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Effect of a short dry period on milk yield and content, colostrum quality, fertility, and metabolic status of Holstein cows

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ABSTRACT

We evaluated the effect of shortening the dry period (DP) on milk and energy-corrected milk (ECM) yields, milk components, colostrum quality, metabolic status, and reproductive parameters. Primiparous (n = 372) and multiparous (n = 400) Israeli Holstein cows from 5 commercial dairy herds were subjected to a 60-d or 40-d DP. Cows within each herd were paired according to milk production, age, days in milk, and expected calving. Analysis of the data from all cows, irrespective of age, revealed significant differences in milk and ECM yields that favored the 60-d DP, with a prominent effect in 2 of 5 examined herds. In primiparous cows, milk and ECM yields were similar between groups in 4 of 5 farms. In multiparous cows undergoing a 60-d (vs. 40-d) DP, milk and ECM yields were higher in 3 herds. These differences could not be explained by milk and ECM yields in cows diagnosed with metritis, ketosis, and mastitis (defined by a somatic cell count threshold of 250,000 cell/mL), distribution of infected and noninfected cows, or new infections during DP and after calving. Including the milk and ECM yields from an average of 19.55 d from the previous lactation revealed higher milk and ECM yields for 40-d (vs. 60-d) DP cows in all herds. Analyzing 2 consecutive lactations revealed similar milk and ECM yields between groups in 4 out of 5 herds. In 1 herd, yields were higher in the 40-d compared with the 60-d DP group. One week after calving, the nonesterified fatty acid concentrations of 40-d DP cows were significantly lower than those of 60-d DP cows, indicating better postpartum energy balance. Colostrum quality, measured as IgG concentration, did not differ between the 2 DP groups. Cows assigned to 40-d DP had better reproductive performance, as reflected by fewer days to first insemination, a lower proportion with >90 d to first insemination, and fewer days to pregnancy. With respect to primiparous cows, a short DP increased conception rate after first artificial insemination and decreased the proportion of nonpregnant cows after 150 d in milk. In light of these findings, we suggest that a short DP be applied for its economic and physiological benefits. This is highly relevant to dairy herds located in regions such as Israel, Spain, and Florida that suffer from reduced milk production during the hot season.

Key words: short dry period, production, fertility, colostrum, metabolic status

INTRODUCTION

The dry period (**DP**) between 2 subsequent lactations is highly important as it eliminates reductions in milk yield throughout the subsequent lactation (Smith et al., 1966; Rémond et al., 1992, 1997; Annen et al., 2007). Duration of the DP has been reevaluated in the last few decades. Whereas 60 d is the most commonly used DP duration (Sørensen and Enevoldsen, 1991; Makuza and McDaniel, 1996; Knight, 1998), shorter DP lengths have been shown to increase milk production in the subsequent lactation, and reduce the risk of mastitis due to lower milk yield at DP onset (Bernier-Dodier et al., 2011). A short DP also decreases the number of changes in diet, which in turn might decrease the incidence of postpartum metabolic disorders (Bernier-Dodier et al., 2011).

Several studies have examined DP length; however, their findings were not clear-cut. In one study, a short DP of 28 d did not have any deleterious effect on milk yield in the subsequent lactation (Annen et al., 2003), whereas others have reported contradictory results (Rastani et al., 2005). Gulay et al. (2003) did not find any difference in milk yield, for 21 wk after calving, of multiparous cows subjected to a 30-d or 60-d DP. Collier et al. (2012) reported that a 30-d DP reduces milk yield in primiparous cows in their second lactation. Recently, Bernier-Dodier et al. (2011) reported that a 32-d DP decreases milk yield for 20 wk postpartum. Pezeshki et al. (2007) and Santschi et al. (2011a) compared 35-d and 56-d DP and found that the shorter DP decreases milk yield in primiparous but not multiparous

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cows. However, Kuhn et al. (2006) suggested that the optimum DP length to maximize production depends on parity, suggesting a DP of 40 to 45 d for first and second lactations and a DP of 55 to 65 d after second and third lactations. They further suggested that DP of <30 d and >70 d should be avoided.

