

Influence of suckling and continuous cow-calf association on the resumption of *post-partum* ovarian function in *Bos indicus* cows monitored by plasma progesterone profiles

E Mukasa-Mugerwa *, A Tegegne, R Franceschini

*Animal Reproduction and Health Section, International Livestock Centre for Africa (ILCA),
PO Box 5689, Addis Ababa, Ethiopia*

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Summary — The effect of suckling on *post-partum* ovarian function was monitored by weekly plasma progesterone determinations using enzyme immunoassay in 16 Small East African Zebu (*Bos indicus*) cows maintained with a fertile bull. Five cows continuously suckled their calves (COS), but starting 30 d after calving 6 cows remained with their calves which were prevented from suckling using nose plates (NOS) while 5 calves were separated and penned (PEN). The mean (\pm SE) interval from calving to first behavioural oestrus was 81 ± 11 d and was significantly ($P < 0.001$) shorter for PEN (43 ± 10 d) than NOS (72 ± 9 d) or COS cows (133 ± 11 d). COS cows nonetheless weaned heavier ($P < 0.001$) calves at 5 months. Ovarian activity determined by plasma progesterone levels ≥ 1.3 ng/ml indicated that "silent ovulation" was initiated in 44% of cows by 40 ± 6 d *post-partum*. The results indicate that continuous suckling or constant cow-calf interaction extend the *post-partum* anoestrous interval in Ethiopian Zebu cows. However, early-weaned calves or those on restricted suckling would need extra nutritional supplementation to ensure continued growth.

Zebu cow / *post-partum* anoestrus / suckling / progesterone

Résumé — Influence de l'allaitement et de la présence permanente du veau avec sa mère sur la reprise des fonctions ovariennes *post-partum* chez les vaches Zébu (*Bos indicus*). L'effet de l'allaitement sur les fonctions ovariennes *post-partum* a été suivi par le dosage (ELISA) hebdomadaire des niveaux de progestérone sanguine chez 16 vaches Zébu Small African accompagnées d'un taureau. Cinq vaches pouvaient allaiter leurs petits en permanence pendant toute la durée des observations (lot COS). Dans 2 autres lots, à partir de 30 j après le vêlage, 6 vaches restaient avec leur veau mais ceux-ci étaient empêchés de téter par une plaque nasale (lot «NOS») et les veaux de 5 autres vaches étaient séparés de leur mère (lot «PEN»). L'intervalle moyen vêlage/premier oestrus a été de 81 ± 11 j ($m \pm SEM$) pour l'ensemble des vaches. Il était significativement plus court ($P < 0,001$) pour les vaches du lot PEN (43 ± 10 j) que pour celles des lots NOS (72 ± 9 j) et COS (133 ± 11 j). Les vaches «COS» ont sevré des veaux plus lourds ($P < 0,001$) à 5 mois. L'activité ovarienne (indiquée par des niveaux de progestérone plasmatique $> 1,3$ ng/ml) commence par une «ovulation silencieuse» chez 44% des vaches, 40 ± 6 j après le vêlage. Ces résultats montrent que

* Correspondence and reprints

l'allaitement permanent ou la présence permanente des veaux près de leur mère augmente la durée de l'anoestrus post-partum chez les vaches Zébu. Cependant, les veaux soumis à un sevrage précoce ou à un allaitement restreint ont besoin d'un complément alimentaire pour poursuivre une croissance normale.

vache Zébu / anoestrus / post-partum / allaitement / progesterone

INTRODUCTION

Calving intervals in *Bos indicus* (Zebu) cows frequently exceed the desirable 365 d (Oyedipe *et al*, 1982; Mukasa-Mugerwa *et al*, 1989a). After parturition cows experience behavioural anoestrus of variable length depending on age, milk yield, nutrition, body weight and condition, health, season, uterine pathology, suckling and milking intensity (Oyedipe *et al*, 1982; Peters, 1984; Hanzen, 1986; Bluntzer *et al*, 1989). In the tropical regions where most Zebu cattle are found, farmers commonly share cow milk with the calf. Milk let-down in Zebu cows occurs only in the presence of their calves. Consequently, Zebu calves often suckle for 8–9 months before weaning.

