Factors influencing the prevalence of *postpartum* anoestrus in New Zealand dairy cows

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ABSTRACT

The aim of this study was to determine the association between age, interval from calving (PPI) and breeding worth (BW) and prevalence of *postpartum* anoestrus (AA), as well their effect on response to hormonal treatment by anoestrous dairy cows.

Individual cow details were collated from 6649 cycling and 2446 AA animals in 29 herds. Probability of AA was influenced by herd and was negatively related to PPI and age ($p < 0.001$); but was not related to BW ($p > 0.05$). Response of AA cows to treatment with progesterone and oestradiol benzoate was evaluated using a subset of 1482 anoestrous cows. Within 7 days of treatment, oestrus was detected in 87.1% cows and conception rate to insemination during this period was 42.2%. Oestrous response varied between herds but was not influenced by BW, PPI or age ($p > 0.1$). Conception rate was positively related to PPI ($p < 0.001$), but was not influenced by BW or age ($p > 0.1$). It is concluded that in commercial dairy herds the likelihood of a cow being AA is greatest in young and recently calved animals, but is not influenced by breeding worth.

Keywords: Dairy cows; anoestrus; treatment; breeding worth.

INTRODUCTION

Postpartum anoestrus is the most common form of infertility in New Zealand dairy cows. A survey of eight herds in the Central Waikato found that 20% of cows which were more than 45 days calved had not been seen in oestrus by one week before the planned start of mating. This figure varied from 9% to 30% among herds (McDougall *et al.*, 1993). In addition to herd effects, previous studies have demonstrated that the interval from calving to first oestrus or ovulation is longer in Friesian cows than Jersey cows and in 2 year old cows compared with older animals (Burke *et al.*, 1995; McDougall *et al.*, 1995).

It has been suggested that selection of cows for increased production may compromise reproductive performance by increasing prevalence of *postpartum* anoestrus or by reducing conception rates (Wheadon 1993). For proven Holstein-Friesian bulls born between 1982 and 1992 breeding worth (BW) has increased from $0 to $50; similarly the BW of Holstein-Friesian cows born between 1984 and 1996 has increased from $0 to $45 (Dairy Statistics 1996-1997). Breeding worth is an index allowing the comparison of animals for breeding herd replacements in terms of net farm profitability (Harris *et al.*, 1996). A number of studies have examined the relationship between genetic lines selected for milk yield and fertility (see review by Macmillan *et al.*, 1996), however very few have been conducted in pasture based, seasonally calving, dairying systems.

The aim of the current study was to examine the association between age, interval from calving and BW, and prevalence of *postpartum* anoestrus within commercial New Zealand dairy herds. The effect of these factors on response to hormonal treatment of anoestrous cows was also examined.

MATERIALS AND METHODS

Details of BW, calving date and age were collated for 9861 cows in 29 seasonally calving herds in the Waikato region. Information was obtained from Livestock Improvement Animal Registers for individual farms. Cows which had not been detected in oestrus by between 7 and 17 days before the date of the herd's planned start of mating (PSM) were examined by a veterinarian. Those animals with no detectable corpus luteum were diagnosed anovulatory anoestrus (AA); animals with a detectable corpus luteum were included with cows which had been detected in oestrus and were assumed to have ovulated without expression of oestrus. Any cow which had calved less than 21 days at the time of examination was excluded from the data set. Data from 6649 cycling and 2446 AA animals were used in the analysis. Logistic regression models included the variables herd, age and interval from calving to examination (PPI) to predict the probability of AA. Since BW and age are confounded, separate analyses were conducted including BW for animals 2 years old, 3 years old and more than 3 years old. Models included herd, BW, PPI and the herd by BW interaction. Differences in variables between AA and cycling cows were examined using analysis of variance.

