

Time of Onset of Post-Partum Luteal Function and Conception in Dairy Cows

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Eldon, J.: Time of onset of post-partum luteal function and conception in dairy cows. *Acta vet. scand.* 1991, 32, 177-182. - The following reproductive parameters were studied in 40 Icelandic dairy cows on 2 farms with free stall and tie stall housing: The time of onset of post-partum luteal activity; the time of first post-partum artificial insemination (AI); the time of conception; conception rate to first post-partum AI; the number of AI's per conception; length of gestation; and the number of days between 2 consecutive calvings. Milk for progesterone analysis was sampled 3 times a week from calving until first AI on farm 1, but every day for 90-100 days from calving on farm 2.

In this study the average onset of luteal function was 21 days post-partum, the cows were inseminated 62 days and conceived 74 days post-partum. Conception rate to first AI was 71 % and number of AI's per conception was 1.6. Significant differences were not found between the 2 farms.

The reproductive performance of the cows in this study was greater than found in earlier studies of the Icelandic dairy cows and indicate that this animal has reproductive capabilities comparable to high producing foreign dairy cows.

progesterone; ovarian activity.

Introduction

The Icelandic dairy cow is a small breed (450 kg) of relatively high milk yield (country average: 4000 kg/milking period, *Jónmundsson*, pers. comm.). The cows graze on cultivated pasture during summer and are fed hay, silage and concentrates (milking cows) during winter. The most common housing arrangement is tie stalls, though free stall housing can be found. According to a recent study, the average time of first post-partum luteal function in Icelandic dairy cows was 29-49 days (*Eldon & Olafsson* 1988). This is 10 to 30 days later than reported for many high milking European breeds (*Larsson et al.* 1984, *Haraszti et al.* 1985, *Carrol et al.* 1988, *Heinonen et al.* 1988).

Conception rate is positively correlated to the number of days from calving and the

number of ovarian cycles preceding the service (*Eldon & Olafsson* 1988, *Butler & Smith* 1989). Early post-partum onset of luteal function is therefore of importance in relation to conception rate.

In light of previous results of late onset of ovarian cyclicity the purpose of this study was to study further the post-partum reproductive performance of the Icelandic dairy cow especially the time of onset of luteal function.

Materials and methods

Animals, housing and feeding

By the help of milk progesterone profiles and farm records the following fertility parameters were studied in 40 Icelandic dairy cows on 2 farms (20 cows on each): The time of onset of post-partum luteal activity; the time of first post-partum AI (artificial

insemination); the time of conception; conception rate to first post-partum AI (non-return rate, i.e. cows that had not returned to heat 60 days post-insemination were considered pregnant); the number of AI's per conception; length of gestation; and the number of days between 2 consecutive calvings. On farm 1 there were 32 milking cows housed in free stalls and milked in a separate milking parlour. The cows were fed hay and silage ad libitum and 3 kg/day of concentrates.

On farm 2 there were 70 milking cows housed in a tie stall but set free twice a day for milking at a separate milking parlour. The cows were fed 13.9 feeding units/day (feeding units according to Scandinavian definition; *Slagsvold* 1973) in the form of hay (10–15 kg/day) and concentrates.

The housing on both farms was good, the barns were light, warm and well ventilated. The farmers cared well for the animals on both farms. Average milk production per cow on both farms was 4000 ± 400 kg/milking period.

Milk sampling

On farm 1, milk was sampled 3 times a week from calving until first AI. On farm 2, milk was sampled every day for 90–100 days from calving. The milk was collected in 10 ml plastic vials. Each vial contained as a preservative 10 mg 2-bromo-1,3-propanediol (Sigma Chemical Co., St. Louis, MO). The samples were frozen at -20°C until assayed.

Milk analysis

Progesterone was assayed by a radioimmunoassay technique as described by *Eldon & Olafsson* (1986). The hormone was determined in the fat free part of the milk, tritiated progesterone was used as tracer and free hormone was separated from bound by dex-

tran coated charcoal. Inter-assay coefficient of variation (CV%) was 12.2 % for a sample containing 6.0 nmol/l of progesterone (n = 50, x = 5.9). Intra-assay CV% for duplicate samples was 6.7 %. The sensitivity of the assay was 0.5 nmol/l and average recovery was 98 %.

Statistical analysis

The data were analysed using ANOVA statistics as described in *Sokal & Rohlf* (1981).

Results

The age of the cow is presented in Table 1 as well as the length of gestation and the number of days between calvings. The values for age were significantly different (p < 0.05) between the 2 farms.

Table 1. Mean age at calving, length of gestation, and number of days between calvings.

