Acta vet. scand. 1985, *26*, 431—441.

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# A SURVEY OF THE POSTPARTUM REPRODUCTIVE PERFORMANCE OF DAIRY COWS WITH FERTILITY PROBLEMS IN SOUTHERN ICELAND

By

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ELDON, J., TH. OLAFSSON and TH. THORSTEINSSON: *A survey of the postpartum reproductive performance of dairy cows with fertility problems in southern Iceland.* Acta vet. scand. 1985, *26*, 431—441. — The purpose of this survey was to evaluate the reproductive performance of dairy cows on problem farms in southern Iceland. In all 229 cows on 6 farms were studied. The animals were examined clinically by rectal palpation, once a month. Blood samples were taken 2—5 and 7—10 weeks after calving. The blood samples were analysed for the contents of glucose, urea, inorganic phosphate, calcium and magnesium. Milk samples for progesterone profiles were taken, by the farmer, every 4th day from day 10 postpartum until first oestrus. Because of this sampling method, 128 cows had no rise in progesterone levels, when milk sampling was stopped. These 128 animals were excluded from the study. The results are based on 101 animals.

There was a large variation between cows in postpartum reproductive performance. In the total material 1st ovulation occurred later than reported in many other countries. Fifty percent of the cows had ovulated 35 days after calving and 90 percent 70 days after calving.

The first luteal phase was short in about 60 % of the cows. The progesterone values assayed from those short cycles were lower than the values assayed from the following cycle. First artificial insemination (ai) was on the average 77 days postpartum (pp). The conception rate to first service was 49 %. Of 100 milk samples taken at the time of ai, 20 had high progesterone value. This indicates a high frequency of luteal phase inseminations.

Clinical ketosis was diagnosed in 35 cows. Of these, 31 had a low glucose value. Cows with clinical ketosis ovulated, on the average, later than other animals and 24 ovulated later than 40 days pp. The results indicated that the fertility problems of these cows studied were late ovulations, low conception rate, probably in part, due to luteal phase inseminations, and a high frequency of ketosis which could be caused by low quality feedstuff.

ovulation; blood components.

Studies of the postpartum reproductive performance show, that in many countries dairy cow herds suffer from reproductive inefficiency (*Roine & Saloniemi* 1978, *Bulman & Lamming* 1978, *Claus et al.* 1983). The most common problems reported are low heat detection, delayed ovulations and irregular luteal activity. This can lead to extended calving interval and decreased milk production (*Lamming & Bulman* 1976, *Oltner & Edqvist* 1981, *Haresign et al.* 1983). The nutritional status of the cattle, seasonal changes in climate, housing and other factors concerning general management of the cattle are suggested as causative factors (*King et al.* 1976, *Rosenberg et al.* 1982).

Analysis of progesterone in milk, sampled sequentially to obtain progesterone profiles, is one of the tools used today for assessment of ovarian function and for pregnancy diagnosis (*Mather et al.* 1978, *van de Wiel et al.* 1979). *Larsson et al.* (1984) reported an extensive study of the postpartum reproductive performance in dairy cows in Sweden. They used clinical examination, plasma porgesterone profiles and heat detection records in their study.

The Icelandic dairy cow came originally from Norway with the first settlers in Iceland in the 9th century. According to *Adalsteinsson* (1981) the Icelandic cattle is related to the old Norwegian landraces Doele, Telemark and Troender cattle. The total number of dairy cattle in Iceland in January 1979 was 63,000, whereof 36,000 were milking cows (*Adalstensson* 1981). The cows are housed for 7—8 months, usually in tie stalls, and fed hay, silage, and feeding grains. During the summer months they are grazed on cultivated pastures. These cows have a high incidence of ketosis and mastitis (*Ólafsson et al.* 1974), *Hlidar* 1979). Hypomagnesaemia occurs frequently (*Sigurdarsson & Thorsteinsson* 1978). Ovarian cysts are infrequent. Diseases such as brucellosis, vibriosis, listeriosis and trichomoniasis have not been verified*.

