INCREASING GLUCOSE PRECURSORS IN RANGE SUPPLEMENTS FED TO YOUNG POSTPARTUM BEEF COWS

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Supplementation is often necessary to meet nutrient requirements of cattle grazing dormant New Mexico range. Greater energy demands during late gestation and lactation may amplify the need for supplementation. Even with a supplementation regimen, young beef cows experience a period of weight loss after calving and during lactation. The length of this weight loss period is important because a cow will not cycle until she has started to gain weight. In order for this to occur, an adequate supply of blood glucose must be available to the animal, and she must be able to absorb that glucose into her tissues. The hormone responsible for glucose uptake is insulin, and in periods of weight loss and nutrient stress the cow is less responsive to its effects. Ruminants must synthesize nearly 100% of all glucose in the blood from products of digestion. They produce glucose from propionate (a product of ruminal carbohydrate fermentation) and amino acids (from protein degradation). However, fermentation of dormant forage yields small amounts of these glucose precursors (propionate). During lactation, the increased demand for glucose for milk production adds to the deficit of glucose available to the cow. Her problem is 3-fold: first, she has an inadequate supply of blood glucose, second, the need for glucose has dramatically increased for milk production, and third, blood glucose is inhibited from entering tissues, thus restricting her ability to gain body weight. A study was conducted to evaluate insulin sensitivity, milk production and weight change responses of postpartum 2-year-old beef cows (n = 27) to supplements differing in glucose precursors. Cows and calves were kept in a common pen at the NMSU Livestock Research Center in Las Cruces. Cows were fed a mixture of wheat straw and alfalfa hay adjusted monthly to match the nutrient content of native range in central New Mexico from February to May. Supplements were individually fed three times weekly at 2 lb per head per day for 90 d postpartum. The three supplements provided 1) 0.7 lb CP and 0.10 lb potential glucose precursors (GP) (LOGP), 2) 0.7 lb CP and 0.14 g GP (MIDGP), or 3) 0.7 lb CP and 0.32 lb GP (HIGP). The glucose precursors were supplied by amino acids in the LOGP and MIDGP supplements and from amino acids and calcium propionate in the HIGP supplement (NutroCal, Kemin Industries, Inc.). A glucose tolerance test was conducted 35 d postpartum, which consisted of infusing a 50% glucose solution (1 cc per 4.5 lb body weight or 0.5 mL per kg) through a jugular catheter. Blood samples were then collected for 3 hours after infusion and glucose and insulin concentrations were measured. When the concentration of a compound in the blood (glucose after infusion or the insulin response to that glucose) and the time necessary for the concentration to return to normal are combined, the value is referred to as the area under the curve (AUC). The smaller the AUC, the faster the concentration of the compound returns to normal (glucose) or the more responsive the animal is to that compound (insulin). Additionally, the time required for a compound to clear the blood is evaluated by estimating its half-life. We calculated glucose half-life, which is the amount of time required for a 50% decrease in peak blood glucose concentration. These results should show a faster half-life if a compound disappears faster, and we expect glucose AUC and half-life to be reduced if glucose utilization was improved. Table 1 compares glucose and insulin areas under the curve and glucose half-lives for the three supplement groups. Glucose and insulin areas under the curve were similar among treatments, as were glucose half-lives. Increased dietary glucose precursors had no effect on how sensitive the cows were to insulin or to how quickly they were able to clear the infused glucose. Cows were milked by machine 50 d postpartum; Table 2 compares milk production and constituents among the three supplement groups. Cows supplemented with HIGP tended to produce more milk than did cows fed LOGP, while MIDGP cows were intermediate. A similar trend existed for lactose produced. Cows supplemented with HIGP lost the most weight (151 lb) from pre-calving to their lowest postpartum weight (body weight nadir) compared to LOGP- (130 lb) and MIDGP-supplemented cows (116 lb). Results from this study suggest that the supply of additional glucose precursors from HIGP supplementation of confinement-fed cows was used to produce more milk. This contradicts results of prior NMSU research; however, the cows in those previous studies were grazing dormant range throughout the supplementation period. From research findings in human nutrition, results show that physical activity aids in the absorption of glucose. The increased activity due to grazing may explain the differences between the range studies and the current study of cattle in a drylot setting.

Table 1. Glucose and insulin areas under the curve (AUC) and glucose half-lives for three supplements containing increasing glucose precursors.

Item	Supplement			SE	Probability
	LOGP	MIDGP	HIGP		
Glucose AUC	11862	10309	11805	1063	$P > 0.05$
Insulin AUC	462	442	428	49	$P > 0.05$
Glucose Half-life	87	77	95	10	$P > 0.05$

Table 2. Milk production and constituents for three supplement containing increasing glucose precursors.

Item	Supplement			SE	Probability
	LOGP	MIDGP	HIGP		
Production (lb/day)	11.2	11.5	12.9	0.70	$P = 0.13$ for HIGP > LOGP
Butterfat (lb/day)	0.47	0.43	0.49	0.03	$P > 0.05$
Protein (lb/day)	0.30	0.29	0.31	0.02	$P > 0.05$
Lactose (lb/day)	0.55	0.57	0.63	0.03	$P = 0.14$ for HIGP > LOGP
Solids non-fat (lb/day)	0.95	0.97	1.05	0.06	$P > 0.05$