

THE PERIPHERAL PLASMA PROGESTERONE CONCENTRATION AND LUTEAL PROGESTERONE CONTENT IN THE POST-PARTUM EWE

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OPSOMMING: DIE PERIFERALE PLASMA PROGESTERON KONSENTRASIE EN LUTEALE PROGESTERON INHOUD BY DIE POST-PARTUM OOI

Die post-partum plasma progesteron konsentrasie en luteale progesteron inhoud is by lakterende en nie-lakterende ooi gedurende 'n normale teelseisoen in die herfs en 'n abnormale teelseisoen in die lente ondersoek.

Die resultate dui daarop dat stil ovulasies gedurende die normale teelseisoen (herfs) gepaard gaan met 'n laer plasma progesteron konsentrasie waartydens estrus simptome afwesig is. Estrus word moontlik deur laktasie onderdruk, maar laasgenoemde het geen invloed op ovulasie nie. Gedurende die lente teelseisoen was ovulasie sowel as estrus vertraag.

Hieruit kan afgelei word dat post-partum ooi in die herfs teelseisoen gouer gedek kan word as soortgelyke ooi gedurende 'n lente seisoen.

SUMMARY:

Post-partum plasma progesterone concentrations and luteal progesterone content were measured in lactating and non-lactating ewes during a normal breeding season in autumn and an abnormal breeding season in spring.

The results indicate that silent ovulations during the autumn breeding season were accompanied by decreased plasma progesterone concentrations and the absence of estrus. Furthermore, estrus activity was probably inhibited by lactation, but the latter had no influence on ovulation. During spring, ovulation and oestrus were delayed.

It was concluded that post-partum ewes can be tupped earlier during an autumn breeding season, than during spring.

After parturition two or three silent ovulations may occur in ewes before oestrus is detected by vasectomized rams (Mauléon & Dauzier, 1965). No explanation was offered for this observation. According to the literature the post-partum plasma progesterone concentration and luteal progesterone content associated with the occurrence of silent ovulation have not been measured. As corpora lutea (CL) development and progesterone production may be related to oestrus, these aspects were investigated in South African Mutton Merino ewes during two different breeding seasons.

lambs of one half of 30 primiparous ewes were weaned within 24 hours. At intervals from the 12th to the 40th day post-partum randomly selected ewes of both groups were slaughtered. The same procedure was followed on 16 primiparous ewes during an autumn (March) lambing season. A normal virgin ewe of the same age group as the primiparous ewes was slaughtered as a control during the spring lambing season. The virgin ewe was slaughtered approximately 9 days after the indication of oestrus to obtain a corpus luteum of known age.

Materials and methods

During a spring (August) lambing season the

Each individual post-partum ewe, as well as the virgin ewe, received an adequate diet, calculated to sustain a lactating ewe. To detect oestrus vasectomized rams were used twice daily.

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Blood was collected from the jugular vein of each ewe prior to slaughtering. After centrifugation plasma was stored at -20°C . Plasma progesterone concentrations were determined by radioimmunoassay (Faure, 1975).

After slaughtering both ovaries were removed as soon as possible and CL, if present, were excised, weighed and divided equally. One half was stored at -20°C . The other half was fixed in Zenker's solution for histological investigation. The frozen half was used for progesterone extraction and determination (Wentzel, 1973). The luteal progesterone content was expressed as $\mu\text{g}/100\text{ mg}$ wet mass tissue.

Results

The individual plasma progesterone concentration and luteal progesterone content of each ewe for different seasons and groups, as well as oestrus detected by vasectomized rams are indicated in Tables 1 and 2.

The mean plasma progesterone concentrations in

lactating and non-lactating ewes which lambed during autumn (Table 1), were generally higher than in those which lambed in spring (Table 2). From Table 1 it is evident that the plasma progesterone concentration of lactating and non-lactating ewes during the autumn season remained relatively constant at low levels during the first 22 days after parturition. During this period no CL were observed in any of the two groups (Table 1).

During the autumn season the plasma progesterone concentration of lactating and non-lactating ewes increased after approximately 22 days post-partum (Table 1); that of lactating ewes increasing earlier and reaching a peak level of 3.75 ng/ml plasma on approximately day 30 and that of non-lactating ewes reaching a peak of approximately 3.88 ng/ml plasma at 36 days or later after parturition. It is evident from Table 1 that the plasma progesterone concentration in both groups increased after the 22nd day of parturition, reaching a mean value more than twice the mean value before the rise occurred. This rise in plasma progesterone concentration correlates with the rise in luteal progesterone content (Table 1).

Table 1

Plasma progesterone concentration and luteal progesterone content of autumn post-partum ewes

LACTATING EWES SLAUGHTERED:	DAYS POST PARTUM								MEAN VALUE	VIRGIN EWE
	12	14	18	20	22	26	30	36		
Plasma progesterone concentration (ng/ml)	1.80	1.13	1.48	0.93	1.34	2.31	3.75	0.63	1.67 \pm 0.98	4.19
Luteal progesterone content ($\mu\text{g}/100\text{ mg}$ CL tissue)	—	—	—	—	0.77	1.63	2.31	1.15	1.47 \pm 0.66	1.54
NON-LACTATING EWES SLAUGHTERED:										
Plasma progesterone concentration (ng/ml)	0.53	0.80	0.85	0.88	0.55	1.31†	2.50	3.88	1.41 \pm 1.18	
Luteal progesterone content ($\mu\text{g}/100\text{ mg}$ CL tissue)	—	—	‡	—	—	1.02	1.35	1.51	1.29 \pm 0.25	
Mean Plasma progesterone concentration of both groups						12	22 days post-partum		1.03 \pm 0.40	
						26	36 days post-partum		2.40 \pm 1.30	

