Strategies for Shortening the Dry Period

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Introduction

Shortening the dry period to less than 60 days has been promoted during the past few years. The major consideration for doing so has been a few recent studies indicating that losses in milk or fat-corrected milk yield the subsequent lactation may be minor if the dry period is reduced from approximately 60 to 30 days. However, the decision to implement a short dry period should be more complex than simply examining the extra income from milk by extending the lactation vs. the potential loss in income from milk the following lactation. Shortening the dry period may involve alteration of grouping strategies and facilities, modification of diets and dietary ingredients, changes in the incidence of metabolic disorders and disease, and effects on reproductive efficiency. All of these factors have economic importance and should also influence the decision of whether to shorten the dry period. Unfortunately, beyond the effects on milk yield, little is known about the consequences of short dry periods. The following discussion is intended to examine some of the issues that are of importance when deciding to shorten the dry period.

Dry period length

As noted above, most of the data available for determining dry period length is based on milk production data. Most studies are older studies and have been retrospective analysis of farm records (e.g. DHI) in which milk yield has been plotted against days dry. These studies do not involve cows that were purposely managed for short dry periods. Therefore, many of the observations for short dry periods represent cows that carried twins, cows with incorrect predicted calving dates, or cows that aborted or had abnormally short gestations. Most of the data from these studies indicated that a 50-60 day dry period was most beneficial. There have been several studies that were specifically designed to examine the effects of reducing the dry period to approximately 30 days on milk production (Lotan and Adler, 1976; Sorensen and Enevoldsen, 1991; Bachman, 2002; Annen et al., 2003; Gulay et al., 2003; Rastani et al., 2003). Results are summarized in Figures 1 and 2. Measurements reflect performance following the treatment period and do not include any data (e.g. additional milk) from the period prior to calving. Measurements made on cows with a shortened dry period are expressed as a percentage of the control cows that experienced a dry period of traditional length (~60 d dry). The length of time cows were followed after calving varies among studies and ranges from 70 to 305 days. Of the six studies summarized in Figure 1, two indicated a significant drop in milk yield. The study by Sorensen and Enevoldsen (1991) which indicated a significant drop in milk and fat-corrected milk yield was conducted on 8 commercial dairies in Denmark and included Danish Black and White, Red Danish, and Jersey cattle. There was a significant drop in milk yield but not fat-corrected milk yield in the study of Rastani et al. (2003). Several studies reported a numerical drop in milk yield that was not statistically significant. This likely reflects inadequate replication (cow numbers) to detect a significant difference. By pooling data from all six studies, it seems reasonable to conclude that one might expect a 5% drop in milk yield the following lactation if the dry period is shortened from 50-60 days to approximately 30 days.

Because treatments were similar across these trials (~60 vs. 30 days dry), important questions that have not been answered are: What is the optimum dry period length? Can one go shorter than 30 days? If one shortens the dry period to 35 or 40 days, will they not lose 5% in milk yield the next lactation? In the early seventies, Cornell researchers conducted the only study in which there was a designed titration of days dry. Cows on 65 commercial dairy farms (average size 65 cows) were assigned to 20, 30, 40, 50 or 60 day dry period for 42 mos. Cows were dried off regardless of treatment when milk production was less that 9 kg/d. Consequently, few cows assigned to the short dry period actually "qualified" for their treatment. For cows that adhered to their assigned days dry, they observed a net milk yield loss (additional milk from the previous lactation was considered) of about 5% when dry period was reduced below 40 days (Figure 3). This data suggests that it may be beneficial to aim for a 40 day dry period. Most dairy producers in the Midwest that have implemented a short dry period have targeted a 40-45 day dry period. Doing so allows a margin of safety for cows that calve earlier than expected.

Grouping Strategies

Shortening the dry period to 30 to 45 days eliminates the need to have two diets during the dry period and hence a far-off dry group and a prefresh transition group (see discussion below). This creates the potential of having one dry cow group. Successful implementation of one dry cow group necessitates that all cows respond similarly (favorably) to shortened dry periods. Unfortunately, we know very little about potential interactions between cows and dry period length. If there are groups of cows that are more likely to be negatively affected by short dry periods, then they must be considered for grouping separately and, therefore, creating the potential need for three dry cow groups (short dry group, long dry group/far off, long dry group/transition).

