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Effect of Increased Milking Frequency in Early Lactation With or Without Recombinant Bovine Somatotropin*

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ABSTRACT

Multiparous Holstein cows (n = 300) were assigned to 1 of 2 milking frequency treatments at parturition. Cows were either milked 6 times (6×) or 3 times (3×) daily to determine effects on early lactation milk yields and subsequent lactation persistency with or without use of recombinant bST (rbST). Treatments included a control group milked 3× and 3 groups milked 6× for either the first 7, 14, or 21 days in milk (DIM). Those 4 groups of cows all received rbST starting at 63 DIM. The fifth treatment group was also milked 6× for the first 21 DIM but those cows received no rbST during the entire lactation. All cows returned to 3× milking after their respective treatment periods ended. Cows milked 3× tended to produce more milk (43.2 vs. 41.5 and 41.0 ± 1.1 kg/d) during the first 9 wk of lactation compared with cows milked 6× for 7 or 21 DIM, respectively. Group milk yields after wk 9 averaged 38.3 ± 0.7 kg/d and did not differ among various groups assigned to an increased milking frequency in early lactation. Percentages of milk fat (3.8 ± 0.12%) and protein (2.9 ± 0.06%) did not differ among treatments during the first 9 wk after calving. Early lactation milk yield (41.9 ± 1.2 kg/d) did not differ between the 2 groups of cows milked 6× for 21 DIM. However, cows subsequently administered rbST (at 63 DIM) produced more milk (38.8 vs. 34.2 ± 0.9 kg/d) from wk 10 to 44. The number of cows sent to the hospital during the 305-d trial for mastitis (97), digestive disorders (14), respiratory issues (9), lameness (22), or retained placenta (16), were not affected by treatments ($\chi^2 = 0.49$). Under the conditions of this commercial dairy herd in Arizona, increasing milking frequency to 6 times daily for 7 to 21 d at the start of lactation conditions did not increase milk yield nor improve lactation persistency.

(**Key words:** milking frequency, early lactation, somatotropin)

Abbreviation key: 2×, 3×, 4×, 6× = milked 2, 3, 4, or 6 times daily, respectively, **ECM** = energy-corrected milk, **IMF** = increased milking frequency, **PP** = postpartum, **rbST** = recombinant bST.

INTRODUCTION

Increasing milking frequency (**IMF**) has enhanced milk yield by 3.5 and 4.9 kg/d when cows were milked 3 (**3**×) or 4 times daily (**4**×), respectively, compared with milking twice daily (**2**×), and there was a tendency for milk fat and protein percentages to be reduced (Erdman and Varner, 1995). Although IMF has been demonstrated to increase milk synthesis during an established lactation (Erdman and Varner, 1995), its effects on milk yield when implemented for a short period (<21 d) during early postpartum (**PP**) lactation are less clear. Bar-Peled et al. (1995), and Sanders et al. (2000) observed 7.3 and 6.0 kg/d increases, respectively, in cows milked 6 times daily (**6**×) for the first 42 DIM compared with cows milked 3×. Hale et al. (2003) demonstrated that IMF (4× vs. 2×) in early lactation (1 or 4 to 21 DIM) enhanced milk yield (>7 kg/d) during 4× milking and the increase persisted (post-IMF) for up to 252 DIM. In addition, a recent field study reported that IMF (6× vs. 3×) in early lactation (1 to 21 DIM) increased milk yield >8 kg/d, and the enhanced production remained >5 kg/d after IMF ended (Dahl et al., 2004). Overall, cows milked 6× during that field study produced ~1118 kg more milk than cows milked 3× according to the first 10 monthly DHIA tests (Dahl et al., 2004). The aforementioned studies have shown that IMF of fresh cows will increase the milk yield during the IMF routine as well as throughout the entire lactation; even after the IMF routine has ceased (Bar-Peled et al., 1995; Sanders et al., 2000; Hale et al., 2003; Dahl et al., 2004). However, few studies have looked at the length of time IMF is required to have an immediate and subsequent effect on milk yield.

Somatotropin is secreted from the anterior pituitary gland and is found at higher concentrations in genetically superior cows (Kazmer et al., 1986). Recombinant bovine somatotropin (**rbST**) consistently increases milk

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Table 1. Composition of TMR fed during the experimental periods.

