Transition Cow Programs -- The Good, The Bad, and How to Keep Them from Getting Ugly

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Take Home Messages

- Transition cow management underpins production and profitability on dairy farms
- Aggressive monitoring programs for fresh cows prevent cascades of metabolic disorders and improve profitability
- We must "manage metabolism" of transition cows by maximizing dry matter intake and ruminal fermentation to optimize glucose supply and minimize problems with metabolism of nonesterified fatty acids (NEFA) by the liver

Introduction

The transition period, beginning approximately three weeks before calving and ending approximately three weeks postcalving, clearly is the most important part of the lactation cycle for profitability of individual dairy enterprises. Factors such as the amount of milk produced at peak, veterinary expenses related to occurrence of postpartum metabolic disorders, and reproductive performance all are closely tied to the transition period and to income and cost control parameters in our dairy farm business summaries. Therefore, it is important that we are able to gauge the success of transition cow programs on individual farms, recognize the interrelationships among metabolic disorders, understand the underlying biology that must be optimized in order for cows to have excellent transitions to lactation, and understand how to apply management in order to optimize the biology of our transition cows.

Assessing and Monitoring Transition Cow Programs

We can start by surveying and benchmarking the fresh cow health performance of our herds. Table 1 summarizes the incidence of fresh cow disorders recorded in eight separate studies of high-producing herds. We can use these numbers to set realistic goals for incidence of different metabolic disorders. Of course, our incidence rates can be affected by the definition and perception of each disorder on individual farms (i.e., a cow may be diagnosed as ketotic in a herd that is aggressively monitored but would go undetected in a herd that is not monitored closely).

There are also a number of important interrelationships among these metabolic disorders. In an experiment conducted a number of years ago on 31 commercial herds in New York involving almost 1,400 cows, Curtis et al. (1985) associated cow and prepartum diet characteristics with occurrence of metabolic disorders postcalving, together with interrelationships among disorders (Figure 1). They calculated odds ratios (OR) for occurrence of the metabolic disorders. Essentially, if an OR is greater than 1, then a cow with a particular disorder is more likely than one that did not have that particular disorder to develop the next disorder in the path. For example, data in Figure 1 indicate that cows that had a retained placenta were 5.7 times more likely than their counterparts to develop metritis and 16.4 times more likely than their counterparts to develop ketosis. Similarly, cows with parturient paresis (milk fever) were 4 times more likely to also have a retained placenta than their counterparts and 23.6 times more likely to develop ketosis.

Table 1. Incidence of fresh cow disorders (%) in high-producing herds.[1]

Study	# herds	# cows	Milk fever	Retained placenta	Metritis	Ketosis	DA
Jordan, 1993	61	14,823	7.2	9.0	NR[2]	3.7	3.3
Dyk, 1995	100	2,260	8.0	12.0	NR	12.0	11.0
Bigras-Poulin, 1990	34	2,204	5.6	7.7	10.7	3.3	NR
Scott, 1995	5	443	8.5	9.0	21.1	8.5	6.3
Grohn, 1995	25	8,070	1.6	7.4	7.6	4.6	6.3
Gearhart, 1990	9	561	9.1	10.3	7.5	NR	NR
Kelton, 1996	110	NR	NR	9.0	NR	3.0	2.0
Crill, 1998	10	3,884	3.3	11.9	NR	NR	1.4
Realistic goals			3-5%	5-7%	5-7%	3-5%	3-5%

[1] Compiled by W. S. Burhans, Cornell University, 1999.
[2] NR = not reported.

