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Efficacy of an anoestrous treatment for dairy cows is reduced if administered within three weeks of calving

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ABSTRACT

The effect of treating dairy cows with anovulatory anoestrus ($n=660$) at various intervals post-partum was investigated. Treatment consisted of priming with progesterone using an intravaginal device (CIDR-B) for 6 days, with an injection of oestradiol benzoate 24h after device removal.

The mean interval from treatment termination to conception tended to be greater for cows calved less than 3 weeks at diagnosis than contemporaries calved at least 3 weeks (32.8 ± 6.3 vs 23.7 ± 1.1 days; $p<0.1$). Final empty rate was higher for cows diagnosed and treated within 3 weeks post-partum (39% vs 13%; $p<0.001$). Survival analysis accounted for the higher empty rate to determine the probability of pregnancy over time. Cows calved less than 3 weeks at treatment had a lower probability of pregnancy than contemporaries calved at least 3 weeks ($p<0.01$).

This study found a negative effect of treating anoestrous cows within 3 weeks post-partum. Further work should define the nature of this problem and the value of delaying treatment until at least 3 weeks after calving.

Keywords: anoestrus; progesterone; oestradiol; post-partum; dairy cattle.

INTRODUCTION

Post-partum anovulatory anoestrus is a major form of temporary infertility among dairy cows in New Zealand. The most effective treatment to date consists of an initial period of progesterone priming using an intravaginal device (Eazibreed CIDR-B™, InterAg, Hamilton, New Zealand) with an injection of 1mg oestradiol benzoate (ODB) at 24 to 48h after device removal (McDougall and Macmillan, 1993; Macmillan *et al.*, 1995). It is now recommended that cows experiencing anovular anoestrus be diagnosed and treated during the week before the date for commencement of a herd's seasonal breeding programme (planned start of breeding; PSB; Macmillan, 1995).

The key events post-partum that lead to the resumption of normal oestrous cycles are uterine involution and the re-establishment of normal neuroendocrine signals in the hypothalamic-pituitary-ovarian axis (Peters and Laming, 1990). If these events are not substantially completed prior to anoestrous treatment then efficacy may be compromised. This study investigated the effect of time post-partum on the oestrus response and subsequent pregnancy rates after treatment of anoestrus.

MATERIALS AND METHODS

Each cow from 10 dairy herds in the Waikato district which had no record of recent oestrus was presented for veterinary examination in October 1995 if it had calved at least 14 days before the examination date. This date occurred during the week preceding a herd's PSB. The ovaries of each cow were palpated rectally at examination, and those with no palpable luteal structures on either ovary

were diagnosed as anovular anoestrus. If uterine involution was proceeding normally, and no pathology was palpated, then the anovular anoestrous cow was treated. Of the 1130 predominantly Friesian cows examined, 660 cows were treated, with 10 to 128 cows contributed from each herd. The effect of time post-partum was analysed as the interval from calving to diagnosis and treatment.

The treatment of anoestrus was initiated by inserting an intravaginal device containing 1.9g progesterone (Eazibreed CIDR-B™) for 6 days. A gelatin capsule containing 10mg ODB and 1g lactose (CIDIROL™ capsule, Douglas Pharmaceuticals, Auckland, New Zealand) was placed in the grooved surface of half of the devices. At 24h to 30h after device removal, each animal was injected with either 1mg or 0.75mg of ODB (CIDIROL™ solution, Douglas Pharmaceuticals, Auckland, New Zealand). These variations in ODB treatment were arranged in a 2 by 2 factorial design with cows being randomly assigned to each treatment group within each herd.

Cows were tailpainted to aid in the detection of oestrus (Macmillan and Curnow, 1977). Detected cows were presented for insemination on a daily basis. Those not detected in oestrus during the 14 days following ODB injection were submitted for a second veterinary examination to be diagnosed either as cyclic, determined by the presence of a luteal structure on either ovary, or as anoestrus. In the former case, they were injected with a luteolytic dose of prostaglandin $F_{2\alpha}$ (Lutalyse, Upjohn Ltd, Auckland, NZ). In the latter case, they received the treatment described previously (with an ODB capsule and a 1mg ODB injection).