In 1981 several dairy farmers in southern Iceland complained about low conception rates and low calving intervals in their cows. The Agricultural Society of Iceland asked the Institute for Experimental Pathology and the Agricultural Research Institute to look into this problem. It was decided to use a combination of clinical examination of the reproductive organs, milk progesterone profiles and blood parameters for this study.

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## MATERIALS AND METHODS

### *Animals*

Two hundred and twenty nine Icelandic dairy cows on 6 farms, housed in tie stalls with or without an iron-grille gutter, were examined. Records of time and number of ai, time of conception and time of calving were kept on the farms. All farms used ai; see Table 1 for a description of size of farms, and number of cows from each farm. The genital organs were examined about once a month by rectal palpation.

During the time of the study, some corrections on the ai technique were made. The insemination technique of the ai technicians was tested in a slaughterhouse in cows to be slaughtered. A searing gun (I.M.V., France), that burned the mucosa of the uterus, was used to detect where the technicians deposit the semen.

### *Analysis of serum and milk*

Blood was collected on 2 occasions, 2—5 weeks and 7—10 weeks after calving. The blood samples were analysed for the contents of glucose, urea, inorganic phosphate (Pi), calcium (Ca) and magnesium (Mg). Ca and Mg were assayed as described in "Perkin-Elmer Analytical Methods". Glucose, urea and Pi were assayed as described in "Technicon AutoAnalyser II, Clinical Methods".

Sequential milk samples for progesterone profiles were taken by the farmers every fourth day from day 10 postpartum until the first signs of oestrus. At that time the collection of frequent milk samples was stopped and samples only taken at the time of ai. The samples were preserved with sodium azide tablets and stored at —20°C until they were assayed 2—5 months after collection.

The progesterone content in milk was assayd in the fat free part by a radioimmunoassay technique* as reported by *Oltner & Edqvist* (1980, 1981). Milk from a cow in heat was used for correction of non-specific binding and for dilution of standards. Inter- and intra-assay coefficients of variation, in a milk sample with the content of 4 nmol/l of progesterone, were 28.3 % and

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* The antiserum used was kindly provided by prof. Lars-Eric Edqvist, the Swedish University of Agricultural Sciences, Uppsala, Sweden.

7.6 %, respectively. The sensitivity of the assay ($B_0$ + 95 % confidence limit) was 1.1 nmol/l, average recovery was 98 % and the correlation coefficient (r) of comparison with a Farmos progesterone in milk assay kit, was 0.89.

## RESULTS

Regular sampling for milk progesterone profiles was stopped at the time of first signs of oestrus and the milk samples were not assayed until 2—5 months after sampling. Collection of sequential milk samples from 128 cows had been stopped before cyclicity had resumed. The results are therefore based upon 101 cows, 70 cows from farm A (Group 1) and 31 cows from farms B-F (Group 2) (Table 1).

Table 1. Total number of milking cows on farms. Number of cows entering the study and number of cows with assayed progesterone profiles.

| | Group 1 | Group 2 | | | | |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F |
| Total no. of milking cows | 92 | 44 | 41 | 32 | 27 | 25 |
| No. of animals entering the study | 80 | 40 | 38 | 27 | 23 | 21 |
| No. of animals with prog. prof. | 70 | 11 | 8 | 3 | 5 | 4 |

The milk progesterone profiles showed that the mean number of days from calving to first ovulation in cows in group 1 and 2 were 40.2 and 40.1, respectively. Table 2 shows that 50 % of the cows in group 1 had ovulated 34 days pp and 35 days pp in group 2. Ninety percent of the cows in group 1 had ovulated

Table 2. Overall means, standard deviations and 50th, 75th and 90th percentiles for interval between calving, first pp ovulation and first pp ai.