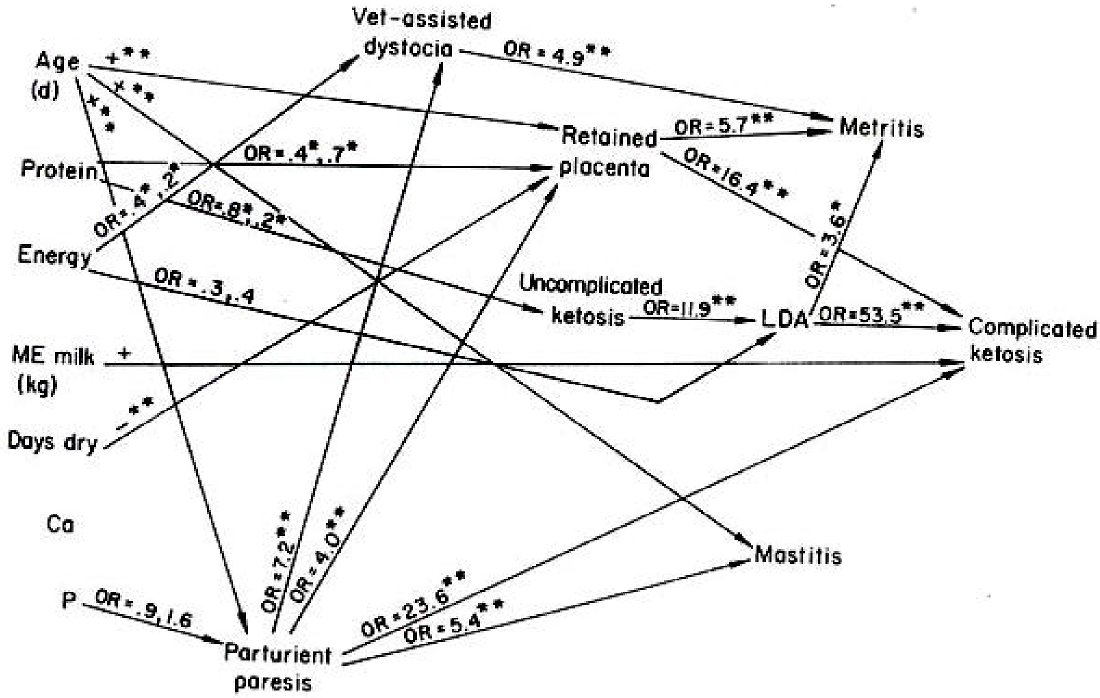

Figure 1. Paths of metabolic disorders (Curtis et al., 1985).

These costs, particularly when multiple disorders are suffered by an individual cow, can be significant. Dr. Chuck Guard from the College of Veterinary Medicine at Cornell recently compiled comprehensive estimates of costs associated with an occurrence of each of these disorders (Table 2). The estimated cost associated with an occurrence of each disorder varies; nevertheless, if a 500-cow herd has an incidence of milk fever of 15% compared with our realistic goal of 3%, we can calculate an opportunity of approximately $14,000 US based upon milk fever alone. This does not take into account the increased risk of these cows to develop secondary disorders such as ketosis nor the costs associated with hypocalcemia that is not severe enough to result in milk fever.

Table 2. Costs of fresh cow disorders.[1]

Disorder	Deaths, %	Culls, %	Delayed conception, days	Discarded milk, kg	Lost milk, kg	Average cost, US $
Milk fever	4	5	13	0	130	181
Dystocia	1	2.2	12	160	178	161
Retained placenta	1.5	6	15	150	250	206
Ketosis	.5	5	10	0	230	151
Left displaced abomasum	2	8	12	140	400	312

[1] Compiled by Dr. Chuck Guard, 1998.

Aggressive postpartum health monitoring programs are essential for early detection and treatment of metabolic disorders in transition cows. A number of different schemes have been reported in trade journals, most involving some type of physical examination as detailed in Table 3.

Table 3. Physical evaluation of fresh cows.

Sign	OK	Problem
General appearance	Bright, alert	Dull, lethargic
Body temperature (rectal)	> 100 and < 102.5	< 100 or > 103
Rumen motility	1 to 3 contractions per minute	Less than 1 per minute
Ketosis	Negative on urine strips	Positive on urine strips

Another method that can be used to monitor transition cow programs is to evaluate the rate of milk yield increase during early lactation using a system that records milk weights at each milking combined with analyses of these records to “flag” cows that are not meeting expectations. One progressive dairy in New York has combined daily milk yield monitoring and physical evaluation of cows into a very aggressive program of fresh cow monitoring and preventive treatment. The manager of this dairy expects a 10% increase per day in milk production in second lactation and greater animals for the first 14 days in milk and an 8% increase per day in heifers during the first 18 days in milk. Animals that fail to achieve this rate of increase, or are not producing 45 kg of milk per day by 20 days in milk (32 kg of milk per day by 20 days in milk for heifers) are flagged by the data analysis system, subjected to a thorough physical exam including some of the elements listed in Table 3, and aggressively treated. This manager recognizes prevention and intervention as key principles of management, and uses the “management by exception” approach to focus labor on this dairy.

