

Does the Diet we Feed Close-Up Cows Affect Newborn Calves?

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Why is this important?

When we feed dry cows, we normally have the cow in mind – how we manage her to prepare for lactation and make the transition period as seamless as possible. But what about the developing calf? Recently there is growing interest in how management of dams can affect offspring. In other species, research has shown that over feeding the dam during late gestation alters glucose and insulin concentrations in the offspring, which can affect growth and development. Insulin is a hormone secreted in the body to stabilize glucose concentrations in blood by increasing glucose uptake into cells. However, cells in the body can become resistant to insulin, resulting in high blood sugar or even type 2 diabetes. It's possible for dairy cattle to exhibit symptoms of type 2 diabetes, whereby more insulin is required to maintain blood glucose levels. This can affect how cows deposit or mobilize fat, thus affecting their growth and development. Therefore, we wanted to determine whether the starch content of close-up diets affects insulin and glucose metabolism in newborn calves.

What did we do?

Thirty-eight pregnant cows carrying female calves were fed a close-up diet containing either a high (HIGH, 26%) or moderate (MOD, 14%) amount of starch starting 28 days prior to expected calving date (Table 1). Immediately following birth, calves were removed from the cow and given 3-2L feedings of colostrum and offered 10L of milk per day (28% CP, 16% fat milk replacer mixed at 130 g/L). At 2 days (after colostrum, but before milk feeding) and 20 days of age, calves were subjected to a glucose tolerance test (GTT).

A GTT is used to determine how much insulin is required to stabilize glucose concentrations in the blood. In our study, calves were fasted for 6 hours and then had glucose infused into their jugular vein. Frequent blood samples were collected for 90 mins after the infusion and analyzed for concentrations of glucose and insulin.

Table 1: Ingredient and nutrient composition of high (HIGH; 26%) and moderate (MOD; 14%) starch diets fed from 28 days prior to calving to calving.

Ingredient, % DM	HIGH	MOD	Nutrient Composition	HIGH	MOD
Barley silage	56.6	56.9	% DM	42.1	42.8
Straw	4.4	23.6	CP, %DM	14.6	15.0
Barley grain	22.1	-	ADF, %DM	23.3	31.5
Canola meal	1.8	6.6	NDF, %DM	37.8	47.7
Malt sprouts	7.0	7.0	Starch, %DM	26.1	14.0
Soy hulls	2.6	0.9	NFC, %DM	39.4	28.1
Mineral and vitamin mix	5.5	5.1	NE _L , Mcal/kg DM	1.63	1.54

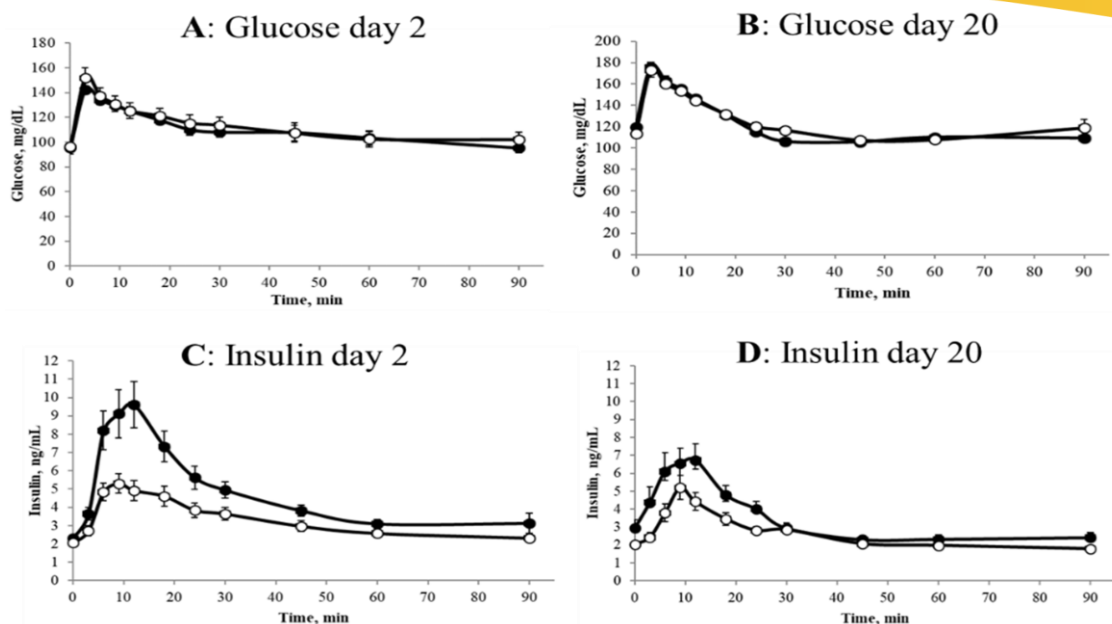


Figure 1. Glucose and insulin concentrations on day 2 and 20 of calves born to cows fed a high (solid circle) or moderate (open circle) starch content close-up diet.

What did we find?

Starch content of the close-up diet did not affect calf birth weight (38.4 kg), average daily gain (1.03 kg/d) or body weight at 20 days of age (58.5 kg). The results of the GTT are presented in Figure 1. The body response of the calf is to stabilize glucose concentrations following the infusion, so we did not expect to see a difference in glucose between HIGH (solid circle) or MOD (open circle) diets, as shown in panel A. However, HIGH had increased insulin concentrations following the glucose infusion (panel C) compared to MOD, and these findings were still present 20 days after birth (panel B and D).

Summary Points

- Dry cows were fed a close-up diet containing either high (26%) or moderate (14%) starch
- Calves born to cows fed high starch showed signs of insulin resistance 2 and 20 days after birth
- More research is required to determine if there are any long-term effects

What does this mean?

These results suggest that calves born to cows fed a high-starch diet require more insulin to be secreted in order to stabilize the same amount of glucose. This indicates that these calves are insulin resistant or show signs similar to type 2 diabetes. While we do not know if there are any long-term effects of these findings, this is of interest to mature cows as glucose and insulin regulation are important for controlling fat mobilization after calving. If calves continue to show signs of insulin resistance into maturity, it may increase the risk of ketosis and other metabolic disorders. Therefore, it is important to consider that we are feeding and managing two animals during the dry period, the cow and newborn calf.

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