

Short communication

Once-daily milking of Holstein cows for one-week decreases milk yield by twenty-five percent without any carry-over effect

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Abstract

Short-term (i.e. several days) once-daily milking (ODM) of dairy cows could help to improve work organization or quality of life for dairy farmers. ODM implemented during three periods of one week in the descending phase of lactation led to an average 23.4% decrease in the milk yield of 9 Holstein cows compared to 9 other cows on twice-daily milking (TDM). Short-term ODM significantly increased fat content (by 4.5 g/kg on average) and somatic cell count (by 73,000 cells/mL) and decreased lactose content by 1.9 g/kg. Protein content increased (by 2.1 g/kg) only in the third period. When twice-daily milking was resumed, there were no longer between-group differences in daily yields of milk, fat, protein, and somatic cells.

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1. Introduction

Once-daily milking (ODM) of dairy cows is relatively common practice in late lactation in New Zealand (see [Davis et al., 1999](#)), where calving and drying-off are seasonal. Dairy producers from many countries - mainly those who work alone on their farm - could see short-term (i.e. for several days) ODM as providing two main benefits: i) freeing up more time for other work that is essential to the smooth and successful running of their farm, and ii) making it easier for a neighbouring farmer to cover them for short periods away, i.e. for holidays, during illness, etc. The effects of short-term ODM (up to 2 weeks) on milk secretion have

already been studied (see review by [Davis et al., 1999](#)), in particular in New Zealand with medium-producing cows in mid-to-late lactation. Milk losses reportedly varied widely (10–40%). Moreover, the carry-over effects of ODM on milk secretion once twice-daily milking (TDM) resumed have been little investigated and data were little consistent, ranging from total lack of recovery ([Stelwagen et al., 1997](#)) to complete recovery ([Knight and Dewhurst, 1994](#)), probably because of differences in the experimental conditions. Before implementing ODM, dairy producers need to know more precisely, in their conditions of husbandry, the direct and residual effects of this management. In this experiment carried out with Holstein cows in the descending phase lactation, we studied the effect of ODM during one week on milk secretion during the ODM period and after resumption of TDM. The

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experiment involved three sessions of a one-week ODM regime.

2. Material and methods

2.1. Animals and experimental design

The experiment was conducted on the INRA experimental farm at Orcival (1100 m above sea level) between 10 February and 17 August 2003. Eighteen Holstein cows (2 primiparous) were used. At the end of two pre-experimental weeks of identical management (TDM, same feeding), the cows were distributed into two similar groups on the basis of lactation number (3.1 on average), lactation stage (10.9 weeks after calving), milk yield (33.1 kg/d), milk fat and protein contents (37.6 and 29.8 g/kg, respectively), and somatic cell count (SCC: 50,700/mL). One group of cows continued to be milked twice-daily until the end of the experiment (group 2M) whereas the cows in the other group (group 1M) were milked once-daily, in the morning, for three separate 7-day periods: period 1 from 24 February to 2 March, period 2 from 24 to 30 March, and period 3, during the pasture season, from 14 to 20 July. Apart from these weeks, all the cows were milked twice-daily. During the stabling period, the two groups were housed together in the same free stabling with cubicles. They received once-daily, ad libitum, the same mixture of forages (hay and wilted grass silage) and a quantity of a commercial concentrate (5.4 kg DM per cow per day, on average) calculated according to their level of milk production. From 28 April onwards, both groups of cows were turned out to pasture in the same herd and received 3 kg concentrate daily per cow per day. Feed regimen remained identical between the two groups during the 3 periods of ODM. Throughout the experiment, the cows were milked in the same milking parlour fitted with automatic cluster removers and milk meters. During the 3 periods of ODM, the cows of group 1M were separated from cows of group 2M just before the afternoon milking.

2.2. Measurements

Individual milk yield was measured at each milking. For each cow, milk samples were taken at each milking during the three weeks where ODM was implemented and at each milking of two consecutive days in the other weeks. These samples were used for protein, fat and lactose analyses by infrared spectrophotometry (Foss Electric, Hillerod, Denmark) and for somatic cell counts (Fossmatic 5000 automatic counter, Foss Electric, Denmark).

2.3. Statistical analyses

Statistical analysis was carried out using the SAS software package (SAS, 1992). Milk yield and composition during the 3 one-week ODM experimental periods (means for days 2 to 7) and the 3 post-experimental periods (means for weeks 2 and 3 following the end of each experimental period) were analyzed according to the following model: $Y = \text{Mean} + \text{Frequency of milking} (1 \text{ or } 2) + \text{Experimental period} (1 \text{ to } 3) + \text{Frequency of milking} * \text{Experimental period interaction} + \text{value of the variate measured during the pre-experimental period (covariate)}$. The analysis of somatic cell count was done on logarithmically transformed data.