† Oestrus detected by vasectomized ram 5 days before slaughtering

‡ *Corpus hemorrhagicum*

Table 2

Plasma progesterone concentration and luteal progesterone content of spring post-partum ewes

LACTATING EWES SLAUGHTERED:	DAYS POST PARTUM									MEAN VALUE
	12	14	18	20	22	26	30	36	40	
Plasma progesterone concentration (ng ml)	0.55	0.63	1.13	0.68	0.78	0.85	0.93	0.60	0.55	0.74 ± 0.20
Luteal progesterone content (μ g 100 mg CL tissue)	--	--	--	--	--	--	--	--	--	
NON-LACTATING EWES SLAUGHTERED:										
Plasma progesterone concentration (ng ml)	0.73	0.68	1.08	1.08	0.70	0.48	0.50	0.88	2.81†	0.99 ± 0.71
Luteal progesterone content (μ g 100 mg CL tissue)	--	--	--	--	--	--	--	--	1.32	
Mean plasma progesterone concentration of both groups			12 — 22 days post-partum						0.80 ± 0.21	
			26 — 36 days post-partum						0.95 ± 0.77	

† Oestrus detected by vasectomized ram 9 days before slaughtering

As can be seen in Table 2, the post-partum plasma progesterone concentration did not rise markedly during the first 40 days of the spring lambing season. The plasma progesterone concentration of both lactating and non-lactating ewes showed no marked difference until the 38th day after parturition. On day 40 a rise in plasma progesterone concentration was observed in the non-lactating ewe.

Discussion

The post-partum plasma progesterone concentration during autumn in lactating and non-lactating ewes continued at a steady level for approximately 20-22 days (Table 1). The increase in both plasma progesterone concentration and luteal progesterone content, which followed, indicated that ovulation occurred a few days earlier — approximately day 18 post-partum.

Observation of the data in Table 1 suggest a higher plasma progesterone concentration and an increased luteal progesterone content in lactating ewes compared to non-lactating, as well as an earlier development of CL as observed in histological preparations of corresponding CL halves (Botha, 1976). Such a conclusion is not necessarily correct, since macroscopic observation revealed a *corpus hemorrhagicum* in the non-lactating ewe 18 days post-partum, while on the 22nd day the lactating ewe had a *corpus luteum*

approximately 5 days old. This indicates that ovulation in both lactating and non-lactating ewes occurred approximately 18 days after parturition. These results are in agreement with those of Torell, Clegg, Weir & Cole (1956), Solomonov (1965), Hunter & Lishman (1967) and Plotka, Erb & Harrington (1970).

The low post-partum plasma progesterone concentration on the 36th day of the ewe lactating during autumn correlates with a *corpus luteum* of approximately 2 days old (Table 1).

The ovary of this ewe contained a single *corpus albicans* indicating that two silent ovulations had occurred within 36 days after parturition. It also indicates that during the autumn season a high incidence of ovulation occurred within 36 days post-partum. These results correspond with those of Mauléon & Dautier (1965) who found that 60 percent of ewes which lambed during an autumn season had ovulated within 25 days post-partum.

The plasma progesterone concentration in lactating and non-lactating ewes during the spring season showed a continuous low level for approximately 36 days after parturition (Table 2). During this period no CL were found, indicating the absence of ovulation. On day 40 after parturition a sharp rise in plasma progesterone concentration occurred in one non-lactating ewe. The vasectomized ram indicated

oestrus activity in this ewe on day 31 post-partum and ovulation in this ewe was confirmed by both the observed marked rise in plasma progesterone concentration and the presence of an active *corpus luteum* of approximately 9 days old. The plasma progesterone concentration exceeded all previous values by approximately twice those in ewes that have been slaughtered during spring.

The continuous low level of plasma progesterone, the absence of CL and the occurrence of a single ewe which ovulated indicates a sustained anovulatory post-partum period in a high percentage of ewes during a spring lambing season. This delay in ovulation correspond with data of Hafez (1952), Barker & Wiggins (1964), Joubert & Louw (1964), Lees (1964) and Mauléon & Dauzier (1965) who found that ewes lambing during the normal breeding season (autumn) and inclined to show post-partum oestrus and ovulate more readily than ewes lambing outside the normal breeding season (spring).

During the autumn season the ovaries of the majority of ewes, both lactating and non-lactating contained CL indicating ovulation. Ovulation was accompanied by oestrus, as indicated by the vasectomized ram, in only one non-lactating ewe. This indicates that a high percentage of silent ovulations occurred during the first 36 days post-partum in autumn. Silent ovulations which are not accompanied by oestrus may be

caused possibly by a decreased post-partum plasma progesterone concentration, which is not followed by normal oestrus. In comparison with this the plasma progesterone concentration during a normal sexual cycle of a virgin control ewe in which oestrus was detected by the vasectomized ram, was much higher (Table 1).

The decreased plasma progesterone concentration which occurred in the majority of ewes could result from decreased CL activity (Folman, Rosenberg, Herz & Davidson, 1973 and van Niekerk, 1975). It is conspicuous that ovulation and CL related to oestrus activity, occurred in the non-lactating ewes during both seasons, which may indicate that CL activity was less suppressed in the non-lactating than in the lactating ewe (Tables 1 and 2). This suppression probably results from a decreased luteinising- and follicle stimulating hormone secretion, as well as from an increased prolactin secretion, which could have been caused by lactation (Graves, Lauderdale, Riesen & Saiduddin, 1968; Hansel & Snook, 1970). This possibility should be investigated.

This result indicates that post-partum ewes may be tupped earlier during the normal breeding season (autumn) than outside the normal breeding season (spring). It also suggests that during the normal breeding season non-lactating, post-partum ewes may be tupped earlier than lactating ewes.

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