| | Interval from calving | Mean | SD | Percentile | | |
|---|---|---|---|---|---|---|
| Group | to | (days) | (days) | 50 (median) | 75 | 90 |
| 1 | 1st ovulation | 40.2 | 21.8 | 34 | 62 | 75 |
| n=70 | first ai | 78.5 | 23.0 | 72 | 92 | 114 |
| 2 | 1st ovulation | 40.1 | 20.2 | 35 | 50 | 55 |
| n=31 | first ai | 74.2 | 21.8 | 68 | 87 | 106 |

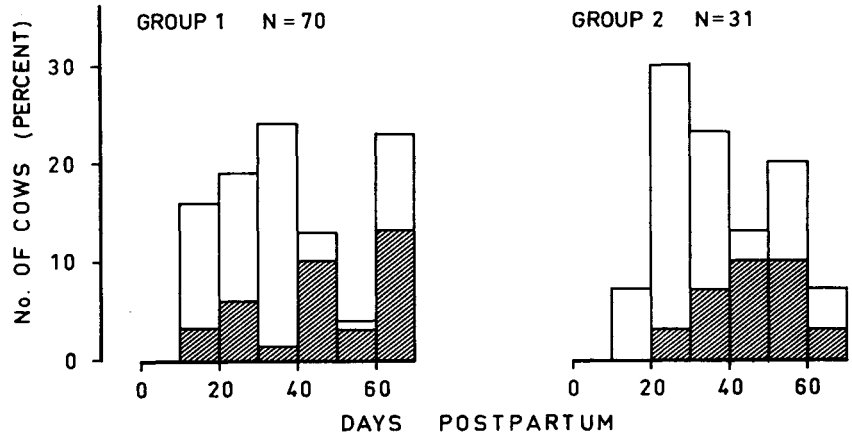


Figure 1. Time of first ovulation after calving. Hatched parts indicate cows that got ketosis. The last columns in both groups represents animals ovulating 60 days pp or later.

75 days pp and 55 days pp in group 2. Fig. 1 shows the distribution of first pp ovulations.

The first pp ovarian cycle was short (9—17 days) in 63 % of the cows in group 1 ($\bar{x} = 13$ days) and in 53 % of the cows in group 2 ($\bar{x} = 12$ days). The means of the highest progesterone values measured during the first cycle were 8 nmol/l (SD = 3.6) for cows in group 1 and 7 nmol/l (SD = 3.2) for cows in group 2. The second pp cycle was measured in 30 cows in groups 1 and 2. The lenght of the cycle was 18—24 days ($\bar{x} = 21$ days) and the mean of the highest progesterone value was 15 nmol/l (SD = 5.6).

The cows were inseminated (first ai) 35—145 days pp. The mean number of days from calving to first ai for groups 1 and 2 were 78.5 and 74.2, respectively (Table 2). First ai conception rate was 49 % in both groups, as confirmed by rectal palpation.

One hundred milk samples taken at the time of ai from both groups of cows were assayed for progesterone. In 20 of these samples milk progesterone was higher than 3 nmol/l. No conception followed these 20 inseminations.

One cow developed pyometra as diagnosed by rectal palpation. The cow had elevated levels of progesterone from day 10 postpartum until she was treated with prostaglandin $F_{2\alpha}$ (Dinolytic®) 160 days after calving. Then she started a normal oestrous cycle, was inseminated and conceived.

Clinical ketosis was diagnosed in 35 % of all animals. The

mean number of days from parturition to first ovulation in animals with clinical ketosis was 49.2 (SD = 17.5). The corresponding figure for animals without ketosis was 34.2 (SD =18.9).

The mean values and standard deviations found for the blood parameters are reported in Table 3. Glucose values below 3 mmol/l were found in 32 cows in groups 1 and 2. Clinical ketosis was diagnosed in 31 of these cows. Urea values below 2.0 mmol/l were found in 17 cows.

