J. Dairy Sci. 94:106–115
doi:10.3168/jds.2010-3141

A retrospective study on the association between different lengths of the dry period and subclinical mastitis, milk yield, reproductive performance, and culling in Chilean dairy cows

P. Pinedo,* C. Risco,*[1] and P. Melendez*†
*College of Veterinary Medicine, University of Florida, Gainesville 32610-0136
†Facultad de Medicina Veterinaria, Universidad Santo Tomas, Viña del Mar, Chile

ABSTRACT

The objective of this study was to determine the association between different dry period lengths and somatic cell counts, milk yield, reproductive performance, and risk of early culling during the subsequent lactation of Chilean dairy cows. The length of the dry period was classified into 5 categories: 0 to 30 d, 31 to 52 d, 53 to 76 d, 77 to 142 d, and 143 to 250 d. Generalized mixed models were used and included herd as random effect. Time-to-event analyses were performed for evaluation of reproductive performance and culling risk. The odds of subclinical mastitis (log linear score, LNSCC $\geq$ 4.5) during early lactation increased with extended dry periods (143 to 250 d) during first, second, and third test day compared with the reference dry period of 53 to 76 d [odds ratio (OR) = 1.27, 1.16, and 1.31, respectively]. Short (0 to 30 d) and extended dry periods had a detrimental effect on early lactation and 305-d milk yield compared with the reference dry period. Longer dry periods were associated with increased number of days for calving-to-first service interval and calving to conception interval. Average calving-to-first service interval for short and extended dry period were 83 d and 89.4 d, respectively. Average days to conception were 127.8 d and 131.4 d for a dry period of 31 to 52 d and extended dry period, respectively. Similarly, the number of services per conception increased with length of previous dry period from 1.62 (31 to 52 d) to 2.44 (143 to 250 d). Cows with previous short and extended dry period had higher odds of culling when compared with cows in the reference group (OR = 2.20 and 1.57, respectively). Compared with the reference group, cows in the dry period category 77 to 142 d had the highest odds of death followed by the category 143 to 250 d (OR = 1.27 and 1.18, respectively).When death and live culling were combined, the highest odds of combined death and culling were for cows in the categories 0 to 30 d and 143 to 250 d (OR = 1.63 and 1.44, respectively). We conclude that extended dry periods (143 to 250 d) increase the odds of subclinical mastitis occurrence during early lactation and have a negative association with reproductive performance. Short and extended dry periods were negatively associated with early lactation and 305-d milk yield and were related to increased overall culling when compared with the reference dry period.

Key words: dry period, culling, reproduction, subclinical mastitis

INTRODUCTION

A nonlactating or dry period for pregnant dairy cows is recommended between consecutive lactations based on the nutritional needs of the late pregnant cow and to allow proper involution of the mammary gland epithelium to maximize milk yield during the subsequent lactation (Swanson, 1965; Hurley, 1989; Annen et al., 2004; Church et al., 2008). The dry period also permits extended intramammary antibiotic therapy to reduce the prevalence of existing infections and reduce the incidence of new infections, without the risk for violative milk residues (Eberhart, 1986).

The optimal duration of the dry period has been a subject of debate, with a period of 51 to 60 d given as the conventional recommended length (Bachman and Schairer, 2003; Church et al., 2008). However, because of management decisions related to gestation length and milk yield, it is common on many farms for cows to have involuntary long or short dry periods. On the other hand, in recent years, consideration has been given to a shorter, 30-d dry periods. Arguments for a 30-d dry period include additional income from milk yield at the end of lactation and improved nutritional state to meet the physiological challenges of the transition period (Bachman and Schairer, 2003; Gulay et al., 2003).

As reviewed by Bachman and Schairer (2003), when dry periods were reduced from 60 to 30 d, the change in milk production ranged from a 10% decrease to a 1% increase. However, after controlling for milk yield, short

Received February 5, 2010.
Accepted October 3, 2010.
[1]Corresponding author: riscoc@ufl.edu

dry periods resulted in lower fertility (14 more days open for 0–10 d dry vs. 61–65 d dry). Similarly, short dry periods were associated with higher SCS during the subsequent lactation (Kuhn et al., 2006a). Conversely, a shortened (34 d) dry period improved the reproductive performance of third-lactation or greater cows compared with the traditional dry period length (20.3 vs. 10.6% of pregnancy at 70 DIM for 34 d and 43 d dry, respectively; Watters et al., 2009). Rastani et al. (2005) reported that shortening the dry period improved the energy balance and decreased the mobilization of body reserves after calving. Still, a clear effect for variations of dry period length on health has not been described (Bachman and Schairer, 2003; Watters et al., 2008), and most studies have centered on the consequences of shortened dry periods (Grummer and Rastani, 2004).

