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The effects of once daily milking as a management practice in late lactation

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ABSTRACT

244 cows managed as a single herd were divided into 4 balanced groups. Group A was milked once daily for the last 89 days of lactation, Group B 61 days and Group C 33 days. All cows including a control group milked twice daily, were dried off on the same date. After culling using commercial criteria the remaining 192 cows were milked twice daily in the subsequent lactation.

Within one week of imposing once daily milking, daily yield of milk, fat and protein fell by 14.6-11.4%, 10.6-8.5% and 8.8-4.0% respectively when compared to twice daily milked cows. Once daily milking increased protein concentration and somatic cell counts. The relative falls in production observed seven days after the imposition of treatment remained until drying off with consequential reductions in total yield over the period of treatment.

Once daily milking reduced the rate of liveweight loss in late lactation. Differences of up to 12.4 kg liveweight remained between groups prior to calving in the subsequent lactation, but no differences could be detected after calving. Improved reproductive or productive performance was not observed in the subsequent lactation.

Keywords Once daily milking, liveweight, milk production, milk quality.

INTRODUCTION

On New Zealand dairy farms, milking requires a large commitment of labour to an onerous job which impacts on the social lives of the milkers and their families. Milking once daily particularly in late lactation is a way to reduce this commitment and has been considered by many authors. (Parker, 1965; Wilson, 1965; Bryant, 1978; Woolford *et al.*, 1985). This, in comparison with twice daily milking, incurs losses of production ranging from 10-35% over the period of once daily milking. (Parker, 1965; Wilson, 1965; Bryant, 1978). In these studies however, little consideration was given to measuring possible carry over effects in cow productivity in the next lactation.

Cows milked once daily produce less milk and may be in better condition at the end of lactation than cows milked twice daily throughout lactation. Cow bodyweight and condition at calving affect the productive and reproductive performance of the cow (Grainger *et al.*, 1982; Macmillan *et al.*, 1980). Although no greater incidence of mastitis from extended intervals between milking was found by Autrey *et al.* (1963); Radcliffe *et al.* (1973); Woolford *et al.* (1985) and

Bailey *et al.* (1973) found changes in pH, chloride concentration and somatic cell count which could affect the processing characteristics of the milk.

The objectives of this study were to measure:

1. The effect of stage of lactation on the response, in terms of milk yield, milk quality and cow health, of cows to once daily milking.
2. The effects of once daily milking at the end of lactation on milk yield and reproductive performance of the cow in the subsequent lactation.

MATERIALS AND METHODS

Animals and Treatment

Two hundred and forty-four Friesian and Friesian X Jersey cows on No. 4 Dairy Farm, Massey University, were used over the last 12 weeks of one lactation and the first 13 weeks of the subsequent lactation. At the start (January 1989), 198 multiparous cows aged three to fifteen years and 46 two year old primiparous cows

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were divided into four equal groups, A, B, C, and D, balanced for age and current production.

The cows milked twice daily were milked at 0630 hours and 1600 hours and those milked once daily at 0630 hours. Group A was milked once daily from 26 January (week 1), Group B from 23 February (week 5) and Group C from 23 March (week 9). The fourth group Group D (control) was milked twice daily until all cows were dried off on 18 April (week 13).

The cows were run together as part of a herd of 270 cows on 90 ha of mixed perennial ryegrass/white clover pastures under commercial conditions. During weeks 1-12 of treatment (February to mid April) pasture allowance was supplemented with approximately 3 kg dry matter (DM) per head of greenfeed maize.

After drying off (week 13) and culling using commercial criteria, the remaining 192 animals were managed as a single herd until calving and fed a diet of pasture, silage and hay at a daily allowance of approximately 8 kg DM per head.

After calving (weeks 27-34, 1 August - 14 September) the experimental cows were again managed as part of a single 270 cow herd and fed pasture ad libitum. All cows were milked twice daily at 0630 and 1600 hrs.