Response of AA cows to hormonal treatment was evaluated using data from a subset of 1482 cows which were all treated 7 days before PSM with intravaginal progesterone (CIDR™ device; InterAg, Hamilton) for 6 days, then injected with 1 mg oestradiol benzoate (ODB; CIDIROL™; InterAg, Hamilton) 24 h after device re-

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moval. Response was evaluated in terms of proportion of cows observed in oestrus during the 7 days following injection with ODB and conception rates to first insemination within this 7 day period. Data were analysed as described above using logistic regression analysis.

RESULTS

Mean (±sem) herd size was 313 ± 21 cows, ranging from 152 to 648 cows. An average of 27.8 ± 2.4% of cows were diagnosed AA, varying between 9.0% and 52.0%.

Probability of anoestrus was significantly influenced by herd and was negatively related to PPI and age ($p<0.001$, Figures 1 and 2). Average PPI was 62.0 ± 0.2 and 53.1 ± 0.3 days, age 4.9 ± 0.03 and 4.4 ± 0.05 years ($p< 0.001$), for cycling and AA cows, respectively. Mean BW was \$30.1 ± 0.2 and did not differ between AA and cycling cows ($p > 0.1$). Within age class, mean BW was \$38.9 ± 0.4; \$33.0 ± 0.4 and \$26.0 ± 0.3 for cows aged 2 years old, 3 years old and more than 3 years old, respectively ($p<0.001$).

FIGURE 1: Relationship between *postpartum* interval and the probability of anoestrus for 4 year old cows in three different herds, indicated by different symbols.

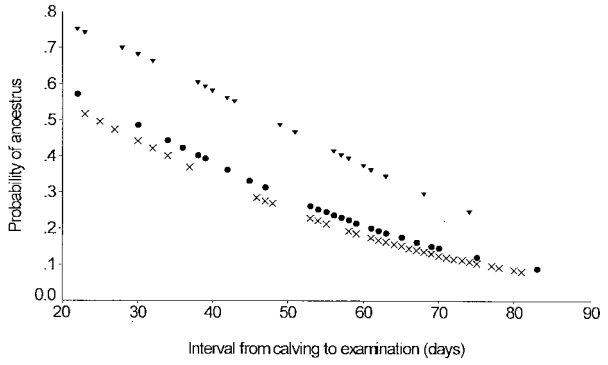
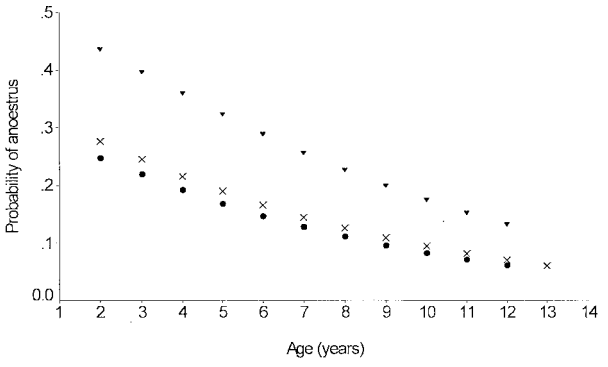


FIGURE 2: Relationship between age and the probability of anoestrus for cows calved between 55 and 75 days in three different herds, indicated by different symbols.

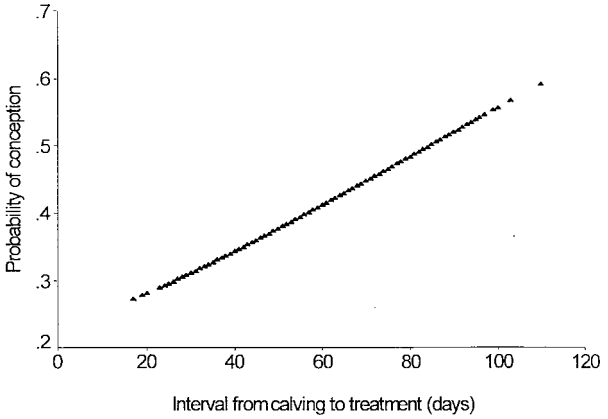


Within age class there was no significant relationship between BW and the probability of anoestrus ($p>0.05$), although there was a tendency within 3 year old cows for BW to be negatively related to the likelihood of anoestrus ($p = 0.09$).

