Effect of Oral Glycerol Drench On Transition Dairy Cattle

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Introduction

The Texas dairy industry is a prime example of the consolidation of agricultural industries. With an increase in average herd size, producers have come under pressure to maximize the milking potential of their herds in an attempt to meet the consumer demand for milk.

Much has been done toward increasing the milking potential of the cow, but there are more areas of investigation underway that prove to be promising for further improvement. These areas deal with the physiological and biochemical phenomena that occur within the dairy cow. The current studies were involved with the negative energy balance that is common around parturition. This negative energy balance is induced by a tremendous energy requirement for milk production, compounded by a decrease in dry matter intake (**DMI**). The idea is to minimize the ill effects of this occurrence in order to aid the cow in making a smooth transition from the dry phase into lactation.

The dairy cow is genetically driven to produce milk, even at the expense of her own metabolic needs. Around parturition, a great amount of stress is placed on the animal. This stress can effectively reduce DMI, thus reducing the availability of nutrients needed for maintenance and milk production. When the body's glucose reserves have been spent, the body mobilizes fat reserves for energy. Blood serum analysis can determine the concentrations of glucose and non-esterified fatty acids (**NEFA**) as an indication of this metabolic switch. This metabolic switch is normal and should not be a cause for concern. However, if this condition persists and DMI is not restored, metabolic disorders can arise. These possible disorders include, but are not limited to: ketosis, displaced abomasum (**DA**), milk fever, and retained placenta.

These studies were performed in the spring and fall of 2001 on a Texas commercial dairy. The studies evaluated the effects of oral drenching glycerol, a glucogenic precursor, to dairy cows at calving. The effectiveness of the drench was evaluated with primary regard to milk production and health events of the subject animals. Blood parameters were also measure to estimate metabolic status of the animal through transition.

Objectives

The overall objective of these studies was to determine the effectiveness of oral drenching glycerol within 6 hrs post-calving and again 24 hrs post-calving. The studies were done during heat stress (fall) and non- heat stress (spring) time periods to evaluate metabolic responses during heat stress.

Table 1. Number of animals per trial and treatment group

	Spring		Fall		
	Control	Glycerol	Control	Glycerol	Totals
Heifers	17	13	32	36	98
Cows	31	40	50	57	178
Totals	48	53	82	93	276

Table 2. Effect of glycerol drench on plasma parameters**.**

	Drench		Drench * Age				P level		
			Heifers		Cows				
	Control	Glycerol	Control	Glycerol	Control	Glycerol	Age	Drench	Age*Drench
Calcium	7.503	7.518	7.900	7.709	7.105	7.326	.0001	.9191	.1606
Magnesium	1.892	1.820	1.854	1.792	1.929	1.848	.0937	.0688	.8156
BOHB	6.735	5.617	6.266	5.518	7.203	5.716	.2280	.0180	.4319
Glucose	65.098	66.513	67.156	66.771	63.040	66.255	.2161	.4495	.3361
NEFA	.557	.591	.542	.692	.572	.491	.0160	.3332	.0012

[a]Beta-hydroxybutyrate.
[b]Non-esterified fatty acids.

The effectiveness of the treatment was evaluated with regard to:

- Milk production,
- Blood parameters to indicate metabolic status of the animals, and
- Health events to evaluate treatment effectiveness.

Materials and Methods

The spring study utilized 71 Holstein cows and 30 heifers while the fall study involved 107 Holstein cows and 68 heifers (Table 1). Holstein cows and heifers on the dairies were assigned to one of two treatments. Treatment 1 involved an oral drench of 9.5L water within 6h post-calving and again 24h post-calving. Treatment 2 involved an oral drench of 1.5L glycerol in 8.0L water within 6h post-calving and again 24h post-calving. Drenching was done via esophageal pump (Springer-McGrath Esophageal Feeder System, McCook, NE). Blood samples were collected prior to each drench and again on days 4 and 10 post-calving. Blood plasma was separated by centrifugation and frozen for subsequent analysis.

Results

The results reported are from the spring study. Data from the fall study is currently being analyzed. Blood measurements and milk production collected during the spring study were not statistically significant. This may have been due to low animal numbers (heifers) evaluated; therefore, no statistical conclusion can be confidently determined. However, trends suggest that substantial benefits may arise from the utilization of the glycerol drench to transition dairy cows. Table 2 shows the levels of plasma nutrients (Ca, MG, Glc)

Table 3. Effect of glycerol drench on plasma BOHB[a] and NEFA[b] values.