3. Results

3.1. Milk yield

Milk yield was lower in the 1M group than the 2M group by 8.1 kg/d, 6.7 kg/d and 5.1 kg/d for experimental periods 1, 2 and 3, respectively ($P < 0.01$; Fig. 1). When expressed relative to the milk yield of the 2M group, these decreases were similar (24.4%, 22.0% and 23.7%, respectively). Individual decreases in milk yield (kg/d) induced by ODM and calculated for cows of group 1M (daily milk yield in the two weeks preceding the 7-day ODM period — daily milk yield during the 7-day ODM period) were not significantly correlated to the milk yield of the cows for periods 1 ($r = -0.46$) and 3 ($r = -0.11$), and were negatively correlated for period 2 ($r = -0.72$; $n = 9$; $P < 0.05$). Therefore, the individual relative decreases in milk yield, which varied from 15% to 38% (mean of the 3 periods) between cows, were stronger in lower-producers and weaker in higher-producers ($r = -0.82$, -0.92 and -0.69 , for periods 1, 2 and 3, respectively; $P < 0.01$ or $P < 0.05$). Individual decreases in milk yield

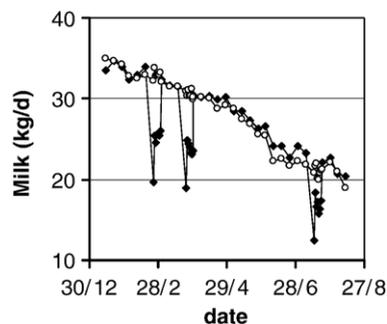


Fig. 1. Milk yield from 1M (◆) and 2M (○) groups during the experiment (daily data for the seven days of each of the three experimental periods, and weekly data for the other weeks).

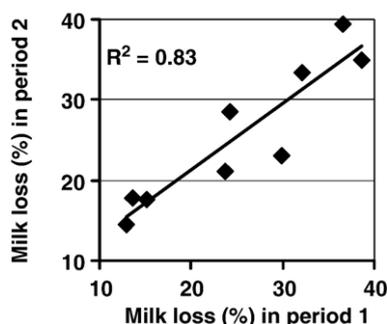


Fig. 2. Relationship between individual relative milk losses for group 1M cows during the first and second experimental periods.

(kg/d) during the 3 periods of ODM implementation showed significant inter-period relationships ($r=0.75$, 0.66 , and 0.69 between periods 1 and 2, 1 and 3, and 2 and 3, respectively). These relationships were even better when milk losses were expressed as a percentage of the milk yield during the preceding week of TDM: $r=0.91$, 0.89 and 0.97 between periods 1 and 2, 1 and 3 and 2 and 3, respectively (Fig. 2). During the post-experimental periods, the between-group differences in milk yield were no longer significant (0.4 kg/d; $P=0.41$; Fig. 1).

3.2. Milk composition

Once-daily milking increased fat content (by 4.5 g/kg on average; $P<0.01$), decreased lactose content (by 1.9 g/kg; $P<0.01$) and significantly but moderately increased SCC (by $73,000/\text{mL}$; $P<0.01$) at each experimental period. Once-daily milking increased protein content only at period 3 (by 2.1 g/kg). The quantities of fat and protein secreted by 1M cows during the three weeks of ODM were lower than the quantities produced by the 2M cows by 17% and 22% , respectively ($P<0.01$). During the post-experimental periods, the differences in milk fat and lactose contents, SCC, and quantities of fat and protein secreted disappeared ($P>0.05$).

4. Discussion

Most of the results recorded in this experiment are not novel. However, since they fall within the wide range of changes in milk yield and composition previously reported to occur under ODM (see Davis et al., 1999; Rémond and Pomiès, 2005), they serve to specify the variations likely to occur under our conditions of husbandry (relatively high milk yield, sustained feeding, repeat implementation of short-term ODM). The observed decrease in milk yield (23.4% on average) falls in the middle of the range reported in the literature (10 –

40% ; Davis et al., 1999) and is in agreement with other studies (i.e. 23% for Knight and Dewhurst, 1994; 19% for Auldish and Prosser, 1998; 29% for O'Brien et al., 2002). Lower losses (10 – 15%) have been observed, but generally in below-average-producing cows and in late lactation (Carruthers et al., 1991; Stelwagen et al., 1994). Our results also confirm previous reports of the high individual variability in milk losses induced by ODM (Claesson et al., 1959; Holmes et al., 1992; Knight and Dewhurst, 1994) and the repeatability of this loss between periods (Carruthers et al., 1993), which Knight and Dewhurst (1994) attributed to individual differences in the distribution of milk in the udder (cistern/alveoli). These observations open up perspectives for the selection of cows tolerant of ODM, as has been successfully and rapidly carried out by Mocquot (1980) in an experimental herd of goats. The absence of an increase in protein content is at odds with various other observations (Davis et al., 1999; Rémond and Pomiès, 2005), but may have been due to the short duration (7 d) of our ODM periods, since other authors using similarly short durations of ODM have also not reported increases in milk protein content (Auldish and Prosser, 1998; Knutson et al., 1993).

Concerning the pivotal question of the residual effect of ODM, this experiment shows clearly and repeatedly (at three different stages of lactation) that one week of ODM implementation has no effect on milk yield once TDM is resumed. This result confirms the lack of residual effect recorded by Knight and Dewhurst (1994) after one or two weeks of ODM implementation, and is consistent with other data showing an increase in the residual negative impact of ODM as the duration of its implementation increases: about 10% for a duration of 8 to 10 weeks (Rémond and Pomiès, 2005) and 40 to 50% for a duration of 20 weeks beginning at calving (Claesson et al., 1959). Once-daily milking decreases the activity of the mammary secretory cells, the number of secretory cells per alveolus, and the number of alveoli in the udder (see Boutinaud et al., 2004). The negative impact of ODM on the mammary capacity to secrete milk when TDM is resumed appears to become even more difficult to reverse as ODM implementation period increases.

5. Conclusion

These results open up perspectives for the implementation of ODM for several days in the descending phase of lactation in high-producing cows. Milk losses are expected to be around 25% and limited to the period of ODM implementation, with little or no impact on milk composition.

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