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Effect of milk cessation method at dry-off on behavioral activity of dairy cows

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ABSTRACT

Drying cows off at the end of lactation is a routine management practice in dairy operations. Most dairies in the United States and many other countries dry cows off abruptly (e.g., stop milking cows on a set day), which has been shown to affect cow comfort. Gradually reducing milk production is another approach to dry cows off, routinely used in some countries and herds. The objective of the study was to evaluate the effects of abrupt and gradual milk cessation and milk yield at the time on cow activity after dry-off. Daily lying time, number of lying bouts per day, average lying bout length, and steps taken per day by abruptly and gradually dried-off cows were monitored by data loggers for 2 wk before and after the final milking at the end of lactation. Gradual cows were milked once daily for the last week of lactation, and abrupt cows were milked as usual (3×/d) until the end of lactation. Gradual cessation of milking significantly reduced milk yield by the day of dry-off. After dry-off, gradual cows tended to have longer lying bouts than abrupt cows, but no other differences in cow activity between the 2 treatments were observed. Regardless of the dry-off method, the average length of a lying bout decreased by 4 min and total daily lying time decreased by 19 min after dry-off for each 5-kg increase in milk yield before dry-off. Lying behavior of primiparous cows was more affected by the level of milk yield at dry-off than that of older cows. A reduction in lying times with increasing milk yield may indicate discomfort due to the accumulating milk in the udder. Using a method that lowers milk production before dry-off and managing primiparous and multiparous cows separately around dry-off are beneficial for cow comfort after dry-off.

Key words: milk cessation method, abrupt, gradual dry-off, behavior

INTRODUCTION

The implementation of a 6- to 8-wk nonlactating (dry) period before a cow's next calving is a common practice in dairy herds to provide the cow's udder a period for cell regeneration between lactations. The effect of the dry period length on milk production and the importance of the dry period in general on health of a cow in the consecutive lactation have been intensely studied (Bachman and Schairer, 2003; Dingwell et al., 2003; Watters et al., 2008; Steeneveld et al., 2013). However, research on the methods used to dry cows off and their effect on udder health is surprisingly sparse. The first studies on the topic date back more than half a century and were conducted with cows producing significantly less milk than modern dairy cows (Wayne and Macy, 1933; Neave et al., 1950; Oliver et al., 1956). Abrupt and gradual cessation of milking were the methods studied, either with or without feed restriction. Abrupt cessation or "stop" milking occurs when normal daily milking is terminated on a set day, which is typically determined by the expected calving date and a desired dry period length. Gradual cessation of milking (also referred to as intermittent milking or reduced milking frequency) occurs when cows are weaned from milking over a period of days or weeks. This method of milk cessation is more aligned with what the cow would endure in nature, as her calf would gradually decrease milk intake before weaning (Vitale et al., 1986).

In addition to being more natural, gradually reducing milking frequency and the resulting lower milk yield at dry-off have been shown to be beneficial for udder health (Natzke et al., 1975; Oliver et al., 1990; Newman et al., 2010). In support of this idea, a more recent study reported that the involution process in cows producing low amounts of milk is associated with metabolic and immunological features that allow the cows to clear apoptotic cells and eliminate and prevent infections more effectively than cows dried off forcefully (abruptly) from large amounts of milk (Silanikove et al., 2013). However, with large herd sizes and intensification of the production, abrupt cessation of milking is the most commonly used drying-off procedure in many countries

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as it is easy and simple to implement (Barkema et al., 2015; Bertulat et al., 2015; USDA, 2016).

