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Use of once daily milking or treatment with progesterone and oestradiol benzoate in anoestrous cows

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ABSTRACT

The aim of this study was to compare the rate of resumption of oestrous cycles and fertility to first insemination of anoestrous cows examined 7 days before the planned start of mating (PSM), which were milked once (OAD) or twice daily (TAD) for at least 28 days and untreated or treated with progesterone and oestradiol benzoate (ODB; CIDR).

By 28 days after the start of treatment, oestrus was detected in 65.8%, 76.6%, 93.5% and 97.9% of cows (TAD, OAD, TAD+CIDR and OAD+CIDR, respectively) ($p < 0.001$). Conception rates to first insemination were lower in CIDR treated than untreated cows (40.4% vs 50.3%; $p < 0.05$), but were not affected by milking frequency. The mean (\pm sem) interval from PSM to conception was shorter in CIDR treated than untreated cows (12.8 ± 1.2 vs 19.0 ± 1.3 days; $p < 0.001$). Daily milk yield decreased by 6.1 ± 0.2 and 2.2 ± 0.2 litres; and milk solids by 0.46 ± 0.02 and 0.19 ± 0.02 kg ($p < 0.001$) in cows milked OAD and TAD, respectively, over the treatment period. Once daily milking increased the rate of spontaneous resumption of oestrous cycles in anoestrous cows compared with TAD, but was associated with a significant decrease in milk production. Compared to treatment with progesterone and ODB, OAD resulted in a longer interval from PSM to conception.

Keywords: Dairy cows; anoestrus; once daily milking; fertility; production.

INTRODUCTION

Postpartum anoestrus is the most common form of infertility in New Zealand dairy cows. In a case controlled study, anoestrous cows had a lower condition score, higher concentrations of urea and lower concentrations of glucose in blood compared with contemporaries which had resumed oestrous cycles (McDougall *et al.*, 1993). These findings suggested that anoestrous cows are in greater negative energy balance, either as a result of lower feed intake and/or greater milk production during early lactation.

The currently recommended treatment regime for anoestrous cows involves a 5 or 6 day period of intravaginal progesterone treatment, followed by an injection of 1 mg oestradiol benzoate (ODB) 24 to 48 h later. This protocol results in 94% of treated animals being detected in oestrus and inseminated within 4 days of the end of treatment (Macmillan *et al.*, 1995). As an alternative to this hormonal treatment, a variety of management strategies may be used in an effort to induce oestrus and ovulation. These include reducing milking frequency from twice to once a day to reduce losses in cow condition and induce spontaneous resumption of oestrous cycles.

Once daily milking during early or mid-lactation results in a decrease in milk yields of between 10 and 27% and in milk fat of between 13 and 29% (Carruthers and Copeman 1990; Carruthers *et al.*, 1993). Significant increases in liveweight were reported following a 12 week period of once daily milking, commencing in September (Carruthers and Copeman 1990). Moreover, plasma glu-

cose concentrations were significantly higher during September and October in cows milked once daily for a complete lactation, compared with cows milked twice daily (Holmes *et al.*, 1992), indicating that once daily milking may result in an improved energy balance during early lactation.

These reports suggest that once daily milking could potentially improve reproductive performance, however its efficacy has never been tested. The aim of the current study was to examine the effect of once daily milking, with or without concurrent hormonal treatment, on submission rates and conception rates to first insemination of anoestrous cows.

MATERIALS AND METHODS

The study was conducted in 10 seasonally calving herds in the Waikato region. Cows which had not been detected in oestrus, but which had calved at least 21 days previously, were examined by a veterinarian 7 days before the date of the herd's planned start of mating (PSM). Those animals with no detectable corpus luteum ($n = 420$) were diagnosed anovulatory anoestrus (AA) and were allocated within herd to four groups, balanced for age and postpartum interval, in a 2x2 factorial design. Half the cows were treated with intravaginal progesterone (CIDRTM device; InterAg, Hamilton) for 6 days then injected with 1 mg ODB (CIDROLTM; InterAg, Hamilton) 24 h after device removal and half remained untreated. Within these two groups half were milked once daily for at least 28 days (range 28 to 32 days), commencing on the day of veterinary

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examination and half were milked twice daily. All cows were managed within the main herd.