Item	Close-up	Fresh	High
	Diet		
DM %			
Alfalfa hay	33.8	36.7	25.0
Alfalfa greenchop	10.0	11.7	14.8
Soybean meal	—	2.6	3.3
Corn silage	25.3	14.6	12.2
Molasses	—	3.7	2.8
Tallow	0.3	0.5	0.9
Energy II[1]	0.4	0.7	2.0
Whole cottonseed	2.4	4.4	4.8
Barley	24.3	21.4	31.5
Vitamin/mineral premix[2]	3.6	3.7	2.7
Nutrition composition			
DM, %	52.6	53.9	53.9
CP, %	16.6	17.4	16.6
RUP, % of CP	26.6	30.9	30.1
NE_L, Mcal/kg[3]	0.75	0.76	0.82
NDF, %	32.7	30.0	27.3
ADF, %	22.0	20.4	17.6
Fat, %	3.4	4.2	5.8
NFC, %	36.9	37.5	40.5

[1]Energy II, Bioproducts Inc., Fairlawn, OH.

[2]Vitamin and mineral mix formulated to meet or exceed NRC (2001) requirements.

[3]Calculated as 0.245 × % TDN − 0.12.

Table 2. Impact of facility on cows milked 3 times (3×) or 6 times (6×) daily during early lactation.

Item	3×	6×
	Milking frequency	
Number of cows in pen		
Average	39	44
Range	20–70	1–70
Walking distance, m		
1-way	51	123
Per d	307	1480
Time out of pen, min		
Average	195	390
Range	180–225	270–450
Time milking, min		
Range	60–75	45–75

yield by 10 to 15% per cow (Bauman and Vernon, 1993). Combining IMF and rbST simultaneously enhanced the production response compared with each treatment alone, indicating that the 2 galactopoietic tools are additive and probably increase milk synthesis via different mechanisms (Knight et al., 1992; Speicher et al., 1994). However, no studies have evaluated the affects of IMF (6× vs. 3×) during the first 7, 14, or 21 d PP, followed by rbST administration at 63 DIM on high-producing multiparous cows.

Study objectives were 1) to determine if cows milked 6× during early lactation would produce more milk during the IMF routine; 2) to evaluate the time necessary to milk cows 6× during early PP to have a positive impact on peak milk yield and lactation persistency, and 3) to determine if effects of IMF in early lactation and subsequent rbST administration during established lactation are additive.

MATERIALS AND METHODS

Cows and Treatments

Three hundred multiparous Holstein cows calving at a commercial dairy near Buckeye, AZ, were randomly assigned to 1 of 5 treatment groups at freshening. All cattle freshened between November 4, 2003, and February 10, 2004. Cows were fed a TMR to provide 100% of NRC (2001) requirements daily at 0400, 1200, and 2000 h (Table 1), and were housed in dry lot corrals (permitting 49.2 m^2/cow) with shades (9.14 m wide by 3.96 m high; permitting 44.5 m^2/cow). Cows milked 6× were housed in a separate pen from cows milked 3× (during the IMF routine; ≤21 DIM) and both pens were located near (87 ± 36 m) the milking parlor (Table 2). Cows milked 6× for 7, 14, and 21 d were moved to the pen housing the 3× cows immediately after their 6× regimens had ended (d 8, 15, or 22), and all cows were commingled in a single pen at 29 DIM through the remainder of the 305-d trial. Use of animals in this investigation was approved by The University of Arizona Institute of Animal Care and Use Committee.

The 5 treatment groups (60 cows/treatment) were: 1) cows milked 3× through 305 DIM, 2) cows milked 6× for 7 DIM and then 3× through 305 DIM, 3) cows milked 6× for 14 DIM and then 3× through 305 DIM, 4) cows milked 6× for 21 DIM and then 3× through 305 DIM, and 5) cows milked 6× to 21 DIM and then 3× through 305 DIM. Cows assigned to treatments 1, 2, 3, and 4 were administered rbST (Posilac; Monsanto, St. Louis, MO) at 14-d intervals beginning at 63 ± 3 DIM and remained on rbST throughout the 305-d study. Cows in treatment group 5 did not receive rbST. Cows that were assigned to treatments and subsequently removed from the herd or relocated to the hospital pen before completion of the 6× milking regimen were replaced with other cows. The 3× group (group 1) was milked at 8-h intervals, and groups 2 to 5 (6×) were milked at 4-h intervals during the IMF regimen.

Measurements

Daily milk weights were measured electronically by Boumatic Computer software (Madison, WI) for each animal milking throughout the 305-d lactation. Monthly milk composition analysis and SCC was conducted at Arizona DHIA (Tempe, AZ) using an infrared analyzer (model 2000 and model 500; Bentley Instruments, St. Paul, MN). Energy-corrected milk (**ECM**) was calculated