Table 3. The mean ($\bar{x}$) and standard deviation (SD) values of the blood parameters.

| Group | | 2—5 weeks pp (mmol/l) | | | | | 7—10 weeks pp (mmol/l) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Glu | Urea | Pi | Ca | Mg | Glu | Urea | Pi | Ca | Mg |
| 1 | $\bar{x}$ | 3.0 | 2.1 | 1.9 | 2.5 | 0.85 | 3.8 | 2.8 | 1.9 | 2.4 | 0.90 |
| | SD | 0.4 | 0.6 | 0.5 | 0.2 | 0.12 | 0.6 | 0.6 | 0.4 | 0.2 | 0.13 |
| 2 | $\bar{x}$ | 2.9 | 2.0 | 1.8 | 2.2 | 0.81 | 3.5 | 2.8 | 1.8 | 2.4 | 0.84 |
| | SD | 0.4 | 0.5 | 0.4 | 0.2 | 0.10 | 0.4 | 0.6 | 0.5 | 0.2 | 0.12 |

## DISCUSSION

The sampling method for sequential milk samples may have caused a selection for cows with no signs of heat, during first ovulation.

The mean number of days from calving until the first pp ovulation was the same for both groups of animals. Higher percentage of cows ovulated late in group 1. The average interval from calving to first ovulation was longer than reported in studies from many other countries (*Morrow et al.* 1969, *King et al.* 1976, *Bulman & Lamming* 1978). *Larsson et al.* (1984) reported that the mean number of days from calving until the first ovulation in 290 Swedish dairy cows was 26.5 and that 50 and 90 % of the cows had ovulated within 19 and 50 days, respectively. A comparable study is being done on pp in Iceland. *Elsaesser et al.* (1979) reported that 62 % of dairy cows, in a herd with no problems of infertility, had ovulated within 36 days of calving, compared with 16 % in a herd with known problems of fertility. *Ball et al.* (1980) found that 85 % of 2000 cows in 15 dairy herds had ovulated within 35 days pp. One of the causes for the late first pp ovulation in this material could be the high frequency of ketosis, especially in the cows that ovulated later than 40 days pp (*Refsdal* 1977, *Möller* 1979, *Andersson & Emanuelsson* 1984). Another cause for late ovula-

tion could be housing arrangements (*Roine & Saloniemi* 1978). *King et al.* (1976) reported that oestrus was first noticed 34.5 days after parturition in cows which were housed in free stalls area as compared to 56.6 days in cows housed in tie stalls. *Claus et al.* (1983) found that acyclia was longer in cows housed in stanchion barns (29 days) compared to loose housing (17 days).

The housing arrangements can also affect oestrus detection by the farmers. Tie stalls and iron-grille gutter through which cervical mucus at oestrus gets lost, can increase the difficulties of oestrus detection.

The short duration and low progesterone secretion during the first luteal phase was in agreement with the findings of various authors (*Morrow et al.* 1969, *Mather et al.* 1978, *Kindahl et al.* 1982, *Williams et al.* 1983). *Edqvist et al.* (1984) stated that the short cycle should be considered as a normal physiological phenomenon because of its high incidence. *Kindahl et al.* (1984) concluded that endogenous $PGF_{2\alpha}$ released shortly after ovulation caused short or irregular luteal phases. The short-duration low-level first luteal phase is probably helping the cow to resume normal luteal activity after calving.

The conception rate to first service was the same in group 1 and group 2, and the interval from calving to first ai was similar. These cows were inseminated later and had a lower conception rate than reported by others, e.g. *Bulman & Lamming* (1978) and *Larsson et al.* (1984).

Luteal phase inseminations in this study were 20 out of 100 inseminations. *Oltner & Edqvist* (1981) reported that the frequency of luteal phase inseminations in 2083 Swedish dairy cows was 4 % in normal cows and 18.4 % in individual problem cows. *Andresen & Onstad* (1979) and *Claus et al.* (1983) reported frequencies of luteal phase inseminations in normal dairy cows 4.4 and 4.1 %, respectively. The frequency of luteal phase inseminations in this study is closer to the findings of *Hoffmann et al.* (1976) who reported a frequency of 14—26 % of luteal phase inseminations.