	Age at calving (years)	Length of gestation (days)	Days between calvings
Farm 1			
x	3.6	286	357
SD	1.6	5	24
Range	2–8	280–297	331–396
Farm 2			
x	5.1	286	376
SD	2.2	5	36
Range	3–12	280–293	334–427
Levels of signific.	*	ns	ns

x = mean; SD = standard deviation; Range = range of values; Levels of significance for differences of means; * = p < 0.05; ns = not significant.

Fig. 1 shows the progesterone profile of cow 012 on farm 2. This profile is typical for the changes in progesterone concentration that occurred in the cows during the first 90–100 days post-partum. The profile shows the

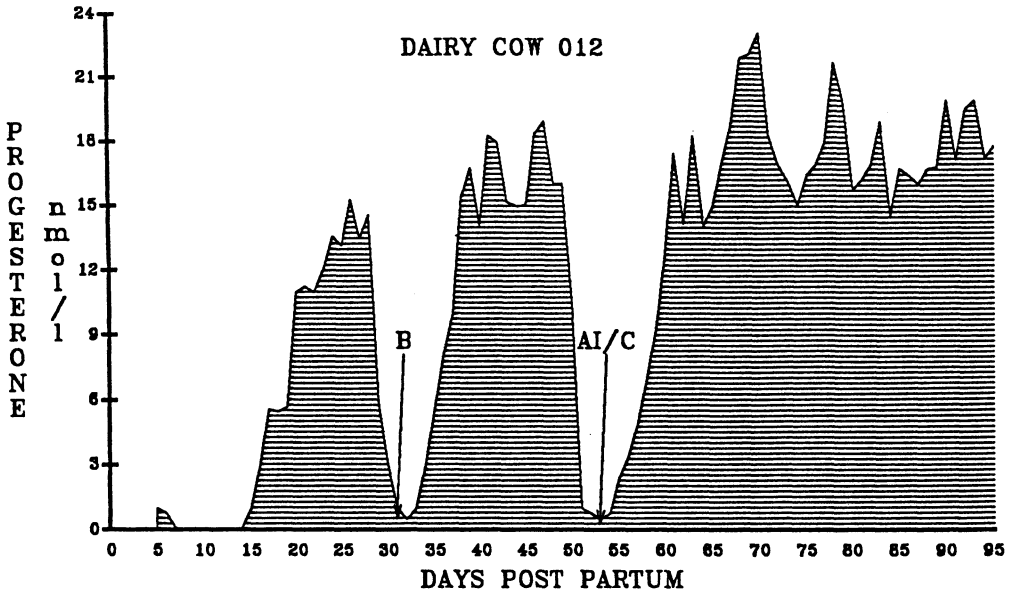


Figure 1. Progesterone profile of cow 012 on farm 2. The profile shows the changes in progesterone concentration that occurred the first 95 days post partum; the time of onset of luteal function; the time of first behavioural heat (B); the time of artificial insemination (AI) and conception (C).

time of onset of luteal function, the time of oestrus and the time of conception.

The onset of luteal function was, on the average, 23 and 19 days post-partum on farms 1 and 2, respectively (Table 2). In 50% of the cows luteal function had started 16 (farm 1) and 14 (farm 2) days and in 90% 40 and 28 days post-partum (Table 3). Table 2 shows that the cows were inseminated (first post-partum AI), on the average, 58 and 68 days after calving. Conception rate to first post-partum AI was 70 and 72 and the number of AI's per conception was 1.6 and 1.5. Accordingly the average time of conception was 79 and 74 days post-partum for farm 1 and farm 2, respectively (Table 2). Fifty percent of the cows had conceived 60 days post-partum and 90% 120 days post-partum (Table 3).

Significant differences were not found between the 2 farms.

Discussion

The mean age of the cows on farm 1 was lower but the age of the cows on farm 2 was in accordance with the mean age (5.0 years) found on 9 farms in Iceland at 3 consecutive calvings (Eldon & Olafsson 1988). Age did not influence the parameters studied.

The length of gestation was 286 days, compared to 287 days reported by Eldon & Olafsson (1988). As a comparison, the gestation length of Holstein-Friesian and Jersey cattle has been reported to be 279 days, 282 days for Swedish-Friesian and 290 days for Brown Swiss (Jainudeen & Hafez 1980).

The average number of days between calvings were 357 and 376 for farms 1 and 2, respectively. Eldon & Olafsson (1988) reported 382 days between calvings and Nieuwhof *et al.* (1989) reported 400 days between calvings for Ayrshire, Brown Swiss, Guernsey and Holstein cows in the United States.

Table 2. The mean values for the number of days from calving to the time of first luteal function, first artificial insemination (AI) and conception, conception rate and number of AI per conception.