	Heifers				Cows			
	0	1	4	10	0	1	4	10
BOHB								
Control	3.896	4.925	7.518	8.726	6.361	7.425	7.331	7.696
Glycerol	5.202	3.853	6.890	6.131	5.278	4.782	6.349	6.454
NEFA								
Control	.739	.593	.494	.343	.884	.682	.435	.287
Glycerol	.910	.561	.784	.512	.770	.432	.435	.328

[a]Beta-hydroxybutyrate.
[b]Nonesterified fatty acids.

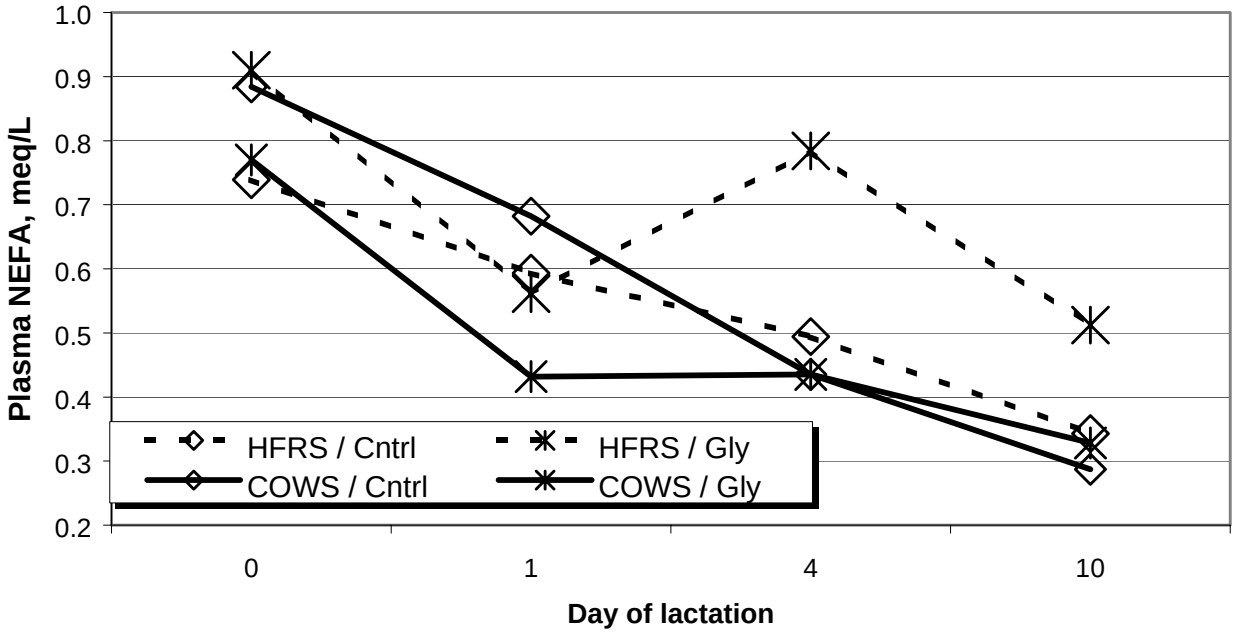

Figure 1a. Response in plasma non-esterified fatty acids to administration of glycerol at calving and 24 hr post-calving. Blood samples collected on days 0 and 1 were prior to drench administration.