Milk Yield and Composition Measurements

Milk yield and composition were measured at two weekly intervals commencing one week before adopting once daily milking with group A (week 0) and ending at week 43 of the trial (16 November).

At each sampling, evening and morning milk yields were recorded using 'Tru-test' milk meters and composite pm/am samples taken. These samples were analysed for fat and protein content using an infra-red milk analyser ('Milko-scan', N. Foss Electric, Denmark).

Somatic cell count of the milk from a sub-sample of this milk was measured using an automatic cell counter ('Foss-o-matic 360', N. Foss Electric, Denmark).

Cow Liveweights

Cows were weighed immediately after milking (i.e. two hours off pasture) at week 0 and then at two-weekly intervals until drying off and then during the dry period

at three-weekly intervals. Liveweight was measured 24 hours after calving and thereafter at four-weekly intervals.

Reproductive Performance

In the lactation following treatment, cows were subjected to normal farm mating procedures. Reproductive disorders were treated between parturition and commencement of mating (week 39, 22 October). Artificial insemination was used for seven weeks and two-year old Friesian bulls were then run with the herd for a further five weeks.

Cows were palpated *per rectum* 5 weeks after mating ended to determine reproductive status and confirm conception date. Reproductive performance was in terms of calving to conception interval and proportion of cows failing to conceive.

Statistical Methods

Effects of once-daily milking treatment on yields of milk, milk fat and milk protein and liveweight were tested by analysis of variance at each sampling time using appropriate values during the pre-treatment period (week 0) as a covariate.

Data relating to conception interval were subjected to one way analysis of variance while the proportion of cows failing to conceive was analysed by a chi-square test.

Data relating to somatic cell counts were analysed using a chi-square test. All statistical analyses except chi-square were undertaken using the computer package 'REG' (Gilmour, 1985).

RESULTS

Liveweight and Condition Score

Liveweight (fitted to covariate weight measured in week 0) of the cows throughout the trial is shown in Figure 1.

All cows initially gained liveweight as herd feeding levels increased as a result of greenfeed maize supplementation and higher pre-grazing pasture levels. However, liveweight declined in late lactation which led to the decision to dry all cows off in week 13.

Liveweight subsequently increased over the dry period until calving, after which it fell until week 32 when liveweights began increasing.

Once daily milking reduced the rate of liveweight loss in late lactation so that there were significant differences by week 8 of the trial. At drying off, liveweight differences between control cows (group D) and groups A, B and C were 14.8, 8.7 and 7.1 kg respectively ($P < 0.01$). Differences of up to 12.4 kg liveweight ($P < 0.01$) remained prior to calving, but differences in post calving liveweights were non-significant ($P > 0.10$).

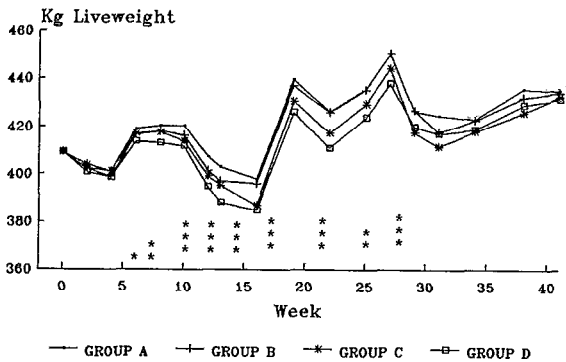


FIG 1 Liveweight (kg) of cows milked once daily for the last 89 days (Group A), 61 days (Group B), 33 days (Group C), and twice daily (Group D) over the last 12 weeks of one lactation and the first 13 weeks of the subsequent lactation. Calving occurred in weeks 27-34 of the trial.

Milk Yield and Composition

Yields (adjusted for corresponding yields during the covariate period) of the four groups are shown in Figure 2.