▪ Key Metabolic Adaptations in Dairy Cows During the Transition Period

The primary reason that aggressive monitoring programs are successful is that they directly support the changes in metabolism that occur in transition cows. The two key metabolic adaptations that must occur if cows are going to have successful transitions to lactation are:

1) The cow alters her glucose metabolism to meet the dramatically increased glucose demand after parturition.
2) The cow mobilizes large amounts of body fat in support of lactation, with important ramifications for liver function and metabolic health.

Both of these adaptations are complex and dynamic in that they change daily for the last week before calving and the first two weeks after calving. Challenges to either adaptation quickly result in other metabolic effects leading to development of metabolic disorders.

Alterations in Glucose Metabolism During the Transition Period

Figure 2 depicts typical predicted relationships between glucose demand and supply during the transition period as calculated from a recent experiment in our laboratory. These estimates indicate that predicted supply of glucose is greater than predicted demand for glucose during much of the closeup dry period; however, predicted supply is considerably less than predicted demand during the first 21 days of lactation. The vast majority of this glucose must be synthesized in the liver of the cow from precursors such as propionate, amino acids, lactate, and glycerol. It is important, therefore, that we focus attention toward optimizing liver health during the transition period, as will be discussed in a subsequent paper at this conference.

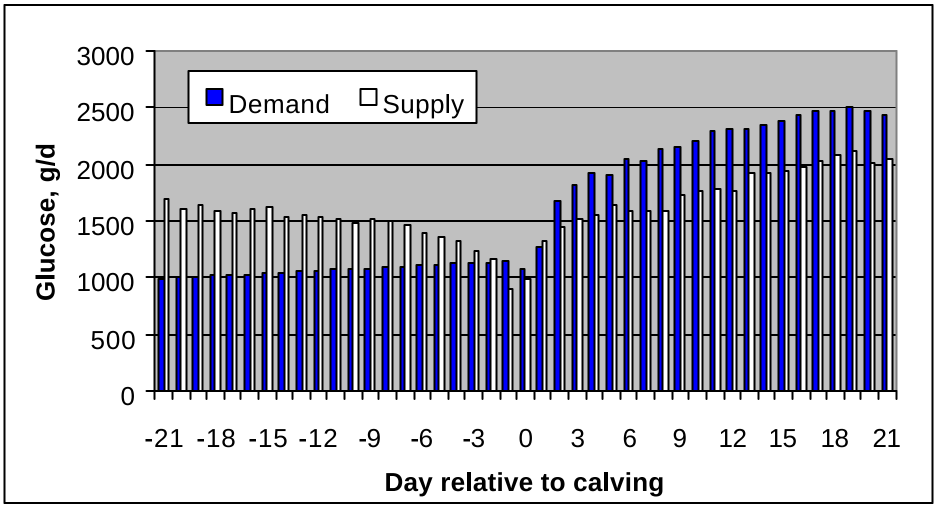

Figure 2. Predicted whole-body glucose demand and supply during the transition period in dairy cows (Performance data from Piepenbrink and Overton, 2000; approach of Overton (1998) as adapted from Bell (1995)).

Mobilization of Body Fat and Ramifications for Liver and Metabolic Health During the Transition Period

Negative energy balance immediately preceding and following calving results in mobilization of body fat and release of nonesterified fatty acids (NEFA) into the blood (Figure 3). It is logical, therefore, that dry matter intake and NEFA concentrations usually are inversely related (Figure 4). The NEFA are utilized to make upwards of 40% of milk fat during the first days of lactation (Bell, 1995) and as a fuel for muscle; however, the liver takes up NEFA in proportion to their supply. Disposal of NEFA by liver either for fuel use or export as lipoproteins is limited; therefore, almost all cows accumulate some fat as triglycerides in liver during early lactation. The net result of this fat accumulation appears to be decreased ability of the liver to synthesize glucose; therefore, our guiding principle is that managing NEFA metabolism to minimize accumulation of fat in liver during early lactation is critical for optimal metabolic health and productivity. This issue will be discussed in much more detail in a subsequent paper at this conference.

