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Comparison of shortened and conventional dry period management strategies

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ABSTRACT

The aim of this study was to compare 2 dry-cow management strategies and evaluate the effect of shortened dry period strategy on feed intake, metabolism, and postpartum performance of dairy cows in early lactation. Twenty-nine high-yielding dairy cows were divided into 2 groups. The control (CON) group (n = 14) was assigned to a traditional dry period of approximately 60 d (57 ± 5.9 d) and was fed a far-off dry cow ration from dry-off to −21 d relative to expected parturition. From d −21 relative to expected parturition, the cows were switched to a precalving ration containing an additional 3 kg of concentrates. The cows of the experimental group (n = 15) were assigned to a shortened dry period (SDP; 35 ± 6.3 d) and were continuously fed a late-lactation diet from d −60 d relative to expected parturition until calving. After calving, both groups were fed the same lactation diet corresponding to their lactation requirements and cows were followed for 100 d of lactation. Prepartum dry matter intake of the cows assigned to an SDP and fed a late-lactation diet was approximately 4.11 kg/cow per day greater compared with the CON group during the 60 d. However, no effect of dry period strategy on postpartum dry matter intake was detected. The cows with an SDP produced approximately 2.78 kg/d (6.9%) less milk in the first 100 d of lactation than CON cows; the difference was not statistically significant. No differences were observed in live body weight, body condition score, or back-fat thickness between the treatments. Similarly, no differences existed in concentrations of plasma metabolites. The cows of the SDP group showed lower pH and increased concentrations of lactic acid and volatile fatty acids prepartum than the CON cows. Postpartum concentrations of lactic acid, volatile fatty acids, and NH_3 and pH in rumen fluid did not differ between the treatments. Shortening of the dry period did not affect the colostrum quality or birth weights of the calves. Based on the results of this study, a traditional dry period management strategy appeared to be more favorable, considering the dry matter intake and milk production, compared with an SDP and feeding a late-lactation diet throughout the dry period.
Key words: nutrition, transition period, milk production, metabolic status

INTRODUCTION

Intensive genetic selection for productivity has resulted in a dramatic increase in milk production in modern high-yielding dairy cows. However, as milk production per cow has increased, transitioning cows from the nonlactating state to peak milk yield has grown more problematic. In general, high milk energy output in early lactation has not been matched with appropriate energy intake. The transition period is the most difficult period in the dairy cow life cycle and is accompanied by decreased DMI, whereas milk production increases in early lactation (Bertics et al., 1992; Hayirli et al., 2002). An energy deficit results in a negative energy balance (**NEB**) and loss of BW, body condition, and body fat reserves. Severe NEB negatively affects immune and reproductive functions, resulting in an increased culling rate. Therefore, it is appropriate to evaluate alternative management and feeding strategies for the dry and transition periods to reduce the magnitude of the NEB.

Traditionally, cows are dried off approximately 60 d before expected calving. They are fed a far-off dry cow ration based on roughage from dry-off to 21 d prepartum and are then switched to a close-up diet enriched by the addition of concentrate mixture (Hutjens, 1996; Degaris et al., 2008). The gradual addition of concentrates in the last 3 wk of pregnancy allows rumen bacteria to adapt to a lactation diet rich in concentrates to facilitate high milk production in early lactation. The NRC (2001) suggests that the required energy concentrations in the diet of dried-off cows are 4.061 MJ/kg of DM at 240 d of pregnancy, 4.396 MJ/kg of DM at 270 d of pregnancy, and 6.029 MJ/kg of DM at 279 d of pregnancy, and the required dietary MP concentrations

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are 6.0% at 240 d of pregnancy, 6.6% at 270 d of pregnancy, and 8.0% at 279 d of pregnancy. To transition a cow during the last weeks of gestation to acclimate her to a lactating ration, NRC (2001) recommends a standard close-up diet with an energy concentration of approximately 6.741 MJ/kg and a dietary MP concentration of 8.5%.