The decision of when to dry off a lactating dairy cow is based on milk production, gestation length, and replacement costs. The effect of dry period lengths varying from less than 30 to 80 d has been reported (Bachman and Schairer, 2003), but limited information exists about the overall consequences of diverse lengths of dry period on performance, udder health, and culling in large populations. In the studies cited earlier (Gulay et al., 2003; Watters et al., 2008, 2009), cows that received a short dry period were fed a balanced diet that met the required nutritional needs of prepartum transition cows (–3 wk from calving). Similarly, cows that were assigned to a long dry period were fed a diet that met the nutritional requirements for dry cows. However, little information exists on the effect of involuntary variations in days dry that could occur because of different stages of gestation at dry off, resulting in failure to meet nutritional requirements during the dry period.

We hypothesized that different durations of dry period length were associated with udder health status, milk yield, reproduction, and culling during the following lactation. Therefore, the objective of the present study was to retrospectively determine the association between dry period length and SCC, milk yield, reproductive performance, and early culling during the subsequent lactation in a population of Chilean dairy cows.

MATERIALS AND METHODS

Dairy Farms and Management

This was a retrospective cohort study that considered dairy farms from the south-central area of Chile. The area is between 36°00′ and 38°30′ S and between 71°00′ W and the Pacific Ocean. Climate is temperate with winter rainfall (1,380 mm/yr) and temperatures that range from 0°C in winter to 32°C in summer (Instituto Geografico Militar, 2006). The south-central area of Chile is a typical agricultural region, and has 30% of Chile's total cattle population.

Dairy farms included in this study consisted of Holstein cattle (90%) and crossbred Black-Pied × Holstein (10%). Median and interquartile range bounds for average milk yield (305-d) per herd were 7,249, 6,154, and, 8,277 kg/cow, respectively. Herd size ranged from 37 to 800 cows, with median and interquartile range bounds of 177, 115, and 301 cows, respectively. Housing was drylot (40%), freestalls (40%), grazing (10%), and mixed systems (10%). Feeding systems were TMR-based and comprised corn silage, alfalfa hay, and concentrates (50%), top-dressed concentrate, corn silage, and green chop/hay alfalfa (30%), grazing (10%), and mixed systems (10%). Dry cow diets were formulated to meet or exceed the nutrient requirements established by NRC (2001). In general, the diets included a far-off period based on corn silage, gramineae hay, and minerals, and a close-up period (21 d before due date) diet of corn silage, ryegrass, soybean meal, and corn grain. Reproductive management consisted of AI based on estrus detection that included visual inspection for primary signs of estrus at least twice per day (80%), natural service (10%), and mixed AI and natural service systems (10%). In natural service herds, when a cow was found to be in estrus, she was brought to the bull for breeding; therefore, the date of breeding was known. No estrus- or ovulation-synchronization protocols were used in this population during the period analyzed. Crude averages for calving interval, calving-to-first-service interval (**CFSI**), calving-to-conception interval (**CCI**), and services per conception (**SC**) during the period in analysis were 407 d, 87 d, 128 d, and 1.74 services, respectively.

Time for dry off varied among farms, but days to next calving (60 d to due date) and milk yield were the most commonly used criteria. Milking frequency was 3 (35%) or 2 times daily (65%) using standard, commercial automated milking machines. Average annual culling rate per herd was 29%.

Study Design

This retrospective cohort study analyzed data collected by a government-certified recording system organization (Insecabio Ltda., Los Angeles, Chile) that has monitored (monthly) a population of approximately 12,000 Holstein cattle in 239 herds during the last 17 yr. The study used records from a population of 223 farms, comprising 145,984 lactations between 1997 and 2009. Given that the enrollment in this recording system is voluntary and involves a cost, not all of the farms in