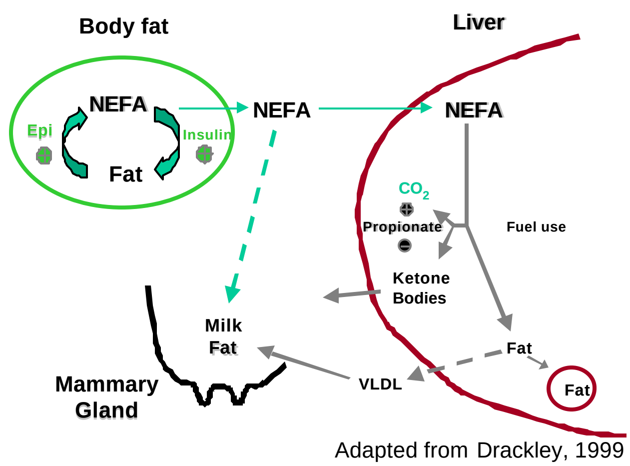

Figure 3. Schematic of metabolism of nonesterified fatty acids (NEFA) in the dairy cow (Adapted from Drackley, 1999).

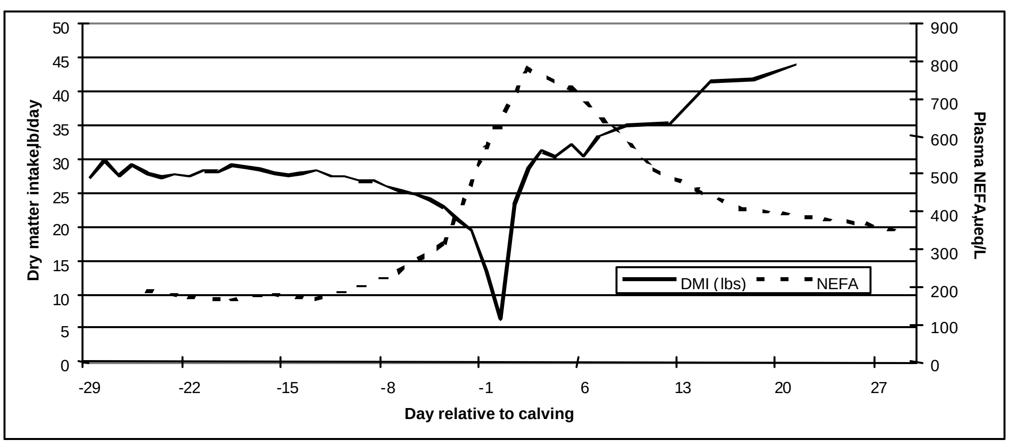

Figure 4. Typical relationships between dry matter intake (DMI) and nonesterified fatty acid (NEFA) concentrations in plasma during the transition period (Burhans et al., unpublished data).

Elevated blood NEFA concentrations prepartum are risk factors for occurrence of metabolic disorders during the transition period. Dyk (1995) conducted a large field study (~1650 cows) in Michigan several years ago in which blood samples were collected from cows ranging from 35 to 3 days prepartum. Analyses for NEFA were conducted, and cows were divided into three groups representing high, medium, or low NEFA concentrations relative to the average NEFA concentration for each day prepartum (Figure 5). Increased concentrations of NEFA prepartum were correlated with all major transition cow metabolic disorders except milk fever (Figure 6). Elevated NEFA concentrations prepartum occur as a result of inadequate energy intake relative to demand; therefore, troubleshooting using NEFA as a tool is relatively straightforward in terms of assessing dry matter intake of closeup cows and diet formulation for this group.