Research is inconsistent regarding parity by dry period length interaction. Several studies have indicated that reducing the length of the dry period to less than 60 days has a more detrimental effect between the first and second lactation than between later lactations (Sanders, 1928; Wilton et al., 1967; Dias and Allaire, 1982; Annen, 2004). However, other analyses have indicated no interaction between parity and optimal length for the dry period (Keown and Everett, 1986; Funk et al., 1987; Sorensen and Enevoldsen, 1991; Rastani et al., 2005).

Although some have speculated that high producing cows may have a need for a longer dry period, there is very little research available to determine if this is the case. By comparing second lactation milk yields to first lactation milk yields, it was noticed that the advantage of a longer dry period was greater for low producing herds than for high producing herds (Dickerson and Chapman, 1939). They speculated that low producing herds were fed a lower plane of nutrition and that a longer "rest period" was needed when cows were underfed. In contrast, higher producing cows, as measured 100 days prior to expected calving, required a longer dry period to obtain peak milk the subsequent lactation but the relationship was only evident for cows between their first and second lactation (Figure 4; Dias and Allaire, 1982). Additional studies are needed before a conclusion can be made whether there is a level of milk production by dry period length interaction.

A very strong interaction has been documented between calving interval and the dry period length to obtain maximum milk yield the following lactation (Figure 5; Dias and Allaire, 1982). Cows with longer calving intervals required fewer days dry, and the relationship was stronger as cows got older. Keep in mind that the data in this type of figure are estimates from statistical analysis and the predictions are less reliable for cow with characteristics at the extreme ends of the spectrum (e.g. oldest cows with longest calving interval). However, if a farm is large enough and flexible enough to create a specialty pen for cows that are good candidates for a short dry period, they should consider selecting older cows with longer caving intervals.

Feeding Strategies

Typical feeding management of cows on an 8 week dry period includes a far-off dry cow diet and a prefresh transition diet. The far-off diet is low in energy density and is designed to maintain body condition of the cow during the first five weeks of the dry period while the prefresh transition diet is fed during the final three weeks of the dry period and is designed to acclimate the cow and rumen microorganisms to the high-energy lactation diet that will be fed following calving. This traditional strategy involves two grouping changes and two diet changes within a three-week time frame. In some cases, this leads to increased stress from grouping and diet changes, larger than desired declines in feed intake, and metabolic complications postpartum.

Feeding one diet the entire 8-week dry period may help reduce the likelihood of this scenario. However, feeding a transition-type diet that is moderate in energy for 8 weeks may lead to over-conditioned cows and an increased incidence of metabolic disorders (Rukkwamsuk et al., 1999). Feeding one high fiber diet during the entire dry period may be successful. However, questions persist as to whether a dramatic jump from a high fiber diet to a low fiber diet at calving is best for the cow or the rumen microbes.

A compromise strategy may be to shorten the dry period and feed one diet with relatively high energy throughout the dry period. The target energy density for this diet would vary depending on the length of the dry period. In other words, as dry period length decreases, the energy density of the diet could increase because there would be less time to accumulate excess body condition.

We designed an experiment with three treatments (Rastani et al., 2005). Multiparous cows were fed a lactation diet from -90 to -57 days prior to expected calving. Cows were dried off and assigned to treatments at -56 days prepartum. The 3 treatments were: 1) 56 days dry; cows fed a low energy far-off diet from -56 to -29 days prepartum and a close-up transition diet from -28 days to parturition 2) 28 days dry; cows continued on the lactation diet (minus buffer) throughout the dry period; and 3) 0 days dry; cows continued on the lactation diet (minus buffer) until calving. After calving, all animals were fed a postpartum lactation ration.

Actual days dry for the 56, 28 and 0 days dry treatments were 54, 29 and 5. Some cows on the 0 days dry treatment spontaneously stopped lactating (i.e. dried themselves off). Continuation of milking resulted in higher dry matter intakes prior to calving (Figure 6). However, even cows on the 0 day treatment experienced a decline in feed intake as calving approached. Differences in feed intake between treatments continued, but to a lesser magnitude, after calving. There was no significant difference in 4% FCM production between 56 and 28 day treatments (Figure 7); cows on 0 day treatment produced about 5 kg FCM less per day than those on 28 d. Cows on the 28 day treatment produced milk with a higher fat test, consequently there were differences in milk yield between cows on the 56 and 28 day treatments (data not shown).

