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Milk Production from Holstein Half Udders After Concurrent Thirty- and Seventy-Day Dry Periods*,†

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ABSTRACT

The objective of this study was to use a within-cow, half-udder model to compare the effect of cessation of milk removal from mammary quarters within respective half udders at either 30 or 70 d before expected calving date (ECD) on the ability of the half udders to subsequently produce milk. Pregnant Holstein cows were assigned to control (n = 14) or treatment (TRT, n = 26) groups. All mammary quarters in the udder of cows in the control group had 70-d (68 ± 9 d) dry periods, whereas in each cow of the TRT group, 1 randomly selected half udder was dried at 70 d before ECD and the other half udder continued to be milked twice daily until dried at 30 d before ECD. From 80 through 70 d before ECD, amounts of milk produced by the left and right half udders of cows in the TRT group were measured at the first-shift milking. No differences were detected in the actual or relative amounts of milk produced by the left (3.46 ± 0.2 kg; 48.8 ± 1.0%) and the right (3.63 ± 0.2 kg; 51.2 ± 1.0%) half udders. Furthermore, the actual and relative amounts of milk produced by the half udders (n = 12 left, 14 right) subsequently dry for 67 ± 7 d (3.56 ± 0.2 kg; 50.2 ± 1.0%) and the half udders (n = 14 left, 12 right) subsequently dry for 27 ± 7 d (3.54 ± 0.2 kg; 49.8 ± 1.0%) did not differ before they were dried. However, from 3 to 100 d of the subsequent lactation, the 30-d dry half udders produced 18.9% less milk than the 70-d dry half udders (16.3 vs. 20.1 ± 1.0 kg/d). In addition, relative amounts of total-udder milk produced by the 30- and 70-d dry half udders in the same cow differed (44.9 vs. 55.1 ± 0.2%, respectively). Cows in the control group produced more milk than cows in the TRT group through 80 DIM (39.5 vs. 35.2 ± 0.6 kg/d), but not from 3 through 150 DIM (39.0 vs. 36.2 ± 1.6 kg/d). Thus, half udders that produced the same actual and relative amounts of milk before being dried did not do so when given a 30-d dry period instead of a 70-d dry period. When compared with the pre-dry value (49.8%), the relative contribution of half udders dry for 30 d to the total milk yield during the first 100 DIM was decreased by 9.8%.
(**Key words:** dry period, milk yield, days dry, half udder)

Abbreviation key: ECD = expected calving date, **CM** = continuously milked, **ME** = mature equivalent, **MEC** = mammary epithelial cells, **MY** = milk yield, **TRT** = treatment.

INTRODUCTION

Results of recent between-cow experiments led to the conclusion that modern multiparous dairy cows do not require a dry period longer than 28 to 35 d (Schairer, 2001; Bachman, 2002; Gulay et al., 2003; Annen et al., 2004b; Rastani et al., 2005). During ensuing lactations, milk production did not differ for cows with short dry periods compared with cows with traditional 50- to 60-d dry periods. The traditional dry period lengths were considered optimal based largely on the retrospective analysis of accumulated milk production records rather than on the results obtained from designed animal experiments (Bachman and Schairer, 2003; Grummer and Rastani, 2004; Kuhn and Hutchison, 2005).

A within-cow, half-udder experimental approach was used to compare the effects of continuous milking (**CM**, 0 d dry) and a 60-d dry period on subsequent milk production (Smith et al., 1967). They reported that the contralateral mammary quarters of the CM cows subsequently produced 38 and 44% less milk than the other 2 mammary quarters within the same udder not milked for 60 d before parturition. The half-udder experimental model eliminated all genetic, endocrine, and nutritional factors, and most of the management factors that can affect subsequent milk production (Bachman and Schairer, 2003). Thus, the advantage of using a half-udder model to compare the effect of different dry period lengths on milk production should be a decrease in

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between-animal variation, thereby reducing the number of dairy cows required to identify the optimal lengths of dry periods for current dairy cows that may vary in parity and management (Annen et al., 2004a).

Our objective was to use the within-cow, half-udder model to compare the effects of cessation of milk removal from the 2 mammary quarters in half udders of the same cow at 30 or 70 d before expected calving date (**ECD**) on the ability of the half udders to subsequently produce milk. For comparison, milk yield (**MY**) was measured in a group of 14 cows in which all 4 quarters in the udder received a 70-d dry period.