The endocrinology of the *post-partum* period in Zebu cattle is not well known and the aim of this study was to: i) assess the effect of cow–calf association and continuous suckling on the resumption of oestral activity; and ii) monitor the temporal patterns of plasma progesterone during the *post-partum* period in grazing Zebu cows under uncontrolled mating.

MATERIALS AND METHODS

This study involved 16 multiparous Ethiopian Small East African Zebu cows with normal calving between March and September 1989 at the ILCA Debre Berhan research station, 120 km north of Addis Ababa at an altitude of \approx 2 850 m. Cows averaged 242 ± 8 kg and ranged from

5–7 in body condition at calving (1 = emaciated; 9 = obese). Station climatic data have been described previously (Mattoni *et al*, 1989). Cows grazed natural pastures during the day and were penned overnight and fed $2 \text{ kg} \cdot \text{d}^{-1}$ per head natural grass hay. Pastures were predominantly composed of *Andropogon*, *Festuca* and *Pennisetum* grass species mixed with *Trifolium semense* legume. Animals were watered daily and mineral licks were available *ad libitum*.

Cows were assigned at calving to 1 of 3 suckling treatments starting 30 d *post-partum*. Five cows continuously suckled their calves (COS). Suckling was prevented in 11 either by the application of calf nose-plates (NOS, $n = 6$) of calf separation and penning (PEN, $n = 5$). Penned calves were provided with grass hay *ad libitum*. NOS and PEN cows were hand-milked twice a day, morning and afternoon, in the presence of their calves. Cow milk yield was recorded prior to feeding the milk to the calf. Cow oestral activity was monitored by a fertile bull fitted with a Chinball marker and maintained permanently with the herd. Cow and calf body weights were recorded monthly and all calves were weaned at 5 months.

Cows were bled weekly starting the last week of gestation until confirmed pregnant by rectal palpation 45 d post-mating. Blood samples were centrifuged immediately and plasma stored frozen at $-20 \text{ }^\circ\text{C}$ until assayed for progesterone. Progesterone determination was carried out by the enzyme linked immunosorbent assay (ELISA) method using Ovucheck kits from Cambridge Veterinary Sciences. Procedural details of the technique were as per manufacturer's recommendations and have been described by Mukasa-Mugerwa *et al* (1989b). The intra- and inter-assay coefficients of variation for plasma containing 8 ng/ml were 0.18 and 0.27, respectively. Data on cow *post-partum* anoestrous interval were analysed by least-squares procedures (SAS, 1987) to assess the effect of treatment and calving season.

RESULTS

Mean cow body weights at calving and calf birth weight were similar for the 3 suckling groups (table I). No subsequent significant variation was observed in cow body weight, but there was a strong treatment effect on calf pre-weaning growth performance. COS calves exhibited faster average daily gains and were almost 2 to 3 times as heavy at weaning compared to their PEN and NOS counterparts ($P < 0.001$).

The overall mean interval from calving to first behavioural oestrus, *ie* the *post-partum* anoestrous interval, was 81 ± 11 d with a wide range from 31 to 192 d. Anoestrous interval differed significantly ($P < 0.001$) between groups, being almost 2 and 3 times longer in COS than NOS or PEN cows. Anoestrous intervals of < 100 d were recorded only for NOS and PEN cows (table I). Further, there was no significant effect of cow weight change on *post-partum* anoestrous duration.

Plasma progesterone profiles are shown to illustrate 2 major phases of the

calving to conception interval. The first was the calving to first oestrous interval with no measurable ovarian activity. The second was the first oestrus to conception interval (service period) characterized by normal and/or abnormal progesterone patterns such as the delaying effect of continuous suckling and constant cow-calf association, and initial silent ovulation or undetected oestrus (fig 1), false or unovulatory oestrus with no concomitant increase in progesterone level (fig 2), and repeat breeding, silent or undetected oestrus and return to oestrus after possible embryonic mortality (fig 3).