Loss of body condition score (Figure 8) and body weight postpartum increased as days dry increased. This reflected a more favorable energy balance as days dry decreased. As one might expect, shortening the dry period resulted in a reduction in plasma nonesterified fatty acids (**NEFA**, Figure 9), and liver triglyceride (**TG**, Figure 10). However, the differences were only significant between cows with 0 and 28 day dry.

There were no differences in calf size due to treatment (42.7, 42.9, and 43.1 kg for 56, 28 and 0 day treatments). Incidences of metabolic disorders are shown in Table 1. Insufficient animal numbers dictated that we refrain from a statistical analysis of this data.

Dry Cow Treatment Strategies

There is very little data from which to base dry cow treatment strategies. Dry cow therapy may be more effective in cows with shortened dry periods and there may be a reduced rate of new infections in cows with shortened dry periods (Natzke et al., 1975; Rindsig et al., 1978). Unfortunately, dry cow therapy may result in the carry-over of antibiotic residues into milk post-calving. Current dry cow therapies are targeted for cows with a 45 to 60 day dry period. Antibiotics from dry cow therapy reside in cows much longer than do those of lactating cows. Consequently, if cows receive a dry cow treatment and have a dry period less than 45 days, antibiotic residues may be present in milk post-calving. Implementation of a short dry period with the use of standard dry cow antibiotic therapies should be accompanied by postpartum testing of milk for residues. A reasonable approach may be to use a lactating cow antibiotic treatment during the final milkings combined with a teat sealant following the final milking.

Reproductive Strategies

One of the most dramatic effects in our study described above was on reproduction. Ovarian dynamics were monitored by ultrasound three times per week. Clearly, reducing the dry period resulted in a more rapid resumption of ovarian activity (Gumen et al., 2003). Although this trial ended at 70 days postpartum, reproductive performance of cows was monitored beyond 70 d. Cows that were on the 0 days dry treatment had higher first service conception rate, fewer services per conception, and fewer days open. However, because these cows were not on experiment beyond 70 d and limited cow numbers were used, these results must be interpreted with caution. It is not known whether these differences in reproductive performance were a consequence of differences in days dry, energy balance, or milk yield. The results, if verified through additional studies, could impact reproductive management strategies. Higher conception rates could allow one to increase the voluntary waiting period since fewer breedings would be required per pregnancy.

Future Strategies for Reducing Dry Period Length

Available data indicates that a 30-day dry period may be feasible, but a 0 day dry period results in significant milk yield losses the subsequent lactation (20-25% loss). Will there be strategies in the future by which the dry period can be reduced beyond 30 days without significant losses in subsequent milk yield? University of Arizona research indicates that the loss can be avoided in multiparous, but not primiparous cows, if they are continuously treated with bST. However, this was off-label use and a control treatment in which cows with a 60 d dry period were continuously treated with bST was not included. Further studies indicated that prostaglandin E_2 (Annen et al., 2004) or 4x milking postpartum (Fitzgerald et al., 2004) could not prevent the yield loss associated with continuous milking of primiparous cows. We are currently examining the effects of milking frequency during continuous milking for the final four weeks of pregnancy on post-calving milk production. Preliminary results indicate that increasing milking frequency prepartum (4x/day) may result in a milk yield loss the subsequent lactation of approximately 15%. More basic research is needed to investigate the factors that affect lactation persistency, including mammary cell proliferation and mammary cell death, so that future strategies can be developed to shorten or eliminate the dry period.

Take home messages

1. The decision to shorten the dry period is dependent on many factors, including milk yield and milk composition during the extra days of milking and into the subsequent lactation, calf survival, incidence of metabolic disorders, reproductive efficiency, and management factors (i.e. facilities, parlor capacity).

2. Shortening the dry period to 30 days may be economically feasible due to only a 5 percent loss in milk yield (vs. 60 d dry). However, eliminating the dry period results in a 20-25 % loss in milk yield in the subsequent lactation.

3. Shorter dry periods can facilitate fewer group and diet changes and lead to increased dry matter intake and a more favorable energy balance. These beneficial changes may result in decreased metabolic problems including reduced liver fat concentrations.

4. Preliminary evidence indicates that reducing dry period length may increase conception rates, which can lead to greater flexibility in breeding programs. However, more replication is needed in field trials to verify potential benefits of short dry periods on reproduction.

