Suckling behaviour and fertility in beef cows on pasture 2. Influence of twelve-hour calf separation on interval to first oestrus after onset of mating period

Iona B. Stewart* and B.P. Louw
Department of Agricultural Development: Natal Region, Private Bag X9059, Pietermaritzburg, 3200 Republic of South Africa

A.W. Lishman
Department of Animal Science and Poultry Science, University of Natal, P.O. Box 375, Pietermaritzburg, 3200 Republic of South Africa

Received 11 December 1991; revised 7 July 1992; accepted 13 November 1992

For two weeks prior to the start of the breeding season, the suckling bebaviour of beef calves, separated from their dams for 12 h out of 24, was investigated. Fifty-six per cent of the 44 cows which were separated from their calves from 18:00 to 06:00 (day-sucklers) exhibited oestrus within 30 days of the start of the breeding season, compared to 22% of the group separated from 06:00 to 18:00 ($P < 0.01$). It was concluded that not only the suppression of suckling may be involved in the onset of ovarian activity. The specific time period during the 24 h when suckling is prohibited may also play a role.

Vir twee weke voor die aanvang van die jaarlikse teelseisoen, is die sogingsgedrag van vleisbeeskalwers wat vir 12 h uit elke 24 h van hul moeders geskei was, bestudeer. Ses-en-vyftig persent van die 44 koeie wat tussen 18:00 en 06:00 (dag-sogend) van hul kalwers geskei was, het binne 30 dae na aanvang van die teelseisoen tekens van hitte getoon, in vergelyking met slegs 22% van die groep wat tussen 06:00 en 18:00 (nag-sogend) geskei was. Die aanvang van eierstokaktiwiteit word nie slegs deur die beperking van soging beïnvloed nie. Die spesifieke periode gedurende 'n 24 h-tydperk, waarin die beperking plaasvind, mag ook 'n rol speel.

Keywords: Oestrus, ovarian activity, separation, suckling.

* To whom correspondence should be addressed.

Introduction

It is widely recognized that a cow which suckles a calf has a delayed *post partum* oestrus. Accordingly, attempts have been made to improve the fertility of cows by restricting the calf's access to its dam (Eduvie & Dawuda, 1986; Wells, 1987). By removing calves from anoestrous cows at three weeks of age or older, an immediate increase in tonic luteinizing hormone (LH) secretion has been observed (Walters *et al.*, 1982).

Some researchers have attempted to remove calves temporarily before the breeding season, with variable results. For example, Alberio *et al.* (1985) temporarily removed Aberdeen Angus calves, age 40 days, for 48 or 72 h, and achieved conception rates of 67% and 72%, respectively, as opposed to 50% in cows which kept their calves.

Another approach has been to limit calf suckling each day. When calves were restricted to nursing only once or twice daily, commencing 11 days before the breeding season, 75 and 78.6% of the cows exhibited ovarian activity, respectively, compared to 51% in control cows (Odde *et al.*, 1986). Wells (1987) found that conception rates in Afrikaners increased by 40% when suckling was reduced to twice a day, starting on day 28 *post partum* and then once a day from day 42 *post partum.*

When the inhibitory effect on ovarian cycles, exerted by the suckling calf, is artificially removed, an increased pulse frequency triggers the first ovulation (Carruthers *et al.*, 1980; Walters *et al.*, 1982). However, even in the cow which suckles her calf normally, ovulation will occur eventually. Thus, it appears reasonable to assume that cycling will recommence spontaneously when the calf withdrawal period has increased beyond a certain threshold limit.

From previous observations (Odde *et al.*, 1985; Stewart, 1991) it was evident that as the calf grew older, the interval between suckling events lengthened, particularly in the period from midnight to the early feed. A natural form of temporary calf removal thus appears to facilitate ovarian activity.

A trial was therefore conducted to investigate the effect of a 12-h separation period on the onset of oestrus, and on the normal suckling behaviour patterns. In other words, would the calves compensate for the enforced separation by suckling more often during the 12 hours when they are together? Furthermore, the significance of the nocturnal separation was also investigated.

Procedure

Over three seasons a total of 88 suckling cows were allocated to one of two treatments according to stage *post partum.* The one group was separated from their calves during the night (day-suckled), and the other during the day (night-suckled). Two weeks before the start of the breeding season, the day-sucklers were separated from their dams from 18:00 to 06:00, whereas the night-suckling group were separated from 06:00

to 18:00. Cows and calves were separated by removing the cows from the pasture camps and leaving their calves behind. Cows were placed in a paddock adjoining the calves. There was little change to the forage or herbage component of their diets.

Suckling behaviour patterns were monitored. Observations were taken over 12 h, commencing at 06:00 when the day-sucklers were reunited with their mothers, and for another 12 h at 18:00 for the night-sucklers.