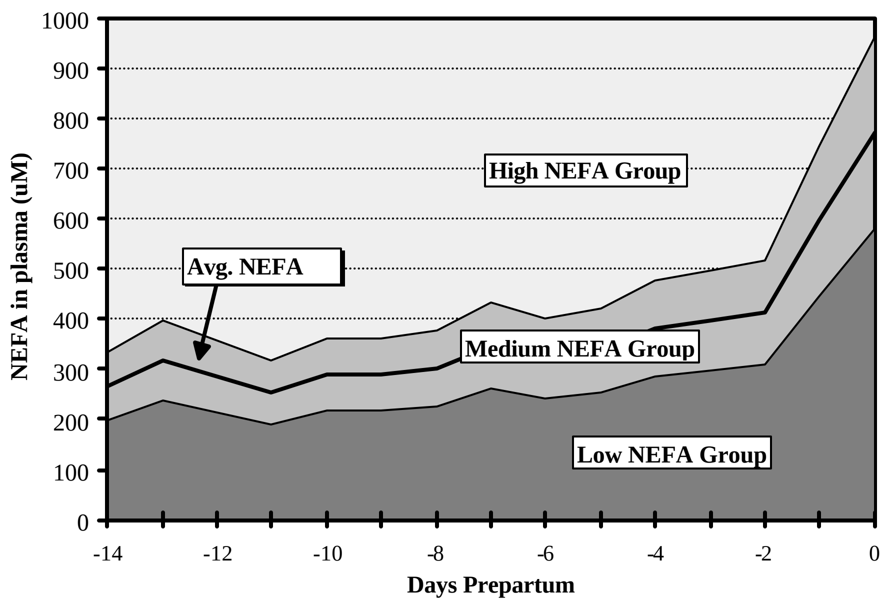

Figure 5. Average concentrations of NEFA, and stratification into low, medium, and high NEFA groups in commercial study involving 1650 cows across 95 farms in Michigan (Dyk, 1995).

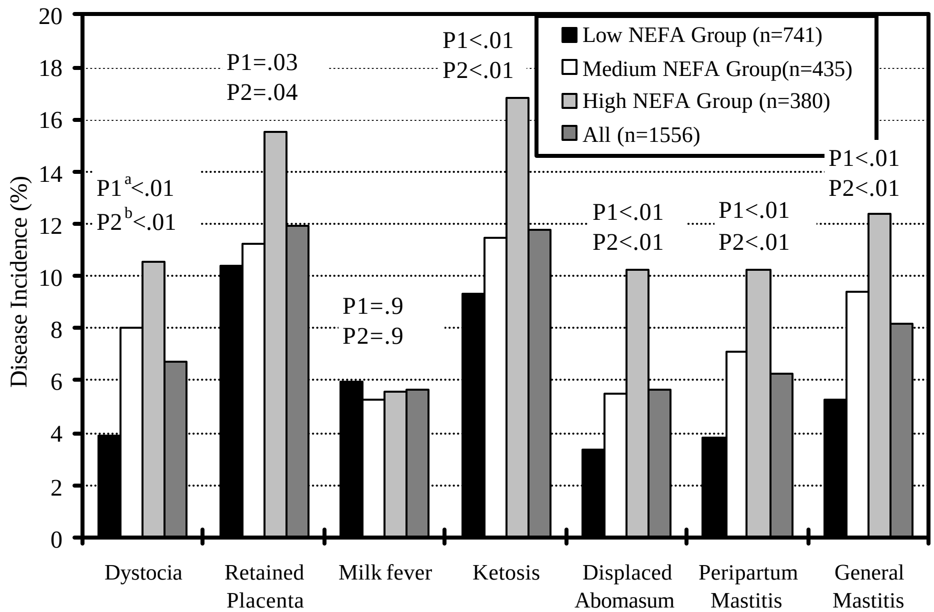

Figure 6. Incidence of disease by NEFA group (Dyk, 1995).

■ Factors Affecting Dry Matter Intake of Cows During the Closeup Dry Period

If elevated NEFA concentrations prepartum predispose cows to developing metabolic disorders postcalving, then it makes sense to examine factors that affect dry matter intake of cows during the closeup dry period. Hayirli et al. (1998, 1999) analyzed a large dataset compiled from University experiments in which dry matter intake was measured on individual cows and dietary treatments varied such that factors influencing intake could be determined. They found that increasing body condition score was a major cow factor causing decreased dry matter intake during the closeup period. In terms of dietary factors, as the concentration of nonfiber carbohydrate increased in the prepartum diet, dry matter intake increased. As the concentration of ether extract (crude fat) increased in the prepartum diet increased, dry matter intake decreased. Thus, our recommendations for body condition score of dry cows is 3.25 to 3.5, with neither gain nor loss of body condition during the dry period. We typically recommend dietary nonfiber carbohydrate concentrations of 34 to 36% of the diet dry matter, and try to avoid supplemental dietary fat to closeup dry cows.

Top Ten Reasons Transition Cow Programs Get Ugly

- Lack of a standard monitoring and treatment protocol for fresh cows.
- Failure to achieve high levels of dry matter intake due to PP feeding management and poor quality forages
- Overcrowding of closeup and fresh cows
- Poor reproductive performance resulting in overconditioned dry cows
- Cleanliness of calving areas
- Large numbers of grouping and diet changes during transition period
- Fresh cows in the low group
- Poor heifer programs
- Inadequate water availability
- Substandard ration formulation

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