Table 1. Number of cows treated for various postpartum disorders.

	56 d	*28 d*	*0 d*
Displaced abomasum	1	1	2
Hypercalcemia	1	3	1
Ketosis	1	1	0
Mastitis	2	6	3
Metritis	2	0	0
Retained placenta	3	1	2

Table 2. Ovarian dynamics and reproductive performance of cows fed and managed for 56, 28, and 0 d dry periods.

	56 d	*28 d*	*0 d*
Follicle diameter (mm) at first ultrasound	6.3[b]	8.2[ab]	9.5[a]
Days to first 10 mm follicle	10.5[b]	8.9[a]	8.0[a]
Days to first postpartum ovulation	32[b]	24[b]	13[a]
Days to first AI	75	68	69
First service conception rate, %	20[b]	26[ab]	55[a]
Services per conception	3.0[b]	2.4[ab]	1.7[a]
Days open	145[b]	121[ab]	94[a]

[a,b] differ at $P < 0.05$.

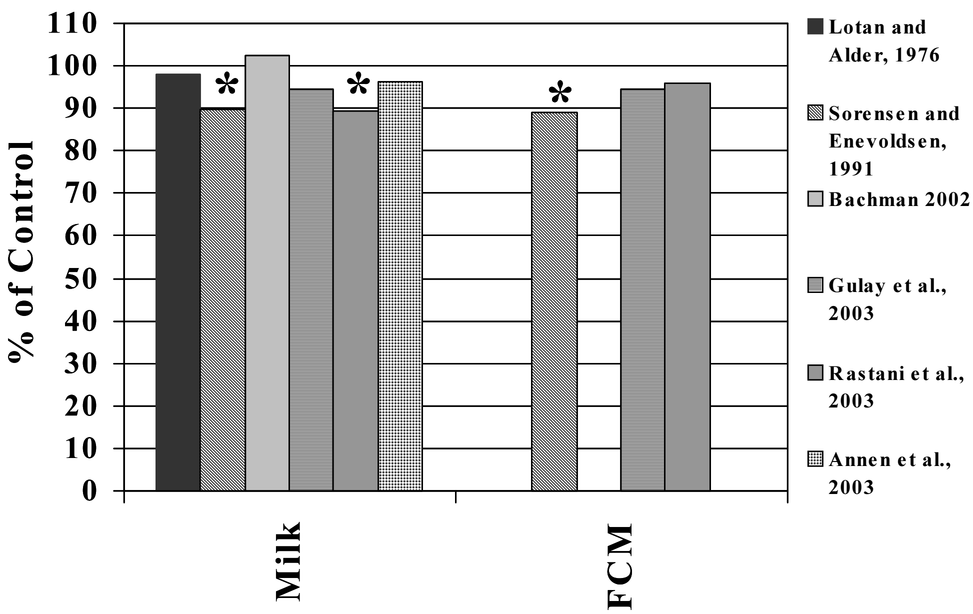

Figure 1. Milk and Fat-corrected milk yield responses of cows that had the dry period shortened to approximately 30 days. Values are expressed as a percentage of control cows that had dry periods of approximately 50 to 60 days. Responses are for periods following calving that ranged from 70 to 305 days depending on the study. *Represents a significant difference from control.