Pregnancy diagnosis by rectal palpation was performed in January and March, 1996. Where insemination dates

suggested conception occurred in the 6 weeks following PSB, pregnancy diagnosis occurred in January. Herdmates not confirmed pregnant at that date were pregnancy tested at least 2 months later and at least 7 weeks after a herd's mating programme had finished. Pregnancy diagnosis was used to confirm the conception date from mating records. The conception interval was calculated as the interval from ODB injection to the date of conception. Cows were categorised as "empty" if they had not conceived during the 110 days following PSB. All cows remained in the herd for at least 30 days of mating, with cows culled after this time included in the final empty rate analysis and as censored data for survival analysis.

Treatment effects involving ODB were tested statistically using ANOVA and are presented by Taufa *et al.*, 1997. No significant differences were found by varying the ODB, either in capsule form or in dose rate after device removal. These data were pooled among treatment groups for analysis by weeks post-partum. Data were square-root transformed and analysed using the general linear model ANOVA to compare mean conception intervals. Categorical data were analysed using χ^2 analysis. Survival analysis was conducted using the LIFETEST procedure of SAS (SAS Institute, USA).

RESULTS

Of the 660 cows enrolled, 585 cows (88%) were inseminated after treatment to a detected oestrus, 37 cows (6%) were injected with prostaglandin $F_{2\alpha}$ because they had ovulated without being detected in oestrus, and 38 cows (6%) required a second anoestrous treatment. This distribution was not affected by time post-partum at treatment initiation.

A comparison of cows treated 2 to 3 weeks post-partum (2-3wk pp) with cows treated 3 to 4 weeks post-partum (3-4wk pp), and cows treated at least 4 weeks post-partum (\bullet 4wk pp) is shown in Tables 1 and 2. The mean conception interval tended to be longer among cows treated 2-3wk pp than those treated 3-4wk pp, or those treated \bullet 4wk pp (32.8 vs 21.4 vs 23.6 days, respectively; $p < 0.1$; Table 1). Final empty rates, including both cull cows and cows which did not conceive, were higher in cows treated 2-3wk pp than cows treated 3-4wk pp or \bullet 4wk pp (39% vs 18% and 13%, respectively, $p < 0.01$; Table 2).

Survival analysis of conception intervals showed that cows treated 3-4wk pp had a similar probability of pregnancy as cows treated \bullet 4wk pp ($p > 0.1$; Figure 1). Cows treated 2-3wk pp had a lower probability of pregnancy than cows treated 3-4wk pp or \bullet 4wk pp ($p < 0.01$).

DISCUSSION

The development of a treatment for anoestrus using progesterone and ODB was originally trialled in cows calved at least 40 days (Macmillan and Peterson, 1993). Farmers are now using this treatment with cows calved less than 40 days to treat this condition prior to the start of mating. A large field trial recently evaluated the routine

TABLE 1: Reproductive parameters for various intervals post-partum at treatment.

	n	SR	CR	Pregnant	CI (\pm sem)
Calved 2 to 3wks	38	66% ^a	24% ^a	23	32.8 \pm 6.3
Calved 3 to 4wks	55	80% ^b	38% ^{ab}	45	21.4 \pm 3.2
Calved \bullet 4wks	567	78% ^b	44% ^b	493	23.6 \pm 1.2
Total	660	78% ^b	43% ^b	561	23.9 \pm 1.1

Different superscripts within each column refer to a significant difference ($p < 0.05$)

SR (Submission Rate) = no. of cows mated 3 days after treatment / no. of cows treated.