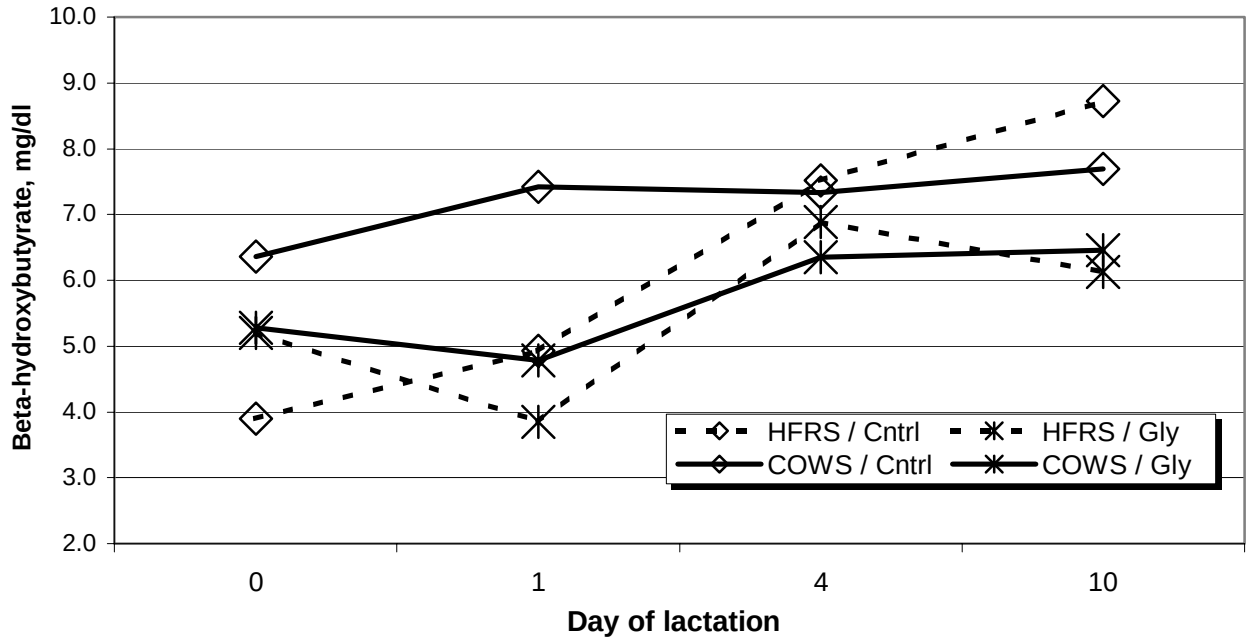

Figure 1b. Response in plasma beta-hydroxybutyrate to administration of glycerol at calving and 24 hr post-calving. Blood samples collected on days 0 and 1 were prior to drench administration.

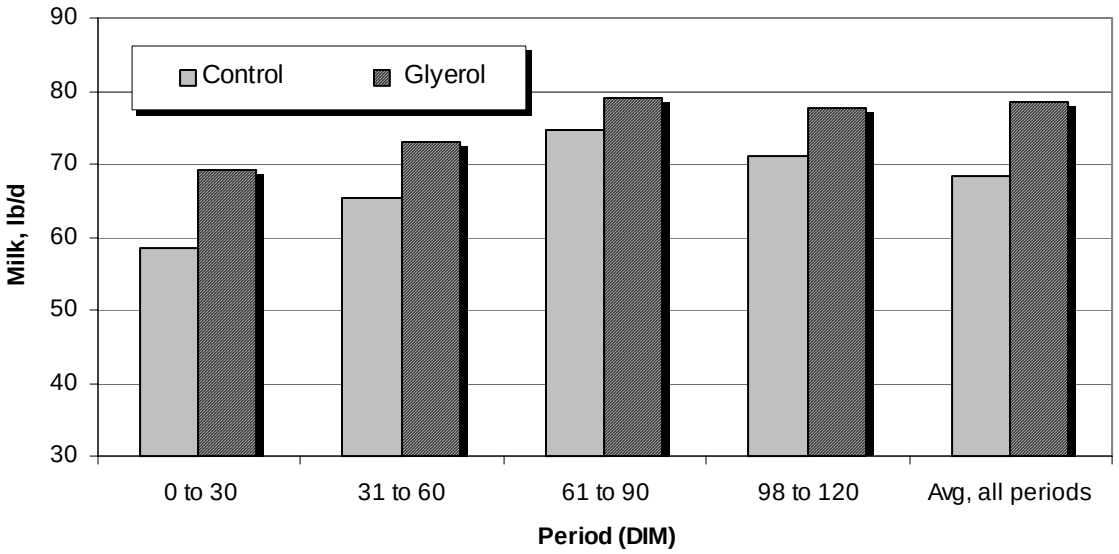

Figure 2a. Response in milk production by heifers to administration of glycerol at calving and 24 hr post-calving.