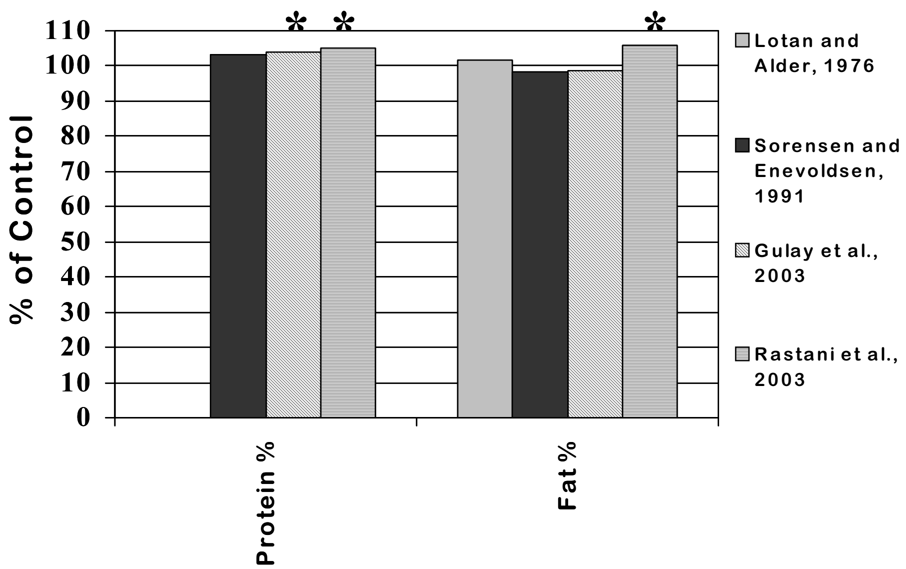

Figure 2. Milk fat and protein percentage responses of cows that had the dry period shortened to approximately 30 days. Values are expressed as a percentage of control cows that had dry periods of approximately 50 to 60 days. Data is for the period following calving that ranged from 70 to 305 days depending on the study. *Represents a significant difference from control.

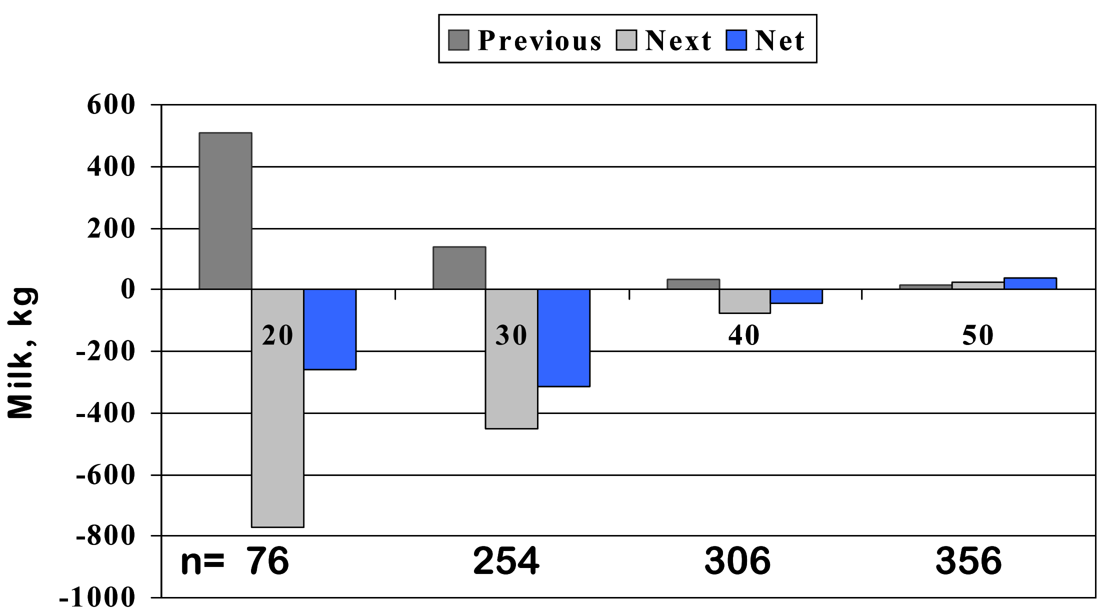

Figure 3. The effects of planned dry period lengths (20, 30, 40, or 50 days) on milk yield of cows on commercial dairy farms (Coppock et al., 1974)

