FACTORS AFFECTING MOBILIZATION OF BODY FAT IN LACTATING BEEF COWS

J.C. Garmendia[1], R.P. Wettemann[2], K.S. Lusby[3], J.C. Baker[4] and R.D. Geisert[5]

Story in Brief

Mature postpartum anestrous Hereford cows were used to determine the effect of insulin injections, glucose infusion, feeding additional energy and protein (flushing) and weaning on the concentrations of glucose, insulin and non-esterified fatty acids in plasma or serum. Neither treatment nor day of sampling significantly affected concentrations of glucose in plasma. Treatments influenced non-esterified fatty acids and insulin. Glucose infusion and feeding additional protein and energy increased serum concentrations of insulin and decreased plasma concentrations of non-esterified fatty acids.

(Key Words: Beef Cows, Body Fat, Post Partum, Reproduction)

Introduction

The supply of energy during the first weeks after parturition is very important in beef cows. The requirements for energy are difficult to meet in early spring calving cows because of the low quality of dry standing forage available. Frequently, the cow cannot eat enough feed to supply the energy needed for lactation and body reserves are mobilized to supply the deficit.

Energy deficiency is well documented as a factor which affects reproductive performance of beef cows. Changes in concentrations of glucose and non-esterified fatty acids (NEFA) in plasma may be used to evaluate the energy status of the postpartum cow. The objective of this experiment was to evaluate the effect of insulin injections, glucose infusion, feeding additional energy and protein (flushing) and weaning on the concentrations of glucose and NEFA in plasma and insulin in serum of postpartum beef cows.

Materials and Methods

Thirty mature anestrous Hereford cows with non-functional ovaries at 25 days post partum were used in this study. Cows received rations during late pregnancy so that they had body condition scores of 5 (1 = emaciated and 9 = obese) at parturition. Such cows usually exhibit their first postpartum estrus between 40 and 70 days post partum. On day 25 post partum, cow and calf pairs were transported 10 km from range pastures and pairs were maintained in individual pens in a total confinement building with 14 h of fluorescent light daily.

On day 25 post partum, five cows were blocked to each of the six treatments based on calving date: (1) Infused with 40% glucose solution (500 grams of glucose per day) continuously via a jugular cannula for 14

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[1]Graduate Student [2]Regents Professor [3]Associate Professor
[4]Graduate Assistant [5]Assistant Professor

days (days 29 - 42 post partum) to increase plasma glucose concentration by about 10 mg% (to about 70 mg%); (2) cows were injected twice daily at 12 h intervals with 50 iu insulin (zinc protamine) during days 29 - 42 post partum; (3) cows were fed an additional 5 kg of a 20% crude protein diet daily from 25 - 42 days post partum; (4) calves were weaned from the cows at 35 days; (5) infusion control cows were infused via a jugular cannula with saline solution from 29 - 42 days post partum and (6) non-infused control cows. Cows and calves were constantly together except for animals assigned to treatment 4.

Jugular cannulae were placed in cows on day 25 postpartum. Two cannulae were placed in cows assigned to treatments 1 and 5 and one cannula in the other cows. Plasma glucose and NEFA and serum insulin were monitored in samples taken daily between 25 and 42 days post partum. On day 42, postpartum cows were returned to range pastures.

Results and Discussion

Neither treatment nor day of sampling significantly affected postpartum concentrations of plasma glucose. Glucose in plasma tended to be greater in cows that received the glucose infusion (73.9 mg/%). Cows treated with insulin had the greatest variation in concentrations of glucose.

Treatments and day significantly influenced concentrations of NEFA ($P < .01$; Table 1). Glucose infusion decreased ($P < .01$) NEFA in plasma (482 uEq/1) when compared with cows that received saline infusion (644 uEq/1). This indicates that fat mobilization was reduced in cows given additional glucose. Similarily, flushing also decreased ($P < .01$) mobilization of depot fat (533 uEq/1) compared to control cows (673 uEq/1). Treatments affected serum insulin concentrations. Glucose infusion and feeding additional energy significantly increased ($P < .05$) serum insulin when compared with control cows. Concentrations of NEFA decreased with day of treatment. This change may be associated with a change of environment and diet since cows were moved from range pastures to the Nutrition Physiology Research Center at the start of the trial. Diet was changed from dry range grass, hay and cottonseed meal to pelleted alfalfa as the complete ration.

In conclusion, plasma concentrations of NEFA may be useful to evaluate the energy status of postpartum cows. Concentrations of NEFA in plasma were reduced by continuous glucose infusion or feeding additional energy and protein. This suggests that less body fat stores were mobilized when cows were given additional energy.

Table 1. Concentrations of glucose, NEFA and insulin in postpartum cows during treatments (13 days).

Treatment	Glucose (mg/%)	NEFA (uEq/L)	Insulin (ng/ml)
Control	67.4	673^{b}	2.0^{b}
Saline Infusion	55.8	644^{b}	1.5^{b}
Glucose Infusion	73.9	482^{a}	6.4^{a}
Insulin	59.6	695^{ab}	3.6^{ab}
Weaning	68.0	568^{b}	3.2^{ab}
Flushing	70.2	533^{a}	6.2^{a}

^{ab}Means in a column with different superscripts differ ($P < .05$).