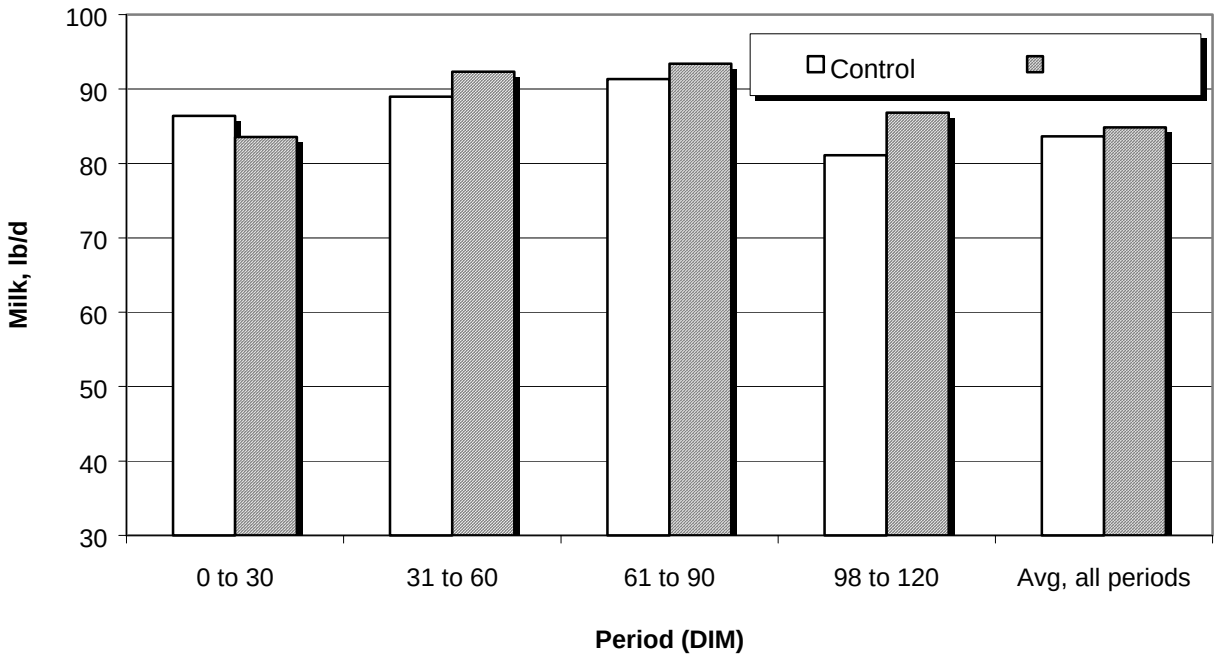

Figure 2b. Response in milk production by cows to administration of glycerol at calving and 24 hr post-calving.

Table 4. Effect of glycerol drench on milk production (average pounds per day) by period[a].

	Drench		Drench*Age						
			Heifers		Cows				
	Control	Glycerol	Control	Glycerol	Control	Glycerol	Age	Drench	Age*Drench
Period 1	72.4	76.4	58.4	69.1	86.4	83.6	.0037	.5764	.3379
Period 2	77.4	82.7	65.3	73.1	89.0	92.3	.0001	.2475	.6452
Period 3	83.0	86.3	74.7	79.1	91.4	93.4	.0033	.5329	.8212
Period 4	76.1	82.3	71.0	77.7	81.1	86.9	.0498	.2041	.9240
Average	76.0	81.7	68.3	78.5	83.6	84.8	.0764	.3455	.4542

[a]Period 1 = 8 – 30 DIM; Period 2 = 31 to 60 DIM; Period 3 = 61 to 90 DIM; Period 4 = 98 to 120 DIM; Average milk = average milk production including all periods of milk.

and metabolic indicators (beta-hydroxybutyrate (**BOHB**) and NEFA). Plasma calcium, magnesium, and glucose values were similar for both groups. Glycerol administration did reduce both BOHB and NEFA levels at day1in both heifers and cows (Table 3; Figures 1a, 1b). While milk production was not statistically increased by the glycerol drench, a trend can be identified (Table 4; Figures 2a, 2b).

Implications

The trends seen in this study *suggest* a potential for oral glycerol administration at calving to reduce 24 h blood NEFA levels (Figure 1a), especially in heifers, and improve milk production in the early lactation period. However, this effect needs evaluated on a greater number of cattle to establish commercial significance.