No ovarian cysts were found in the 101 cows in this study. This indicates that the frequency of ovarian cysts is low. *Refsdal* (1982) reported that the frequency of ovarian cysts in 62 Norwegian (NRF) dairy cows was 27.4 %. He found significantly higher plasma values of acetoacetate in cystic cows than in normal cows.

The total mean values of the blood parameters were within reported normal values (*Jönsson et al.* 1980, *Oltner & Berglund* 1983, *Oltner & Wiktorsson* 1983). Low glucose values were found in 31 cows with clinical ketosis. This correlation is in agreement with the findings of *Möller* (1979).

The method for sampling the sequential milk samples for the progesterone profiles most probably selected for cows with weak oestrous signs during first ovulation. It is also a possibility that these cows were reproductively inferior to the cows that showed strong oestrous signs.

In comparison with other studies, the 101 cows in this study had a long interval from calving to first pp ovulation, especially the cows with clinical ketosis. The cows had a rather low conception rate to first ai, possibly caused by a high incidence of luteal phase inseminations.

A rather poor nutritional status of the cows, as suggested by the high frequency of ketosis, low glucose values in the hyperketonaemic cows and low urea values in 17 % of the cows, could have led to the reproductive status described above.

## ACKNOWLEDGEMENTS

This work was supported by the International Atomic Energy Agency and the Icelandic Science Fund.

We are indepted to Drs. Hans Kindahl, Stig Einarsson and Lars-Eric Edqvist at the Departments of Obstetrics & Gynaecology and Clinical Chemistry, Swedish University of Agricultural Sciences, for fruitful discussions.

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## SAMMANFATTNING

*En undersökning över postpartumperiodens reproduktionsstatus hos mjölkkor med fertilitetsproblem på södra Island.*

Avsikten med undersökningen var att studera orsaken till låg dräktighetsfrekvens och långa kalvningsintervall hos mjölkkor på södra Island.

Totalt ingick 229 kor från 6 gårdar i undersökningen. Korna undersöktes regelbundet, en gång i månaden, kliniskt genom rektalpalpation.

Blodprov samlades i intervallen 2—5 och 7—10 veckor efter kalvning. Blodproverna analyserades för glukos, urea, fosfat, kalcium och magnesium.

Mjölkprover för analys av progesteron togs var 4:e dag från dag 10 till första brunst. Denna provtagningsmetod orsakade att endast progesteronprofiler från 101 kor kunde räknas. Övriga 128 kor hade inte förhöjda progesteronvärden när provtagningen avbröts.

Resultaten från 101 kor visar på en avsevärd variation mellan djur beträffande könsfunktionerna efter kalvning. I hela materialet inträffade den första ovulationen efter kalvning senare än vad som rapporteras från många andra länder. Femtio kor hade ovulerat inom 35 dagar efter kalvning och 90 kor hade ovulerat 70 dagar efter kalvning. Den första lutealfasen postpartum var kort och progesteronnivåerna i mjölken var låga i 60 % av korna.

Första ai var mellan 35—145 dagar efter kalvning. Konceptionsfrekvensen var 49 %. Etthundra mjölkprov tagna samtidigt med insemination analyserades med avseende på progesteron. Tjugo av dessa prover hade höga progesteronvärden och ingen av dessa inseminationer resulterade i dräktighet.

Trettiofem kor diagnosticerades med klinisk ketos. Trettioen av dessa kor hade låga glukosvärden i blodet. Merparten av ketoskorna ovulerade senare än kor som inte hade klinisk ketos.

Dessa resultat tyder på att kornas fertilitetsproblem kan bero på deras almänna skötsel och utfodring.

*(Received March 27, 1985).*

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