Within the 1482 AA cows treated using progesterone and ODB, oestrus was detected in 1292 (87.1%) cows by 7 days after injection with ODB. This response was not influenced by age or PPI, or by BW within age class ($p>0.1$). There were significant differences between herds ($p = 0.02$), with the percentage of cows detected in oestrus varying from 69.0% to 100.0%.

Conception rate to first insemination during this 7 day period was 42.2%. There was no significant effect of herd or age, or BW within age class on conception rates ($p>0.1$). However, the interval between calving and treatment was positively associated with conception rate to first insemination ($p < 0.001$; Figure 3).

FIGURE 3: Relationship between *postpartum* interval and the probability of conception to first insemination for anoestrus cows treated with progesterone and ODB.



DISCUSSION

The significant relationship demonstrated in this study between age and likelihood of anoestrus agrees with previous findings of a longer interval to first oestrus in 2 year old cows compared with older animals (Macmillan and Clayton 1980; Fonseca *et al.*, 1983; McDougall *et al.*, 1995). These younger animals have additional energy requirements for growth as well as production. They are also likely to be dominated by older cows, resulting in lower pasture intakes and increased negative energy balance.

There was also a significant relationship between PPI and proportion of anoestrous cows, in spite of all cows included in the analysis having calved more than 21 days. Mean interval from calving to examination was 53 days in AA cows compared with 62 days in cycling cows. These results reflect the extended period of time required by pasture fed dairy cows to resume oestrous cycles, especially when intakes are limited by high stocking rates. The mean interval from calving to first oestrus in Friesian cows stocked at 3.0 and 4.0 cows/ha was 35 and 52 days, respectively, in the study by McDougall *et al.*, 1995.

Interval from calving to treatment also influenced conception rates to first insemination, but not oestrous response, of anoestrous cows treated with progesterone and ODB. These results suggest that although the hormo-

nal treatment is very effective at inducing oestrus and ovulation in anoestrous cows, the physiological status of these animals will influence their fertility. During the *postpartum* period, sequential changes in the hypothalamo-pituitary axis precede the first ovulation and oestrus (Lamming *et al.*, 1981). Insufficient gonadotrophic support during the early *postpartum* period could be associated with ovulation of immature ovarian follicles and inadequate luteal function, thus compromising establishment of pregnancy.

No negative effects of increased BW on the probability of anoestrus or on response of anoestrous cows to treatment were demonstrated in the current study. These results were based on data from 29 farms and values for BW varying between $58.1 and $92.8. Previous studies have differed in their conclusions on the effect of genetic selection for milk yield on reproductive performance. Hageman *et al.*, (1991) compared two lines of American Holsteins differing in 305 day milk yield by 800 kg and found that the interval to first oestrus only tended to be longer by 3.5 days in the high producing line during the first, but not second lactation. In another study comparing selected and control lines of Scottish Holstein-Friesians there were no differences in days to first oestrus or other reproductive parameters, although milk yield during the first 26 weeks of lactation differed by 700 kg (McGowan *et al.*, 1996). Grosshans *et al.*, (1997) examined the records from more than 66 000 New Zealand cows and reported a moderate antagonistic genetic correlation between milk yield and the proportion of cows pregnant by 21 days after PSM. However, phenotypic correlation between fertility and reproductive traits were close to zero, indicating that management practices may overcome production effects on fertility. Certainly, the use of hormonal treatments for anoestrous cows will mask any effects of increased production on the interval to first oestrus.

In conclusion, examination of records from over 9000 cows in 29 Waikato herds showed that the likelihood of anoestrus is greatest in young and late calving cows. In the current study, there was no relationship between breeding worth and prevalence of anoestrus.

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