CR (Conception Rate) = no. of cows conceived 3 days after treatment / no. of cows mated 3 days after treatment

Pregnant = no. of cows pregnant after 110 days of mating

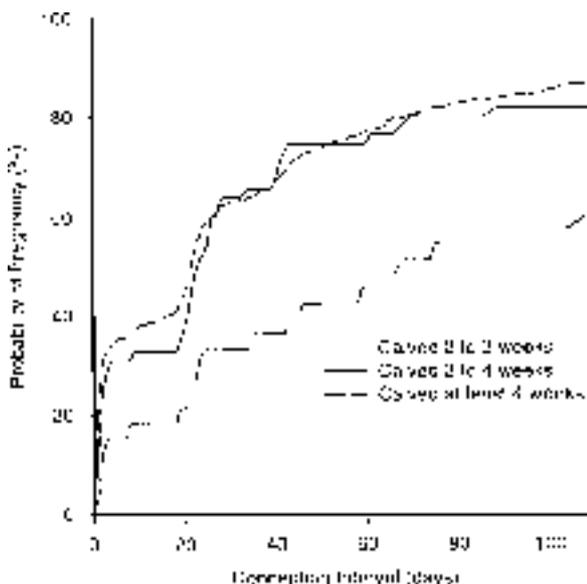
CI (Conception Interval) = mean interval from end of treatment to conception

TABLE 2: A comparative analysis of response to anoestrous treatment by interval post-partum at diagnosis and treatment initiation. Conception interval (CI) was the interval from ODB injection to conception. Final Empty Rate consisted of cows culled prior to the end of mating (Culled) and cows which did not conceive (DNC).

	n	Pregnant	Culled	DNC	Final Empty Rate
Calved 2 to 3wks ^a	38	61%	13%	26%	39%
Calved 3 to 4wks ^b	55	82%	5%	13%	18%
Calved \bullet 4wks ^b	567	87%	2%	11%	13%
Total ^b	660	85%	2%	13%	15%

Different superscripts refer to a significant difference for each parameter ($p < 0.05$)

FIGURE 1: Cumulative probability of pregnancy following anoestrous treatment comparing initiation of treatment at varied intervals post-partum.



treatment of anoestrus within 2 to 3 weeks post-partum during the early part of the pre-mating period (Nation and Macmillan, 1996). That study showed no improvement in

reproductive performance from the early treatment of anoestrus. This current trial extends these results by showing that treatment initiated within 2 to 3 weeks post-partum reduced reproductive performance, although those treated represented only 38 of the 1130 cows originally examined.

All trial cows which responded to treatment should have had at least two opportunities to conceive (ie 2 rounds of insemination) as they were not culled for at least 30 days after treatment. Cows treated less than 3 weeks post-partum required 25 days of mating to match the probability of pregnancy of their herdmates after 3 days of mating (Figure 1). It required 2 rounds of inseminating to match the first round results of their earlier calving herdmates that also required treatment for anoestrus. Farmers were apparently more likely to cull cows treated less than 3 weeks postpartum during the mating period than their herdmates, given this delay in conception (Table 2).

Survival analysis compares the cumulative probability of pregnancy. It is a useful tool as it accounts for cows which were culled during the mating period by including them in the analysis up to the time of culling. Cows calved less than 3 weeks prior to treatment had a lower probability than cows calved at least 3 weeks (Figure 1). In contrast, cows calved 3 to 4 weeks at treatment had a similar probability of pregnancy to cows calved at least 4 weeks. This time of 3 weeks corresponds with the period when uterine involution should be completed (Moller, 1970). The treatment of anoestrous cows prior to 3 weeks post-partum may be interfering with the process of involution, thus compromising the potential to initiate another pregnancy before the uterus has regained a receptive, non-gravid state. The reduction in conception rate (Table 1) may also reflect this situation.

A poor conception rate in cows treated when less than 3 weeks post-partum, is not the sole cause of an extended conception interval (Table 1). These cows also had a lower submission rate, which represents a poor oestrous response following treatment. This response may represent an inability for cows to respond to treatment for anoestrus until uterine involution is completed and normal hormonal feedback mechanisms are restored.

Cows that had calved at least 3 weeks prior to anoestrous treatment had a good reproductive performance. Their mean conception intervals of 21.4 and 23.6 days (Table 1) compare favourably with the average of 21.2 days recorded in a large New Zealand study involving cows which had resumed oestrous cycles spontaneously before their herd's PSB (Xu *et al.*, 1996).

This study has demonstrated the need to more precisely define responses to treatment of anoestrous cows relative to time post-partum. By delaying anoestrous treatment of cows calved 2 to 3 weeks for at least a week, subsequent breeding performance could be similar to that observed in herdmates which have spontaneously resumed oestrous cycles.

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