	Number of days from calving to first post-partum			
	luteal function	AI	conception	
Farm 1 (n = 20)				
x	23	58	79	
SD	12	17	48	
Range	10-55	38-111	38-199	
Conception rate to first AI				70 %
Number of AI per conception				1.6
Farm 2 (n = 20)				
x	19	68	74	
SD	10	23	29	
Range	9-45	44-134	44-144	
Levels of significance	ns	ns	ns	
Conception rate to first AI				72 %
Number of AI per conception				1.5
Both farms combined				
x	21	62	74	
SD	11	20	37	
Range	9-55	38-144	38-199	
Conception rate to first AI				71 %
Number of AI per conception				1.6

n = number of animals; x = mean; SD = standard deviation; Range = range of values; Levels of significance for differences of means; ns = not significant.

The cows on farm 1 were housed in free stalls and milked in a separate milking parlour. The onset of luteal function was, on the average, 23 days post-partum. The cows on farm 2 were housed in tie stalls but set free twice a day during milking in a separate milking parlour. The onset of luteal function was, on the average, 19 days post-partum. The difference was not statistically sign-

Table 3. The 50 (median), 75 and 90 percentiles for the onset of post-partum luteal function (Lf), first post-partum artificial insemination (AI) and conception (Co).

	Percentiles		
	50	75	90
Farm 1			
Lf	16	29	40
AI	54	63	68
Co	61	73	120
Farm 2			
Lf	14	24	28
AI	57	75	93
Co	60	85	102

ificant. *Eldon et al.* (1985), *Eldon & Olafsson* (1986) and *Eldon & Olafsson* (1988) reported that the average time from calving to the onset of post-partum luteal function was 43 ± 26 days for Icelandic cows housed in tie stalls. Forty days post-partum, luteal function had started in 90 % of the cows on both farms in this study which is comparable to the findings of *Morrow et al.* (1969), *King et al.* (1976), *Bulman & Lamming* (1978) and *Larsson et al.* (1984). Longer average time of onset of luteal function found in earlier studies of Icelandic dairy cows could probably be explained by stalls and milking arrangements. The cows in earlier studies were housed in tie stalls and milked in the stalls, whereas the cows in this study were housed in free stalls and tie stalls but milked in a separate milking parlour. The exercise and the possibility to express normal behaviour, which the cows get in free stalls and when they are set free for milking, probably stimulate the activity of the hypothalamo-pituitary-ovarian axis and so promote the onset of ovarian cyclicity (*King et al.* 1976, *Claus et al.* 1983, *Hare-sign et al.* 1983). On farm 1 the cows were inseminated (first AI), on the average, 58

days post-partum and on farm 2, 68 days post-partum. Conception rate to first AI was 70 % on farm 1 and 72 % on farm 2. This difference is not statistically significant, but increased time interval from calving to first AI has been found in earlier studies (*Eldon & Olafsson* 1988, *Larsson et al.* 1984, *Butler & Smith* 1989).

In accordance with the time of first post-partum AI and the conception rate was the time of conception which averaged 79 days on farm 1 and 74 days on farm 2. *Eldon & Olafsson* (1986, 1988) found that Icelandic dairy cows housed in tie stalls were inseminated 74 days post-partum, on the average and conceived 97 days post-partum. Conception rate to first post-partum AI, in that study, was 59 % (conception confirmed by rectal palpation). These results are in accordance with the findings of *Butler & Smith* (1989) that conception rate is positively correlated to the number of ovarian cycles preceding the service.

It can be concluded that the reproductive performance of the cows in this study was greater than found in earlier studies of the Icelandic dairy cow and was comparable to the best results found in any foreign breed of dairy cattle.

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Sammanfattning

Tidspunkten för början av gulkroppens funktion postpartum och för dräktighet hos mjölkkor.

Tidspunkten för början av gulkroppens funktion efter kalvning, konstgjord inseminering (AI) och konception undersöktes hos 40 isländska mjölkkor från 2 olika besättningar. Dessutom bestämdes konceptionsfrekvensen till första AI postpartum; antalet AI per konception; längden av dräktighetstiden och kalvningsintervallet. Mjölksprov för analys av progesteron togs var tredje dag från kalvning till första AI i besättning 1, och varje dag för 90–100 dagar i besättning 2.

Medeltalet för tiden för början av gulkroppens funktion efter *partus* var 21 dag. Medeltiden för första AI och konception efter *partus* var 62 respektive 74 dagar. Konceptionsfrekvensen till första AI efter *partus* och antal AI per konception var 71 % respektive 1.6. Undersökta reproduktionsparametrar visade inte signifikant skillnad mellan besättningar.

Reproduktionsaktiviteten hos kor i denna undersökning var högre än tidigare undersökningar har visat. Resultaten visar att den isländska mjölkkon har reproduktionskapacitet som liknar de högtproducerande mjölkornas reproduktionskapacitet i skandinavien.

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