The yield of milk fell in all groups in the two weeks following commencement of the trial but the fall was greater (12.5%) in Group A which was milked once daily. A week after commencing once daily milking in Group B, production fell by 11.4% in comparison with Groups C and D which were still milked twice daily. The yield of cows in Group C fell prior to commencing once-daily milking, but was 14.6% less than that of cows in Group D one week after commencing treatment. Treatment effect was significant ($P < 0.01$) at each

measurement.

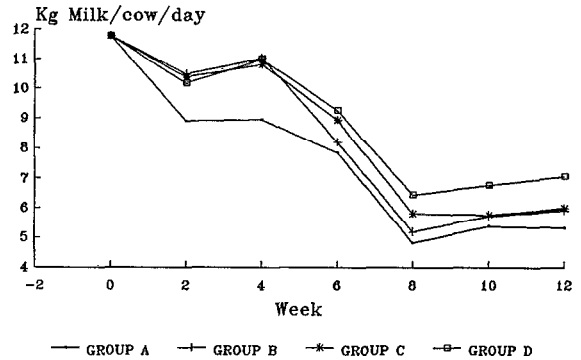


FIG 2 Daily milk yield (kg) of cows milked once daily over the last 89 days of lactation (Group A), 61 days (Group B), 33 days (Group C), or twice daily throughout (Group D).

Milkfat yield in groups A, B and C respectively, was 8.5%, 10.6% and 8.6% lower after seven days of treatment than control cows milked twice daily. Similarly, daily milk protein production was 8.8%, 5.9% and 4.0% lower after seven days of treatment than control cows.

The relative falls in production observed seven days after the imposition of treatment on each group remained until drying off at week 13.

Total yield of milk and milk solids for each treatment over the last 89 days of lactation are shown in Table 1. Once daily milking reduced milk and milk solids yields with the greatest losses occurring in cows milked once daily for the longest time.

TABLE 1 Yields (\pm S.E.) of milk, fat and protein over the last 89 days of lactation for cows milked once daily for the last 89 days (Group A), 61 days (Group B), 33 days (Group C) or twice daily throughout (Group D).

Group	Milk Yield (kg)	Milk Fat (kg)	Milk Protein (kg)
A	635 \pm 17.2	31.7 \pm 0.7	23.5 \pm 0.6
B	678 \pm 16.5	34.3 \pm 0.7	25.2 \pm 0.5
C	701 \pm 17.4	35.0 \pm 0.7	25.3 \pm 0.6
D	728 \pm 16.9	36.3 \pm 0.7	26.5 \pm 0.5

When compared to cows milked twice daily, once daily milking significantly ($P < 0.001$) increased milk protein concentration as shown in Figure 3.

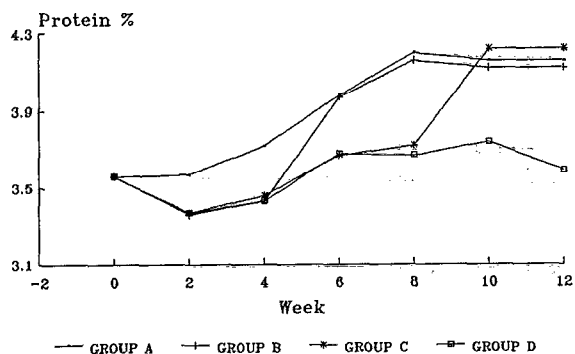


FIG 3 Milk protein concentration of milk produced by cows milked once daily over the last 89 days of lactation (Group A), 61 days (Group B), 33 days (Group C), and twice daily throughout (Group D).

Milk and Milk Solids Yield in the Subsequent Season

In the subsequent season, treatment in the previous season did not affect either the pattern or total production of milk or milk solids ($P > 0.10$).

Reproductive Performance

Once daily milking in the preceding season had no effect on the calving to conception interval ($P > 0.10$) and proportion of cows failing to conceive ($P > 0.10$).

Somatic Cell Count

Somatic cell count (SCC) of each cow at each sample date was classified into four categories based on methodology commonly used by New Zealand dairy farmers in herd mastitis control programmes and similar to that described by Bringe (1976).

