RANGE COWS RESPOND TO NUTRIENTS DIFFERENTLY DEPENDING ON SEASON

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Young beef cows experience a period of weight loss after calving and during lactation when grazing dormant New Mexico range. In order for weight gain to occur, an adequate supply of glucose must be available to the animal, and she must be able to absorb that glucose. The hormone responsible for glucose uptake is insulin, and in periods of weight loss and nutrient stress the cow may not respond to insulin stimulation. Insulin is produced in the pancreas and is released in response to an increase in blood glucose. Ruminants must synthesize nearly 100% of all glucose from products of digestion. They produce glucose from propionate (a product of carbohydrate fermentation) and amino acids (from protein degradation). However, dormant forage often does not yield adequate amounts of these glucose precursors (propionate) for weight gain. During lactation, the increased demand for glucose for milk production adds to the deficit of glucose available to the cow. However, with adequate precipitation during the growing season, forage quality improves, and insulin sensitivity may increase. We propose that differing performance of cows in different years may be due to environmental effects on the function of and response to metabolic hormones. An experiment was conducted to investigate seasonal changes in nutrient status of young range cows (n = 22) at the New Mexico State University Livestock Research Center and the Corona Range and Livestock Research Center. Two glucose tolerance tests (GTT) were conducted, one at 35 d postpartum (spring) and one at 165 d postpartum (summer). At the time of the spring GTT, 2-year-old cows were group fed a mixture of wheat straw and alfalfa hay similar in nutrient content to New Mexico native range in March and April. Cows were grazing New Mexico green forage at the time of the summer GTT. A glucose tolerance test consists 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 are then collected for 3 hours after infusion and glucose and insulin concentrations are measured. When the amount of a compound in the blood (glucose or insulin) and the time necessary to clear it are combined, it is referred to as the area under the curve (AUC) for that compound. Additionally, the time it takes for a compound to clear from 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. Table 1 compares glucose and insulin areas under the curve and glucose half-lives for the spring and summer glucose tolerance tests. Glucose and insulin areas under the curve were smaller in the summer than in the spring. Glucose half-life was 50% shorter in the summer when compared to the spring. Therefore cows grazing green summer forage were more sensitive to insulin than cows consuming a poor quality diet and were more capable of using blood-borne nutrients. Cows were infused with the same amount of glucose per lb of body weight in each tolerance test. In the summer, cows cleared the same amount of glucose with less insulin than in the spring and did so in half the time it took in the spring. Cows are often supplemented after calving when they are grazing dormant forage with the goal of preventing weight loss and/or promoting weight gain. This study suggests that even though a supplement is fed after calving the nutrients it supplies may not enter the tissues to result in weight gain. Supplement provides an increased supply of glucose precursors, but cows may be insensitive to insulin at the time of supplementation, creating a less efficient condition. It appears that differences in cow performance between late winter and summer may be partially due to differences in insulin sensitivity and nutrient uptake by tissues.

Table 1. Glucose and insulin areas under the curve (AUC) and glucose half-life from spring and summer glucose tolerance tests.

Item	Spring	Summer	Probability
Glucose AUC	11337 ± 541	9606 ± 573	$P < 0.05$
Insulin AUC	445 ± 25	302 ± 27	$P < 0.05$
Glucose Half-life (minutes)[a]	87 ± 6	45 ± 6	$P < 0.05$

[a]Normal glucose half-life is 35 minutes.

SUPPLEMENTAL BYPASS METHIONINE IN RANGE SUPPLEMENTS INCREASES THE EFFICIENCY OF NITROGEN USAGE BY YOUNG GESTATING BEEF COWS

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Key Words: Cattle, Methionine, Supplementation

Inadequate supply of methionine or required amino acids may limit protein synthesis and productivity in gestating beef cows consuming dormant New Mexico range vegetation. Amino acids are the building blocks for proteins, which are responsible for lean tissue growth (muscle, fetus, udder, etc.). In the process of making new proteins the amino acid methionine is required for the proper initiation of protein synthesis. Therefore, if methionine supply is less than required then the animal will be restricted or unable to properly synthesis new proteins for lean tissue growth. Our objectives were to demonstrate that pregnant cows consuming low quality forages typically do not receive an adequate supply of methionine and by increasing the supply of methionine their nutritional status would improve. A study using ruminally cannulated gestating beef cows (1080 ± 59 lbs) was conducted to evaluate the effects of post ruminal methionine (Met) supplementation on nitrogen efficiency, serum metabolites, and plasma amino acid concentrations. Cows were allowed ad libitum access to water, mineralized salt, and experimental diet, which comprised of 67% wheat straw (1.9% CP and 78.7% NDF, OM basis) and 33% alfalfa (17.0% CP and 43.2% NDF, OM basis). Daily experimental diet was individually fed and refusal weights recorded for nitrogen intake determination. Treatments consisted of no urea (NU), urea (U), urea + 5 g/d Met (5MU), urea + 10 g/d Met (10MU), and urea + 15 g/d Met (15MU). Urea was administered into the rumen via rumen cannula once a day at 6:00 AM in two gelatin capsules to achieve a diet of 6.8% CP as fed. Methionine was infused into the abomasum twice a day at 6:00 AM and 6:00 PM. Cows were adapted to the diet 30 days prior to the initiation of the experiment. Experimental periods were 14 days; 4 days to allow clearance of previous treatment affects, 4 days for adaptation to treatments, and 6 days for total fecal and urinary collection. Serum and plasma samples were collected every 4 hours for 24 hours on day 13 of each period for analysis of serum urea nitrogen, glucose, non-esterified fatty acids, and plasma amino acids. Nitrogen efficiency (animals ability to utilize and retain intake nitrogen (i.e., protein)), was improved ($P < 0.05$) with urea and incremental amounts of methionine (52.9, 57.7, 67.4, 67.1, and 70.8 ± 3.9 % for NU, U, 5MU, 10MU, and 15MU, respectively). No differences ($P > 0.05$) were identified for serum urea nitrogen (a measure of nitrogen availability and/or wastage), glucose (blood sugar (i.e., energy for body tissues)), or non-esterified fatty acids (a measure of energy status). The addition of urea initially dropped plasma methionine concentrations when compared