At the end of the two-week period, all the cows and calves remained together as one herd, and breeding by artificial insemination commenced. During the subsequent 60-day mating period, heat-spotting was used to check for signs of oestrus on a twice-daily basis. The heat-spotting period lasted for about 30 min and was done at 06:00 and at 18:00.

Results

The suckling behaviour patterns observed after the cows and their calves were reunited after 12 h of separation, are summarized in Table 1.

Table 1 Frequency and duration of suckling in day- and night-sucklers. Data expressed as the mean ± *SE*

	Day-suckled	Night-suckled
No. of cows	44	44
No. of suckling bouts	3.3 ± 0.96	2.4 ± 0.49
Range in no. of bouts	2 – 5	2 – 3
Duration (min)	12.6 ± 2.19	11.4 ± 1.7
Range	10.1 – 15.1	8.7 – 14.0
Longest interval (h)	2.4 (+ 12)	1.2 (+ 12)
Range	5.3 – 0.0	1.8 – 0.1
Total suckling time (min)	40.2	27.2
% Cycling in 30 days	56.8	22.0

The overall length of the longest interval between two suckling events for the night-sucklers was the imposed 12 h plus the relatively short time between the 4:00 suckling event and 06:00 (1.16 h), when separation took place. The inter-suckling interval for the day-sucklers was as long as 12 plus 5.3 h (those which suckled at about 12:30 and were then separated at 18:00) and as short as 12 h.

There appeared to be no attempt to 'make up for lost time' by calves which fed at night and were nursed less often than those during the day, and their total sucking time (27.2 min) was much shorter than that of the calves with their dams during the day (40.2 min).

Of the 44 cows in the day-suckler group, 25 were inseminated within the first month of the breeding season whereas 13 of the 44 in the night-suckler group were inseminated during the same period. Of these groups, 81 and 66%, respectively, subsequently calved. The mean period *post partum* to first insemination in cows which exhibited oestrus, in the day-suckler and night-suckler groups was 72.4 and 71.1 days, respectively.

Discussion and Conclusions

Results obtained by Stewart (1991) showed that cows and calves do not change their suckling behaviour patterns as a result of a 12-h separation. The day-sucklers nursed more frequently during the 12 h with their dams than did the night-sucklers. This was consistent with the normal daytime suckling behaviour of calves (Stewart, 1991) which were with their dams continuously. Similarly, the night-sucklers reflected suckling behaviour characteristics consistent with normally-suckled calves, i.e. less frequent suckling during the night than during the day. It thus appears that calves which are with their dams for only 12 out of 24 hours, do not compensate for the period during which they were separated from their mothers.

The two groups of cows were separated from their calves for 12 h each day. If the length of time of no suckling was the only trigger to stimulate the onset of oestrous cycles, a similar response would have occurred in the two groups. However, a higher percentage of day-sucklers exhibited oestrus within the first month of the breeding season than the night-sucklers ($P < 0.01$), even though the total suckling time in the day-sucklers was nearly twice as long as in the night-sucklers (Table 1).

It is possible that the day-suckler cows altered their pattern of oestrus, coming into season during the day when they were more readily heat-spotted. This possible shifting of oestrous display could have been evoked by elimination of the suckling bout around midnight, which occurs in cows with access to their calves throughout a 24-h period (Stewart, 1991).

In a study of Afrikaner cattle, normally-suckled cows displayed 50% of their oestrous behaviour between 19:00 and 05:00 (Wells, 1987). However, when the calves were partially weaned, the occurrence of oestrus shifted and only 17% occurred between 19:00 and 05:00.

Another possible explanation for the difference in response to day suckling and night suckling, observed in this study, is the episodic release in LH that is necessary to restore ovarian cyclicity in *post partum* cows and that can be triggered by removing the suckling stimulus (Walters *et al.*, 1982; Williams *et al.*, 1982). Furthermore, there is evidence that a control pathway involves endogenous opioid peptides which suppress LH secretion in suckling cows (Whisnant *et al.*, 1986; Gregg *et al.*, 1986). It is known that endogenous opioids suppress LH secretion in suckling cows, since an administration of an antagonist will increase the LH concentrations (Whisnant *et al.*, 1986).

Research using ovariectomized heifers has indicated that photoperiod alters the circulatory concentrations of LH, and the pulsatile release of LH and melatonin. LH levels and pulse amplitude were higher in blood samples taken nocturnally than in those taken diurnally. Melatonin concentrations showed similar patterns, though melatonin pulse amplitude was higher during periods of light stimulation (Crister *et al.*, 1987b; Short *et al.*, 1972). Melatonin injections given at 16:00 tended to inhibit a decrease in LH concentrations (Crister *et al.*, 1987a).