Class 1	< 250,000	cells/ml
Class 2	250,000-500,000	cells/ml
Class 3	500,001-750,000	cells/ml
Class 4	> 750,000	cells/ml

The number of cows in each class at each sampling date for each treatment is shown in Figure 4.

Treatment effects on number of cows in each class were evident in week 2 of the trial ($P < 0.05$). In week 6 differences were not significant but thereafter the number of cows in each class was affected by treatment ($P < 0.01$).

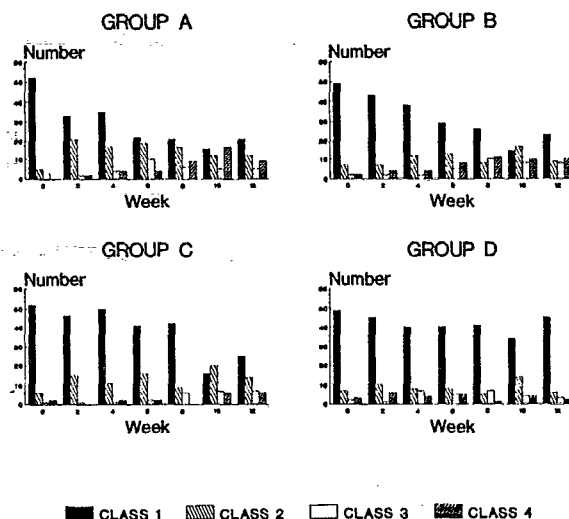


FIG 4 Numbers of cows from each treatment group falling into four classifications of somatic cell count concentration at each sampling date. Class 1 < 250,000 cells/ml; Class 2 250,000-500,000 cells/ml; Class 3 501,000-750,000 cells/ml; and Class 4 > 750,000 cells/ml.

DISCUSSION

Daily losses in milkfat production from once daily milking of between 8.5 and 10.6% in this trial are consistent with results reported by Carruthers and Copeman (1990), and Bryant (1978), but less than the 30% reported by Parker (1965) and 24-28% reported by Wilson (1965) in earlier trials. In this trial daily reductions in milk fat yield extrapolate to a reduction of between 12.7% and 3.6% in total milkfat yield for the period of the trial; the extent of the reduction being dependent on the length of time once daily milking was practiced.

In this trial once daily milking reduced the loss of cow liveweight although this result is not consistently observed (Bryant, 1978; Carruthers and Copeman, 1990; Parker, 1965).

Differences between the groups of up to 12.4 kg liveweight remained prior to calving but these differences were no longer evident after calving. Assuming

carryover effects would be due to improved liveweight at calving, the lack of differences between the groups in productive and reproductive performance observed in the subsequent season would be expected.

Increased protein concentration in milk from cows milked once daily was also reported by Claesson *et al.* (1959). Claesson *et al.* measured an increased concentration of the whey proteins with change in the concentration of the casein component. Such changes are often observed towards the end of lactation and are frequently attributed to an increase in the movement of blood serum proteins into the milk. The substantial and progressive increase in the number of somatic cells in the milk of the cows milked once daily also indicates a greater flow of blood serum components into the milk. It remains to be determined if these changes in milk composition will influence the processing quality of the milk but some dairy companies are already imposing financial penalties for high somatic cell counts.

Somatic cell counts in excess of 500,000 cells/ml are generally considered indicative of subclinical mastitis. The failure to detect an increase in the incidence of clinical mastitis, however, counsels caution in interpreting the substantial increases in somatic cells in cows milked once daily in terms of an increase in infection. Thus it may not be appropriate to use somatic cell counts from cows milked once daily as a basis for determining the use of dry cow therapy.

This trial shows that losses from once daily milking do arise and despite reducing the loss of liveweight in late lactation, improved performance in the subsequent season may not eventuate. Milk quality is also altered, and this may have implications to the dairy industry as a whole. Therefore gains from once daily milking may only result from savings in expenditure in such areas as labour and farmer lifestyle considerations.

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