Mean plasma progesterone concentration prior to first behavioural oestrus was 0.56 ± 0.35 (SD) ng/ml. By considering cows to have resumed ovarian cyclicity based on progesterone levels > 1.3 ng/ml (the mean basal level plus 2 standard deviations), it was found that 7 (44%) animals manifested initial "silent ovulation" (no oestrus detected) followed by a luteal phase which was shorter than the normal duration and plasma progesterone profiles lower than during the normal cycle, by 40 d after calving. Otherwise, after regular ova-

Table I. Effect of suckling regime on cow and calf body weight and *post-partum* anoestrous interval in Zebu cows ($m \pm$ SEM).

Suckling regime	Obs	Body weight (kg)			Anoestrous length (d)
		At calving	3 months	5 months	
PEN cows	5	240 \pm 16	251 \pm 35	264 \pm 35	43 \pm 10 ^a
NOS cows	6	243 \pm 15	233 \pm 33	232 \pm 34	72 \pm 9 ^b
COS cows	5	254 \pm 16	243 \pm 35	236 \pm 35	133 \pm 11 ^c
PEN calves	5	17.5 \pm 0.8	33.7 \pm 5.6 ^a	47.6 \pm 6.4 ^a	
NOS calves	6	16.4 \pm 0.8	31.2 \pm 5.3 ^a	35.1 \pm 6.0 ^a	
COS calves	5	19.8 \pm 0.8	53.8 \pm 5.6 ^b	83.2 \pm 6.4 ^b	

COS : continuous suckling; NOS = nose-plated calf; PEN = penned calf. Means in the same column with different superscripts differ significantly; $P < 0.05$.

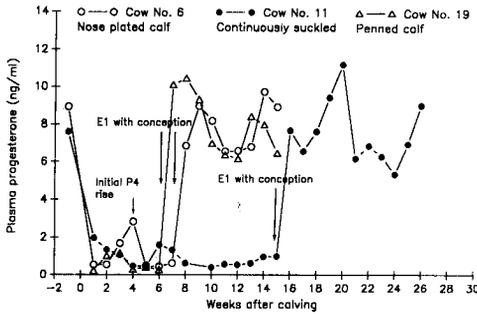


Fig 1. Progesterone profiles of Zebu cows showing the effect of suckling and cow-calf association on ovarian function. E : œstrus; P4 : progesterone.

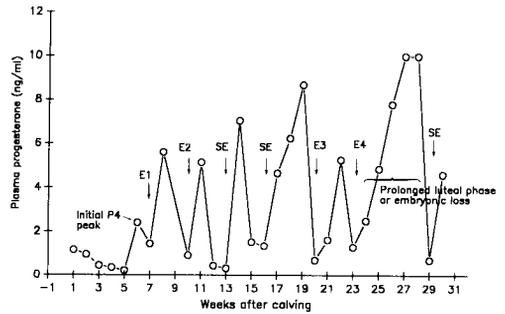


Fig 3. Progesterone profile of a Zebu cow showing repeat breeding (E) and silent or undetected œstrus (SE).

rian cycles had resumed, 15% of heats were "silent" or undetected in 18% cows; and 6% of heats were false or unovulatory as they were not associated with subsequent increases in progesterone values. Extended luteal phases, suggestive of early embryonic mortality, were recorded in 2 cows.

Five (31%) cows conceived at first mating, 2 on the second and the rest required more services. The shortest interval followed by conception at first mating was 31 d long.

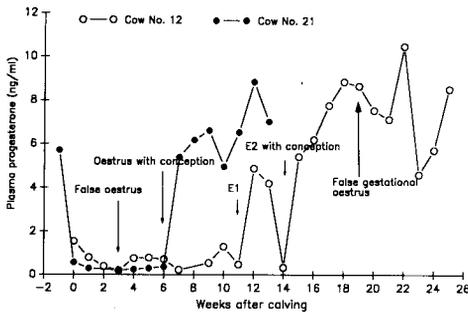


Fig 2. Progesterone profiles of Zebu cows showing "false" œstrus before and after conception.