The volume and composition of milk produced by individual cows was measured 27 days before allocation to groups and at the end of the period of once daily milking. Oestrous behaviour was recorded from the day of veterinary examination until the end of the mating period. Commencing at the PSM, all cows which were detected in oestrus were artificially inseminated. Any cow not detected in oestrus by 21 days after the PSM was re-examined by rectal palpation and cows which were still AA were treated with a CIDR device and ODB, as before. Cows with a palpable corpus luteum were treated with prostaglandin F_{2α}. Natural mating using herd bulls commenced between 4 and 5 weeks after the PSM. Conception dates were confirmed by manual palpation *per rectum* or transrectal ultrasonography 6 weeks after the end of the period of artificial insemination.

Differences between treatment groups in dichotomous variables were assessed using logistic regression analysis and analysis of variance was used for continuous variables. Models included the main effects of herd, hormone treatment and milking frequency; interactions were included if significant ($p < 0.05$).

RESULTS

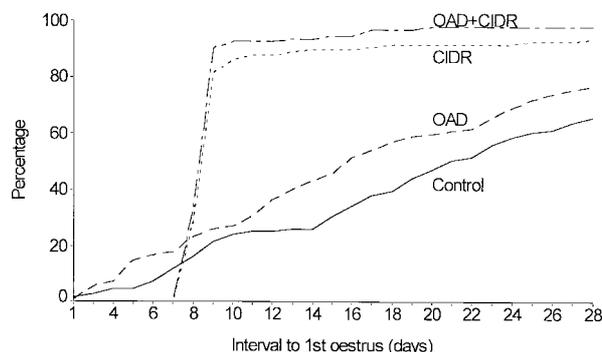
The percentage of cows detected in oestrus by 28 days after examination was influenced by both hormone treatment ($p < 0.001$) and milking frequency ($p = 0.05$; Table 1, Figure 1). Mean (\pm sem) interval from PSM to first insemination was reduced in hormone treated compared with untreated cows (-9.5 ± 0.6 days; $p < 0.001$), but was not influenced by milking frequency ($p = 0.21$; Table 1).

Conception rates to first insemination were significantly influenced by hormone treatment ($p = 0.03$), but not by frequency of milking ($p = 0.08$; Table 1). Treatment with progesterone and ODB significantly increased the percentage of cows pregnant by 7 and 28 days after PSM ($p < 0.05$), but not at 21 days after PSM ($p = 0.09$, Figure 2). The interval from PSM to conception, for those

TABLE 1: Effect of once daily milking (OAD) and/or hormone treatment (CIDR) on submission rates and fertility, compared with untreated cows (Control).

	Control	OAD	CIDR	OAD+CIDR
Cows enrolled (n)	111	107	108	94
First oestrus by 28 days after examination (%)	65.8	76.6	93.5	97.9
Conceived to 1st insemination (%)	53.5	47.4	46.5	33.7
Interval from PSM to 1st insemination (days, mean \pm sem)	12.7 \pm 0.7	11.4 \pm 0.6	2.7 \pm 0.7	2.4 \pm 0.6
Interval from PSM to pregnancy (days, mean \pm sem)	20.1 \pm 1.7	17.8 \pm 1.7	12.0 \pm 1.6	13.6 \pm 1.7

FIGURE 1: Effect of milking anoestrous cows once daily (OAD) and/or treating with progesterone and ODB (CIDR) 7 days before the PSM, compared with no treatment (Control), on interval from start of treatment to first oestrus.



cows diagnosed pregnant at the end of the period of artificial insemination, was reduced in hormone treated cows (-6.1 ± 1.6 days; $p < 0.001$), but was not influenced by milking frequency ($p > 0.1$; Table 1).

Daily milk yield and total milk solids declined over 33.2 ± 0.1 days between herd tests and this decline was influenced by milking frequency ($p < 0.001$), but not by hormone treatment ($p > 0.1$; Table 2). Once daily milking reduced milk yield by 3.9 ± 0.3 litres ($21.1 \pm 1.6\%$) and milk solids by 0.28 ± 0.02 kg ($19.3 \pm 1.6\%$), compared with twice daily milking.

There was no interaction between the effects of hormone treatment and milking frequency on any of the variables studied.

FIGURE 2: Effect of milking anoestrous cows once daily (OAD) and/or treating with progesterone and ODB (CIDR) 7 days before the PSM, compared with no treatment (Control), on the percentage of cows pregnant 7, 21 and 28 days after PSM.