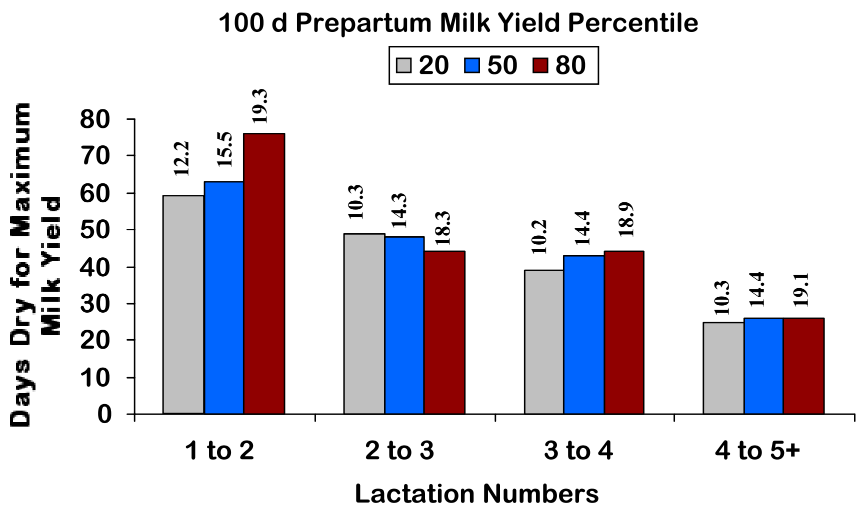

Figure 4. Effects of lactation number and milk yield at 100 days prior to calving on the number of days dry required to achieve maximum milk yield the subsequent lactation (Dias and Allaire, 1982). Numbers on top of the bars represent the milk yield (kg/d) for cows in the 20th, 50th and 80th percentile at 100 days prior to calving.

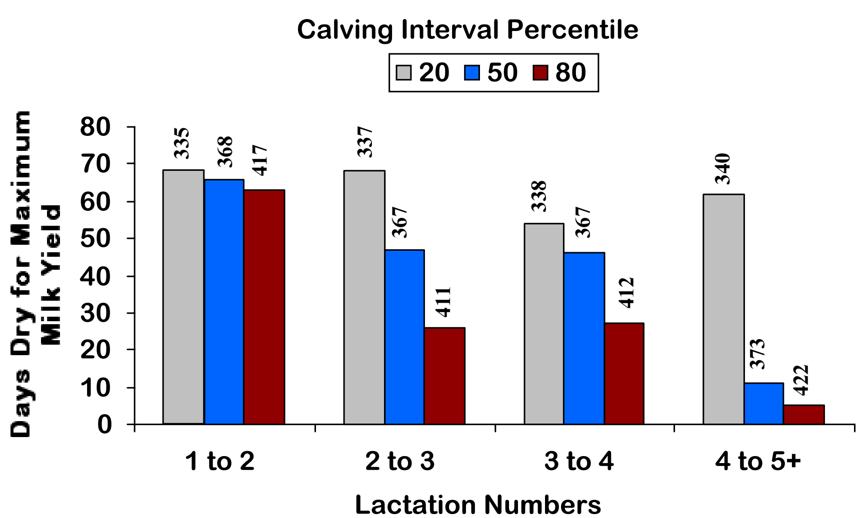

Figure 5. Effects of lactation number and calving interval on the number of days dry required to achieve maximum milk yield the subsequent lactation (Dias and Allaire, 1982). Numbers on top of the bars represent the calving interval (in days) for cows in the 20th, 50th and 80th percentile.

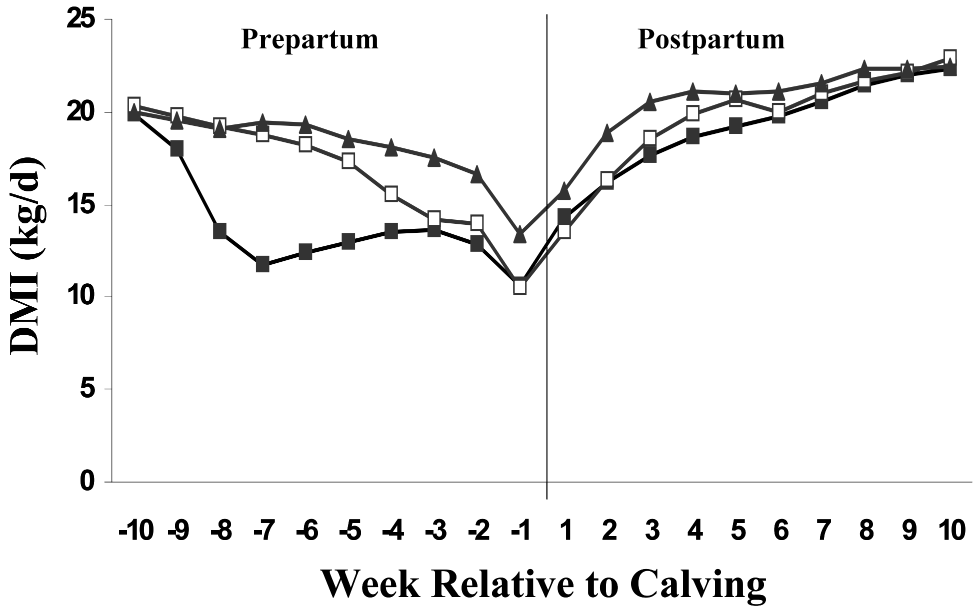

Figure 6. Dry matter intake (kg/d) of cows fed and managed for 56 (■), 28 (□), or 0 (▲) d dry periods. Prepartum: 56 d dry vs. 28 d dry , $P < 0.001$; 28 d dry vs. 0 d dry, $P < 0.001$; treatment x time, $P < 0.001$. Postpartum: 28 d dry vs. 0 d dry, $P < 0.15$.