In fact, Short *et al.* (1988) were excited about recent additions to available options for further study of ovulation control using central nervous system (CNS)-related hormones, e.g. endogenous opioids, oxytocin, melatonin, or their antagonists. Not only do calves suckle less frequently at night than during the day, but from midnight to dawn is a very quiet and

inactive period when cows and calves alike rest and sleep, whether they are together for 12 or 24 h.

It would appear from the present study that there could be an association between the onset of oestrus and the longest interval between suckling events and the regular occurrence of this interval before about 04:00.

Factors such as suckling, endogenous opioids and melatonin modify the pulsatile pattern of LH release. As the calf grows older, in other words the *post partum* period increases, the intensity of suckling is reduced by a lengthening of the longest interval between two suckling bouts. This takes place during the hours of darkness. The inhibitory effect of the endogenous opioids is reduced and melatonin, with higher nocturnal concentrations, influence the LH concentrations in the anoestrous cow until a point is reached where an LH surge is sufficient to initiate the onset of oestrus.

It is suggested from the results of this study that it is the long, predawn interval between two suckling bouts that holds the clue to the suppressive effects of suckling on *post partum* oestrus.

References

ALBERIO, R.H., BUTLER, H.M., PALMA, C.R. & TORQUATT, O., 1985. Effect of temporary calf removal and/or parenteral copper on post partum sexual activity in multiparous cows. Abstract. Asociaco n Latinamericano de Prodducio n Animal, 1983.

CARRUTHERS, T.D., CONVEY, E.M., KESNER, J.S., HAFS, H.D. & CHENG, K.W., 1980. The hypothalamo-pituitary gonadotropic axis of suckled and non-suckled dairy cows. *J. Anim. Sci.* 51, 949.

CRISTER, J.K., HINSHELWOOD, M.M. & HAUSER, E.R., 1987a. The effect of exogenous melatonin administration on gonadotropin and prolactin patterns in ovariectomised estradiol treated heifers exposed to increasing photoperiod. *Theriogenology* 28, 257.

CRISTER, J.K., BLOCK, T.M., FOLKMAN, S. & HAUSER, E.R., 1987b. Effect of photoperiod on LH, FSH, prolactin and melatonin patterns in ovariectomised prepubertal heifers. *J. Reprod. Fert.* 81, 29.

EDUVIE, L.O. & DAWUDA, P.M., 1986. Effect of suckling on reproductive activities of Bunaji cows during the post partum period. *J. agric. Sci., Camb.* 107, 235.

GREGG, D.W., MOSS, G.E., HUDGENS, R.E. & MALVEN, P.V., 1986. Endogenous opioid modulation of luteinizing hormone and prolactin secretion in post partum ewes and cows. *J. Anim. Sci.* 63, 838.

ODDE, K.G., KIRACOFE, G.H. & SCHALLES, R.R., 1985. Suckling behaviour in range beef cows. *J. Anim. Sci.* 61, 307.

ODDE, K.G., KIRACOFE, G.H. & SCHALLES, R.R., 1986. Effect of forty eight hour calf removal, once or twice daily suckling and norgestamet on beef cow and calf performance. *Theriogenology* 26, 3.

SHORT, R.E., BELLOWS, R.A., MOODY, E.L. & HOWLAND, B.E., 1972. Effects of suckling and mastectomy on bovine postpartum reproduction. *J. Anim. Sci.* 34, 70.

SHORT, R.E., STAIGMILLER, R.B. & BELLOWS, R.A., 1988. Hormonal treatments to induce ovulation. 11th International Congress on Animal Reproduction and Artificial Insemination, Dublin. Vol. 5.

STEWART, I.B., 1991. Suckling behaviour and fertility in beef cows on pasture. M.Sc.(Agric.) thesis, Univ. Natal, Pietermaritzburg.

WALTERS, D.L., KALTENBACH, C.C., DUNN, T.G. & SHORT, R.E., 1982. Pituitary and ovarian function in beef cows. 1. Effect of suckling on serum and follicular fluid hormones and follicular gonadotropin receptors. *Biol. Reprod.* 26, 640.

WELLS, P.L., 1987. The influence of suckling during early lactation on the resumption of ovarian activity and oestrous behaviour in the Afrikaner cow. PhD. thesis, University of Natal, Pietermaritzburg.

WHISNANT, C.S., KISER, T.E., THOMSON, F.N. & BARB., C.R., 1986. Naloxone infusion increases pulsatile luteinizing hormone release in post partum beef cows. *Dom. Anim. Endocrin.* 3, 49.

WILLIAMS, G.L., KOTWICA, J., SLANGER, W.D., OLSEN, D.K., TILTON, J.E. & JOHNSON, L.J., 1982. Effect of suckling on pituitary responsiveness to gonadotropin-releasing hormones throughout the early post partum period of beef cows. *J. Anim. Sci.* 54, 3.