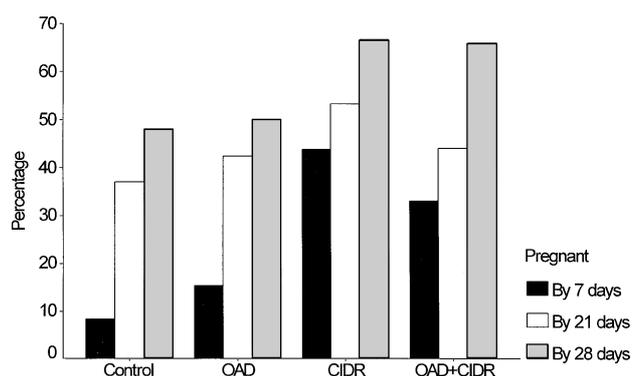


TABLE 2: Decrease in milk production of anoestrous cows milked once or twice daily for one month commencing 7 days before PSM (mean \pm sem)

		Twice daily milking	Once daily milking
Change in milk yield	(l/day)	2.2 \pm 0.2	6.1 \pm 0.2
	(%)	8.6 \pm 1.3	29.2 \pm 1.4
Change in milk solid yield	(kg/day)	0.19 \pm 0.02	0.46 \pm 0.02
	(%)	9.1 \pm 1.3	27.6 \pm 1.4

DISCUSSION

This study presents data from the first controlled field trial examining the effects of once daily milking over a 28 day period on resumption of oestrous cycles in anoestrous dairy cows. The results showed that decreasing milking frequency from twice to once daily increased the percentage of cows seen in oestrus over the 28 day period. The reproductive response was associated with a decrease in milk yield of 21%. These findings uphold the supposition that reduced milking frequency allows energy to be diverted from lactogenesis to the reproductive axis. Plasma concentrations of glucose are increased in cows milked once daily compared with twice daily during early lactation (Holmes *et al.*, 1992; Auldism and Prosser 1998). Increased availability of glucose, or another metabolic signal such as insulin, is thought to be involved in stimulation of the hypothalamic-pituitary axis required for resumption of oestrous cycles (Zurek *et al.*, 1995). Further intensive studies are required to establish the relationship between once daily milking, metabolic status and the reproductive axis.

Conception rates to first insemination tended to be lower in cows milked once daily compared to those milked twice daily ($p = 0.08$). Mating management did not differ between groups and this observation was consistent across most farms. The reason for this decrease in fertility is not apparent from the current study, especially since resumption of oestrous cycles was enhanced by once daily milking.

Treatment of anoestrous cows with progesterone and ODB resulted in more than 90% of cows being detected in oestrus and inseminated during the first 21 days of mating, as previously reported (Macmillan *et al.*, 1995). Indeed, 91% of treated cows were inseminated during the first week of mating. In contrast, only 77% of untreated cows milked once a day had been detected in oestrus by 28 days after first examination.

Conception rates to first insemination were significantly lower in cows treated with progesterone and ODB compared with untreated cows. However, when comparing treated cows milked twice daily with untreated cows milked once daily, conception rates were similar (46.5% vs 47.4%). These values agree with previous figures for AA cows treated with progesterone and ODB (45%, Macmillan *et al.*, 1995), but are lower than reported for cows mated at their first spontaneous oestrus postpartum (59%, Xu *et al.*, 1997). Herd and seasonal factors are likely to be responsible for differences between trials. Nevertheless, more than 60% of cows were pregnant by 28 days following hormone treatment compared with 50% of untreated cows, resulting in a greater percentage of cows being pregnant to artificial insemination and potentially able to provide heifers as herd replacements.

The 19% decrease in milk solids production in cows milked once daily compared with twice daily would result in a loss of income of approximately \$27 per cow over the

28 day period, with no significant change in the interval from PSM to conception and only an 11% increase in cows spontaneously resuming oestrous cycles. In contrast, hormone treated cows milked twice daily had an 8 day shorter interval to conception compared with untreated cows, resulting in more days in milk and a longer interval between calving and the planned start of mating during the subsequent lactation. They would therefore be less likely to be anoestrus at the start of the next mating period (see Rhodes *et al.*, 1998).

In conclusion, once daily milking from 7 days before to 21 days after the PSM, increased the percentage of anoestrous cows detected in oestrus compared with twice daily milking. However, daily milk yield was reduced by 21% during the treatment period. In addition, the interval from start of mating to conception was 6 days longer in cows milked once daily compared with cows treated with progesterone and ODB and milked twice daily.

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