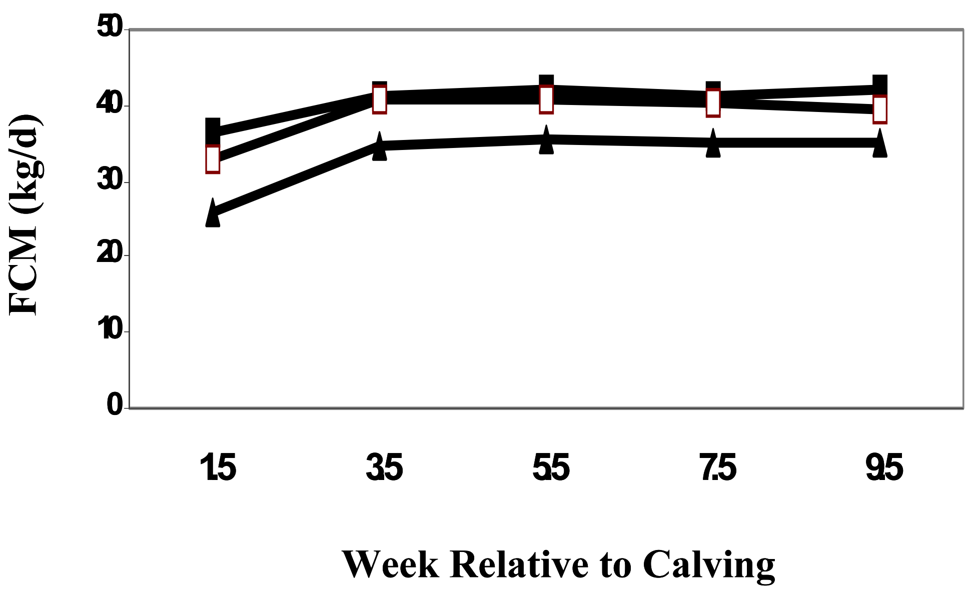

Figure 7. 4% Fat-corrected milk production of cows fed and managed for 56 (■), 28 (□), or 0 (▲) d dry periods. Treatment vs. week interaction, P < 0.1; 28 d dry vs. 0 d dry, $P < 0.01$.

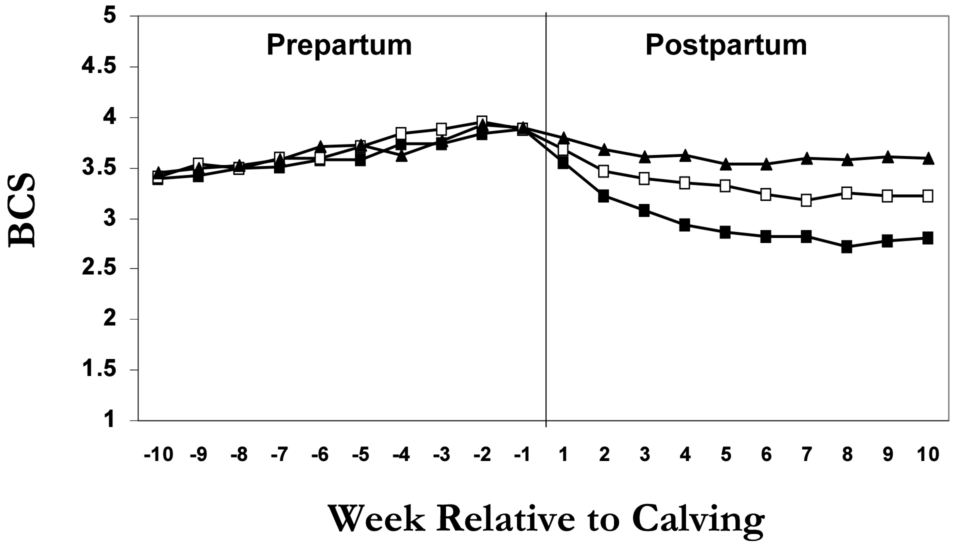

Figure 8. Body condition scores of cows fed and managed for 56 (■), 28 (□), or 0 (▲) d dry periods.