MATERIALS AND METHODS

Experimental Design and Animals

Pregnant Holstein cows were assigned randomly to control (n = 14) and treatment (**TRT**, n = 26) groups at approximately 85 d before their ECD. Parity of cows for the experimental lactation ranged from 2 to 8, but parity of all cows was 4 or less except for 3 cows in the TRT group whose parities were 5, 6, and 8. There were 2 and 9 primiparous cows assigned to the control and TRT groups, respectively. Previous mean 305-d mature equivalent (**ME**) lactation MY of the control and TRT groups of cows did not differ (10,669 ± 472 vs. 10,977 ± 433 kg; $P > 0.10$), and neither the previous lactation DIM nor the actual milk production differed. All mammary quarters in the udder of cows in the control group were allowed a 70-d dry period. In contrast, at 70 d before ECD, milk removal from the 2 mammary quarters on the same side of the udder (half udder) of each cow in the TRT group was discontinued but removal of milk from the other 2 mammary quarters of the opposite side (half udder) continued until 30 d before ECD. Thus, of the 4 mammary quarters within a TRT group cow, 2 mammary quarters on the same side of the udder were dry for 70 or 30 d before the parturition that initiated the subsequent lactation.

Feeding Management

At 70 d before ECD, cows in the control group were dried, and then were moved to a dry-herd lot and fed a far-off dry-herd diet. At 30 d before their ECD, the cows in the control group were moved to a close-up dry lot and fed an anionic (–13 mEq/100 g of DM) close-up dry-cow diet until parturition (Gulay et al., 2004). Upon cessation of milk removal from 1 half udder at 70 d before ECD, cows in the TRT group remained in the milking herd and continued to consume the milking-herd TMR until the remaining half udder was dried at 30 d before the ECD. Then, these newly-dried cows from the TRT group were transferred directly to the close-up dry-cow lot where they were managed with the cows from the control group that were also within 30 d of ECD. After parturition, all cows were managed in the same free-stall barn and consumed a TMR based on corn silage, whole cottonseeds, and grain concentrate (Gulay et al., 2004).

BCS and BW

After parturition and through 100 d postpartum, BCS (1 to 5, thin to fat, respectively; Ferguson et al., 1994) and BW of cows were recorded weekly on a fixed day, before the a.m. feeding and first-shift milking.

Milk Removal and Measurement

All cows in the TRT group were switched from 3× to 2×/d milking at 80 d before ECD. On this schedule, cows were milked at the end of the first (1000 h) and third (0100 h) milking shifts which gave daily milking intervals of 9 and 15 h. From 80 through 70 d before ECD, MY from the left and right half udders of each cow in the TRT group were measured during the first-shift milking (n = 486). One half udder within each cow of the TRT group was selected randomly to be dried. All mammary quarters of cows in the control group were dried at 70 d before ECD. From 70 through 30 d before ECD, the MY of the other half udder continued to be recorded at each milking and then it was also dried. A commercial antibiotic preparation was infused into quarters at the milking during which they were dried. The dry-off treatment coupled with teat dipping and milking parlor hygiene were apparently effective, as only 1 incidence of mastitis each in 4 of the 26 cows in the TRT group was observed, and only 1 of those had mastitis in 1 quarter of the half udder given a 30-d dry period. In the control group, only 2 cows had mastitis, but 1 of those cows had 4 instances across 2 quarters.

Birth weight of calves was recorded within 12 h of birth. Yields of first-milking colostrum from cows in the control group and from each half udder of the cows in the TRT group were measured and collected. The concentration of antibody in each colostrum sample was estimated using a colostrometer (Nasco, Fort Atkinson, WI). From 3 to 100 d postpartum, the MY of the half udders in the TRT group of cows that had been dry for 70 or 30 d were measured during both milking shifts on 3 d each week (Monday, Wednesday, and Friday). However, total milk production was recorded daily through 150 DIM for all cows in both the control and TRT groups. Starting at 80 DIM, all cows were supplemented with bST (Posilac; 500 mg; Monsanto, St. Louis, MO) every other week. Beyond 100 DIM all cows were milked 3×/d with 8-h intervals between each milking.