Recent research has found that abrupt milk cessation methods can also affect the affective state of the animals. For example, Bertulat et al. (2013) found that high-producing cows that were abruptly dried off had higher levels of fecal glucocorticoid metabolites, physiologic indicators of stress, compared with those that were gradually dried off. Zobel et al. (2013) reported that cows dried off abruptly showed strong motivation to be milked by standing at the gate leading to the milking parlor after dry-off, which the authors attributed to possible frustration with not being milked with the rest of the herd. It has also been suggested that an abrupt cessation of milking can cause discomfort as the udder becomes engorged with milk (O'Driscoll et al., 2011); however, evidence for this is lacking. For example, Zobel et al. (2013) measured lying time as an indirect measurement of discomfort in cows dried off abruptly and gradually, but found no difference in lying time between the treatments. Similarly, a study under New Zealand pasture conditions did not find any behavioral differences in lying bouts among groups of cows with different milking frequencies and feeding levels before and after dry-off (Tucker et al., 2009). Milk production levels in this pasture-based system, however, were lower than they typically would be when TMR and more energy-dense rations are fed. Another method to decrease milk production is to restrict the cow's feed intake; however, this method has been shown to cause increased vocalizations in cows, which has been interpreted as a behavioral sign of distress, potentially due to hunger (Valizahneh et al., 2008).

To our knowledge, no studies investigating the effect of different drying-off methods on dairy cow behavior have been conducted in US confinement systems or have specifically focused on the effect of high milk production at dry-off on lying behavior and activity of cows. Thus, the objectives of the current study were to evaluate the effects of (1) abrupt and gradual milk cessation and (2) milk yield on dairy cow lying behavior and activity around dry-off. It was hypothesized that higher milk yield before dry-off and abrupt cessation of milking, due to milk accumulation and consequent udder distension, would cause discomfort to the cow and this would be exhibited indirectly through changes in their activity and lying behavior.

MATERIALS AND METHODS

Study Population

This study was part of a larger project evaluating effects of 2 different milk cessation methods at dry-off on

udder health, milk yield, and milk quality in the subsequent lactation, as described in Gott et al. (2016). All procedures used in the present study were approved by The Ohio State University Institutional Animal Care and Use Committee (protocol #2011A00000136). The 2 drying-off methods assessed were abrupt and gradual cessation of milking. The sample size for the larger project was calculated based on expected differences in udder health parameters between the treatment groups (Gott et al., 2017). The study reported here was conducted in a single large Holstein herd, which was enrolled in the larger study. This herd had approximately 1,200 cows housed in freestall barns, and cows were milked 3 times a day, at 8-h intervals. Following the established on-farm protocol, cows were dried off abruptly once a week, and after the final milking, all quarters of all cows were treated with a commercially available antimicrobial dry cow product and internal teat sealants were also administered. No alterations were routinely made to the diet before dry-off in the herd, and the feeding management was not changed as a part of the study protocol either; thus, all cows remained on the farm's late lactation ration for the final week of lactation. After the final milking at the end of lactation, cows were moved to a dry cow pen with other dry cows.

During the larger project, cows with no observable clinical symptoms were enrolled 7 to 14 d before their dry-off date (**PRE**), which was based on cows' expected calving dates and the desired dry period length (50 d) in the herd. For this behavioral study, only cows that had activity data available for 14 d before and 14 d after dry-off were included in the activity data analyses. All cows to be dried off in 1 wk were assigned to the same treatment [abrupt (**ABR**) or gradual (**GRAD**)] to make management of the cows easier for the herd personnel. Enrollment of cows occurred during spring and summer of 2014, and altogether, 4 sets of cows were enrolled during the spring (March–April) and 4 sets during the summer (July–August), and these sets varied in size between 7 to 24 cows. The first set of cows was assigned to the abrupt cessation group, and thereafter group assignment alternated weekly between gradual and abrupt cessation groups. Abrupt cessation cows maintained the farm's regular milking schedule (3×/d) until the last day of lactation, whereas GRAD cows were milked once daily (1×/d) for the final week of lactation. During the 1× milking period, GRAD cows were housed in the same pen and managed together with the rest of the late-lactation cows. All cows went through the parlor together during every milking, but GRAD cows were only milked once per day according to the study protocol. The GRAD cows were identified with brightly colored leg bands on one hind leg so the

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