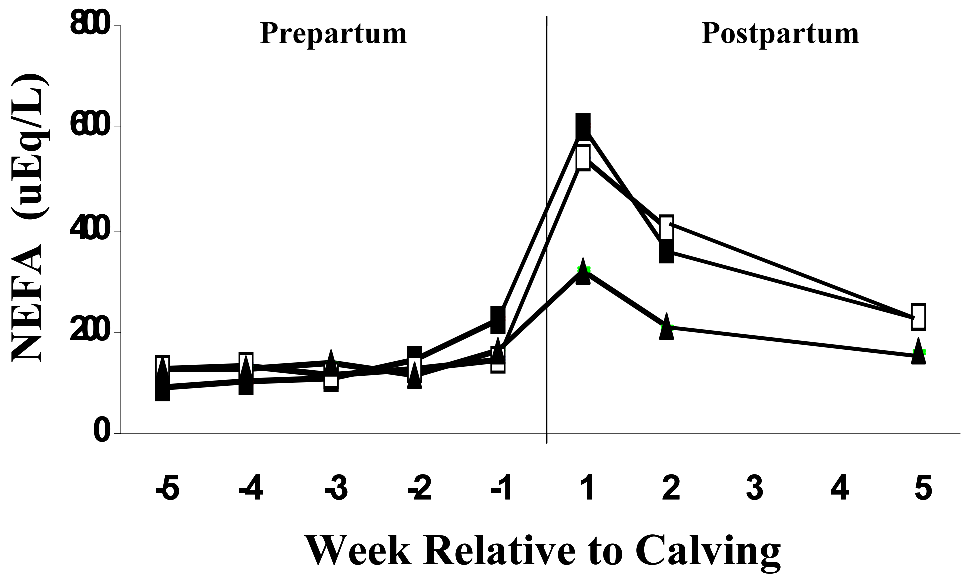

Figure 9. Plasma NEFA concentrations in cows fed and managed for 56, 28, or 0 day dry periods.

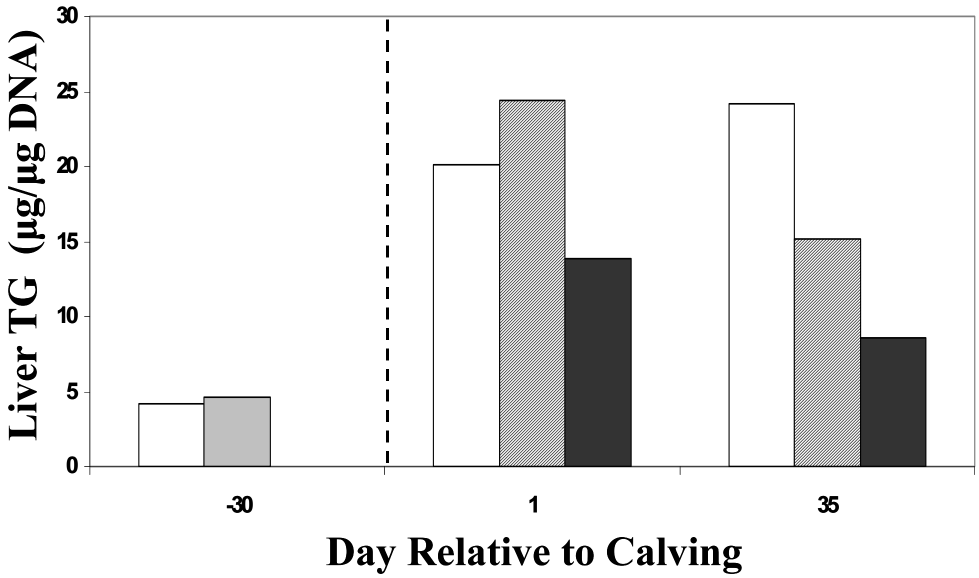

Figure 10. Liver triglyceride (TG) at 30 days prepartum and 1 and 35 days postpartum when cows are managed for 56, 28 or 0 day dry periods.

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