DISCUSSION

The overall mean *post-partum* anoestrous interval of 81 d obtained in this study was within the range of 45–168 d previously reported for cattle in the tropics (Hansel and Alila, 1984) and 20–110 d for taurine cattle in temperate regions (Hanzen, 1986). The observation that our NOS and PEN cows conceived by 100 d indicates that Zebu cattle under restricted suckling are actually capable of short *post-partum* anoestrous periods and more frequent calving than COS cows. This is consistent with the results of Eduvie and Dawuda (1986) on suckled and non-suckled Nigerian Bunaji cows. Similar conception patterns have also been reported in Afrikaner cows (Wells *et al*, 1985) and taurine beef cattle (Wiltbank and Cook, 1958; Short *et al*, 1972).

The present lack of a significant effect of cow weight change on anoestrous duration, despite differences due to suckling manipulation, agrees with the observations of Short *et al* (1972) who found that if suckled and non-suckled cows had similar

body weight losses, *post-partum* anoestrous interval was still longer in suckled cows. The longer anoestrous interval we observed for continuously suckled cows is in accord with the findings of Wiltbank and Cook (1958) and Short *et al* (1972).

Our results agreed with those of Holness *et al* (1980) who reported a shorter calving interval ($P < 0.05$) in Mashona and Afrikaner cows whose calves had been nose-plated for 8 d 50 d after calving than in continuously suckled cows. Further, the significant differences in *post-partum* anoestrous interval between PEN and NOS groups (43 vs 72 d) points to a delaying effect of cow-calf interaction on ovarian function. In mastectomised beef cows, ovulation and oestrus were suppressed for at least 50 d after calving by some cow-calf interaction independent of lactation or suckling (Viker *et al*, 1989). In contrast, Williams *et al* (1987) among others, concluded that the ability of suckling calves to suppress tonic LH secretion derives from cues not fully stimulated by the presence of non-suckled calves.

Our Zebu cows exhibited progesterone profiles similar to taurine cows, except for the extended *post-partum* anoestrus. Hormone levels were basal (≤ 1.3 ng/ml) before first behavioural oestrus. Prior to first oestrus, the frequency of 44% cows that showed an initial progesterone peak agreed with 50% observed in taurine cattle (Schams *et al*, 1978; Lamming *et al*, 1981) or their crosses (Ramirez-Iglesia *et al*, 1988) but was lower than shown in other reports (Rawlings *et al*, 1980; Webb *et al*, 1980). The frequency of these events might have been higher if progesterone concentration had been assayed more frequently than weekly.

These initial rises, probably resulting from luteinized follicles (Corah *et al*, 1974),

may have an organising effect on the *post-partum* ovarian-pituitary-hypothalamic axis (Webb *et al*, 1977) and the re-establishment of regular oestrous cycles (Lamming *et al*, 1981; La Voie *et al*, 1981). But as our data indicate, these initial peaks are not exclusive prerequisites for conception. This is consistent with a previous report on taurine beef cows that conceived to natural service prior to any rise in milk progesterone levels (Peters and Riley, 1982).

Restricted suckling reduced the anoestrous interval but concurrently depressed calf growth rate, possibly because of less milk production. This would be unfavourable on commercial ranches where productivity and profitability is dependent on calf weight weaned per cow per year, and might be worse among traditional smallholders who often share cow milk with the calf. Furthermore, calf survival rate is also related to calf nutrition. Such milk-restricted calves would have to be fed extra nutritional supplement to realise the combined benefits of short anoestrous interval and continued calf growth. One way to reduce the cost of supplementation would be to adopt "once-daily" calf suckling from 30 d, which Randel (1981) and Bluntzer *et al* (1989) found to have no effect on the weaning weight of Brahman-cross heifers and cows.

In summary, the present results indicate that Ethiopian Zebu cows calving with average body weight and body condition can cycle and conceive by 100 d *post-partum* under natural mating conditions provided they are not continuously suckled. Therefore, improved cow management, especially as regards nutrition during the last trimester to ensure that cows calve with good weight and in good condition, minimal suckling and better oestrous detection, are required to ensure prompt *post-partum* ovarian cyclicity.

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