During oestrus, Malin and LT ewes had a progesterone concentration of 0.20 ng/mL; DHM ewes had a lower concentration of 0.16 ng/mL. The mean progesterone concentration during luteal phase (met- and dioestrus) in Malin, DHM and LT ewes was 2.94, 2.54 and 2.33 ng/mL respectively, which was lower than that of 3.7 ng/mL reported by Pant et al. (1977). Maximal range of luteal progesterone concentration in Malin, DHM and LT ewes was 3.18–6.81, 2.71–5.72 and 2.43–4.81 ng/mL respectively. Edqvist and Stabenfeldt (1989) reported a lower range of 2–4 ng/mL. The progesterone concentration during the luteal phase may rise up to 8 ng/mL as suggested by Diagnostic Products Corporation, USA.

Small peaks in progesterone concentration of less than 0.8 ng/mL prior to normal ovarian cyclicity were observed in five Malin and DHM ewes, and in three LT ewes. The slight elevation in the progesterone concentration could be due to secretion from luteal tissues formed from follicles that failed to ovulate. This appears to be important for the recurrence of oestrus after lambing.

Short oestrus cycles were observed in Malin and DHM but not in LT ewes (*Table 1)*. The three breedtypes had 6–12 long oestrus cycles as catagorized by Hafez (1952). However, a majority of the cycles were of the normal-length single cycle. The proportion of the various cycles was similar to those reported by Hare and Bryant (1982). Two DHM ewes had multiple oestrus cycles, or where ovulation had been missed. The occurrence of ovulation in this study was only assumed since laparotomy facilities were not available for examining the corpus luteum on the ovaries of the ewes. There is a possibility that the rams might have failed to detect oestrus and these were, therefore, true silent ovulations. The efficacy of oestrus detection varied between individual rams and breed of ewes (Dyrmundsson and Lees 1972). However, in this study, the efficacy and accuracy of oestrus detection was likely to increase since there was a high ratio of rams to ewes which was 3:40 and also the weekly rotation of the three rams among the three ewe breeds. DHM and Malin ewes recorded 24% and 45% more cycles respectively than LT ewes.

Based on the progesterone profiles, Malin ewes had significantly shorter (p <0.05) oestrus cycles than LT ewes *(Table 1)*. The length of oestrus cycle in this study was similar to those reported by Sefidbakth et al. (1978). However, the oestrus cycle could reach 25 days in DHM and LT ewes in this study. Occurrence of short oestrus cycles of about 8–10 days was observed in some Malin and DHM ewes, similar to those reported on temperate ewes (Fitzgerald and Cunningham 1981).

Acknowledgements
The authors are grateful to Mr Ajis Hassan for his field assistance and Ms Zainab Masri for running the progesterone radioimmunoassay of plasma samples.

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Accepted for publication on 17 January 1996