A dry period of 40 to 60 d facilitates the proliferation of mammary cells to maximize milk, fat, and protein yields in the next lactation (Capuco et al., 1997; Kuhn et al., 2005; Sawa et al., 2012). However, recent research has indicated that shortening or even omitting the dry period seems to shift milk production from the critical period shortly after calving to the weeks before calving, when the energy demands of the mammary glands for milk production can be easily matched by feed intake (Weber et al., 2013; Wiedemann et al., 2013). Moreover, short-dry-period management requires less abrupt changes in diet composition and may result in a more sustained level of feed intake, which is beneficial for the energy status (Rastani et al., 2005; Mantovani et al., 2010b) and may increase milk and milk component yields and improve the health and fertility of dairy cows during early lactation (Klusmeyer et al., 2009; O'Driscoll et al., 2012; McArt et al., 2013). In contrast, the potential risks of a reduced dry period include reduction in milk yield in subsequent lactation (Sørensen and Enevoldsen, 1991; Annen et al., 2004; Rastani et al., 2005), impaired udder health (e.g., higher milk SCC and increased mastitis incidence; Enevoldsen and Sørensen, 1992; Kuhn et al., 2006; Whist et al., 2006), and reduced colostrum quality, potentially affecting calf health (Annen et al., 2004; Rastani et al., 2005; Klusmeyer et al., 2009).

The present study compares traditional (60-d) and shortened (35-d) dry period (**SDP**) management strategies to evaluate their effects on DMI, milk production, body condition, metabolic status, colostrum quality, and birth weight (**BiW**) of the calves. The hypothesis was that shortening the dry period combined with feeding a late-lactation diet would be more beneficial, considering the DMI, milk production and other parameters, compared with the conventional dry period of 60 d and feeding a far-off and close-up dry-cow diet.

MATERIALS AND METHODS

Experimental Design, Animals, and Diets

The experiment included 29 high-yielding dairy cows, which were divided into 2 groups according to breed, parity, milk yield in the previous lactation, and live BW. There were 14 cows (12 Holstein-Friesian and 2 Czech Fleckvieh) in the control (**CON**) group and 15 cows (13 Holstein-Friesian and 2 Czech Fleckvieh) in the experimental group (SDP). Mean milk yield in the previous lactation (mean = 299 d) was 9,088 kg (SD = 2,061 kg) for the CON group and 8,801 kg (SD = 2,189 kg) for the SDP group. There were 7 primiparous and 7 multiparous (parities 1–3) cows in the CON group and 8 primiparous and 7 multiparous (parities 1–4) cows in the SDP group. Mean BW was 618 kg (SD = 76 kg) for the CON group and 596 kg (SD = 69 kg) for the SDP group.

Cows were housed in a freestall stable with beds littered with straw, and they were followed from −60 d precalving to d 100 of lactation. The diets were based on maize silage, lucerne silage, lucerne hay, ensiled crushed maize cobs with bracts, fresh brewer grains, and concentrate mixture. The ingredient composition of the diets is reported in Table 1. Table 2 shows the composition of the concentrate mixtures included in the diets. The diets were formulated according to NRC (2001) guidelines and fed in the form of TMR ad libitum. The CON group, assigned to the conventional dry period of 57 d (SD = 5.9 d), was fed a far-off dry cow ration (**TMRD**) from dry-off to 21 d prepartum. Approximately 21 d before planned calving, the concentrate mixture (3 kg/d) was added to their diet. The SDP group, assigned to an SDP of 35 d (SD = 6.3 d), was continuously fed a late-lactation diet (**TMR2**) from d −60 to calving. After calving, all cows in both groups were fed TMR2 first 7 d postpartum and the early-lactation diet from d 8 to 100 of lactation, corresponding to their lactation requirements.

Measurements, Sampling Procedures, Analytical Methods, Calculations, and Estimates

Cows were equipped with electronic identification chips to allow automatic measurement of their feed intake. Intake was recorded electronically by software using the automatic feeding system of Insentec BV (Marknesse, the Netherlands) with troughs on tensometric scales. Once per month, samples of feed (both TMR and ingredients) were taken. Dry matter content was determined by drying samples of feed at 102 ± 3 °C to a constant weight immediately after their collection. The standard AOAC International (2005) procedures were used to determine the content of CP, crude fat, starch, and ash in the feed. Crude protein content (6.25 × N) was determined using a Kjeltec 1030 Auto Analyzer (Foss Tecator AB, Höganäs, Sweden), and crude fat content was determined with a Soxtec 1043 extraction system (FOSS Tecator AB). Mineral element (i.e., Ca, K, Mg, and Na) concentrations were determined by atomic absorption spectrometry (Solaar M-6; TJA Solutions Ltd., Northampton, UK), and the