Nutritional regimen might alter the effect of DP duration on subsequent lactation. Dirksen et al. (1985) suggested that using 2 different diets during the 60-d DP (a low-energy diet from 60 to 30 d before calving and a moderate-energy diet from −30 d to parturition) does not allow optimal adjustment of the ruminal flora to the postpartum diet. In the last week of pregnancy, a rapid decrease in DMI occurs (Bertics et al., 1992), suggesting that when a short DP is applied, cows will not have sufficient time for appropriate ruminal flora development for the next lactation. Rastani et al. (2005) found that postpartum negative energy balance is more pronounced in cows subjected to a 56-d versus 28-d DP, probably due to higher DMI in the latter. Negative postpartum energy balance increases the risk of calving diseases such as ketosis, retained placenta, displaced abomasum, and metritis (Grummer and Rastani, 2004). Santschi et al. (2011b) reported that a short DP (35 d) combined with the feeding of a precalving ration for the whole period is correlated with decreased incidence of ketosis but increased incidence of retained placenta in adults, although the reason for this finding was not clear.

Given the association between postpartum energy balance and timing of first postpartum ovulation (Butler et al., 1981; Canfield et al., 1990), a short DP (28 d) might accelerate the time of first ovulation and return to cyclicity (Thatcher and Wilcox, 1973; Darwash et al., 1997) if only 1 high-energy diet is supplied (Gümen et al., 2005; Watters et al., 2009). In support of this, a short DP during which 2 rations were applied increased days open postpartum (Pezeshki et al., 2007). Dry period length might affect the quality of colostrum, in terms of IgG concentrations, which is essential for disease prevention in calves and hence their development (Collier et al., 2012). Omitting the DP entirely may reduce the IgG concentrations in colostrum, but shortening the DP for at least 4 wk had no effect on colostrogenesis in terms of changes in colostrum cell and fluid composition (Annen et al., 2004; Rastani et al., 2005; Watters et al., 2008).

Most planned DP experiments have been conducted with a small number of cows (Gümen et al., 2005; Rastani et al., 2005; Pezeshki et al., 2007). Moreover, most studies exploring DP length have been retrospective analyses (Bachman and Schairer, 2003). Results obtained using the latter approach are biased in favor of a 60-d DP due to inappropriate nutrition before calving in the case of a short, unplanned DP.

The objective of the present study was to compare the effects of long (60 d) versus short (40 d) DP on primiparous and multiparous cows in large commercial dairy herds. The examined outcomes were milk yield and components and relationships between DP length, BCS changes, milk production, metabolic disorders postpartum, colostrum quality, and reproductive performance.

MATERIALS AND METHODS

Cows and Experimental Layout

The experiment was conducted over 3 consecutive years in 5 large commercial herds with 300 to 1,000 cows each. Cows were housed in loose-housing barns (bedded area ~20 m^2/cow) in all herds. During the summer, all cows were cooled in the milking-parlor holding yards during and between milking and along the feeding lanes after milking. Primiparous and multiparous cows in mo 6 to 7 of pregnancy were paired within herd according to expected 305-d ECM yield, evaluated for age, DIM, and days in pregnancy, and randomly assigned to the 40-d or 60-d DP group. Actual accumulated 305-d ECM yield did not differ between the experimental groups (11,681 kg for 40-d DP and 11,720 kg for 60-d DP, SEM = 80; $P > 0.05$) or within each farm (Table 1). Originally, 820 cows were paired for the experiment. Pairs in which 1 cow had a DP less than 25 d or left the herd less than 5 mo in lactation postpartum were excluded from the analysis. The reasons for excluding cows from the experiment were mastitis and abortions. Several pairs were also excluded due to incorrect dry period. The final analysis was carried out on 372 primiparous and 400 multiparous cows (Table 1).

Cows were dried off as generally practiced in Israel. Briefly, after the last milking, teats were dipped in a 0.5% iodine solution and wiped using individual towels. Teat ends were then swabbed with sponges soaked in 70% alcohol, and antibiotic (Nafpenzal DC $N8^R$, Intervet International, Boxmeer, the Netherlands) was applied by intramammary infusion, and dipped again in 0.5% iodine solution; cows were then transferred to the dry cow group.

Feeding regimen on all farms was based on a TMR. For the 60-d DP group, nutrition was based on 2 rations. The first contained 12% CP and 1.40 Mcal of NE_L/kg of DM and 75% roughage and was fed from 60 to 21 d before expected calving (d = 0). From d −21 until calving, cows were fed a close-up ration containing 14.5% CP, 1.55 Mcal of NE_L/kg of DM and 60% rough-