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Relationship of plasma glucose to performance and carcass traits in finishing cattle

Abstract

Blood glucose levels of finishing cattle were measured between 3 and 30 days prior to slaughter and compared to performance and carcass traits. In trial 1, blood samples were obtained from 318 heifers at 2 hours postfeeding at 30 days before slaughter. Plasma glucose levels were correlated positively with fat thickness ($P < .01$) and kidney, pelvic, and heart fat ($P < .02$). Trial 2 utilized 72 steers from which blood was collected at 15 hours postfeeding at 3 days before slaughter. Blood glucose was correlated positively with average daily gain ($P < .01$); dry matter intake ($P < .01$); hot carcass weight ($P < .01$); ribeye area ($P < .01$); fat thickness ($P < .06$); and kidney, pelvic, and heart fat ($P < .01$). A third trial was conducted with 77 individually fed steers to determine if blood glucose levels could be used to predict finishing performance and carcass traits. Contrary to trials 1 and 2, plasma glucose did not reflect performance or carcass traits except marbling score ($P < .03$).

Keywords

Cattlemen's Day, 2000; Kansas Agricultural Experiment Station contribution; no. 00-287-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 850; Beef; Glucose; Finishing cattle

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RELATIONSHIP OF PLASMA GLUCOSE TO PERFORMANCE AND CARCASS TRAITS IN FINISHING CATTLE

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Summary

Blood glucose levels of finishing cattle were measured between 3 and 30 days prior to slaughter and compared to performance and carcass traits. In trial 1, blood samples were obtained from 318 heifers at 2 hours post-feeding at 30 days before slaughter. Plasma glucose levels were correlated positively with fat thickness ($P < .01$) and kidney, pelvic, and heart fat ($P < .02$). Trial 2 utilized 72 steers from which blood was collected at 15 hours post-feeding at 3 days before slaughter. Blood glucose was correlated positively with average daily gain ($P < .01$); dry matter intake ($P < .01$); hot carcass weight ($P < .01$); ribeye area ($P < .01$); fat thickness ($P < .06$); and kidney, pelvic, and heart fat ($P < .01$). A third trial was conducted with 77 individually fed steers to determine if blood glucose levels could be used to predict finishing performance and carcass traits. Contrary to trials 1 and 2, plasma glucose did not reflect performance or carcass traits except marbling score ($P < .03$).

(Key Words: Glucose, Finishing Cattle.)

Introduction

We have postulated that digestive disorders or decreased performance in cattle may be related to poor regulation of blood glucose. These studies were conducted in an effort to define relationships between glucose levels, performance, and carcass traits of finishing cattle.

Experimental Procedures

Experiment 1 utilized 318 heifers in a 120-day finishing trial. Heifers were allotted to pens of 11 to 12 animals each and were fed finishing diets containing different levels of fat and choline once daily at 8:00 a.m. On day 90, blood was collected via the jugular vein at 2 hours after feeding.

In Experiment 2, 72 steers were fed different sources and levels of protein in the diet for 107 days. Steers were allotted to individual pens and fed once daily at 3:00 p.m. Blood was collected at 20 hours after feeding 3 days prior to slaughter.

In Experiment 3, 77 Angus \times Hereford crossbred beef steers (825 lb) were fed finishing diets containing various levels of tallow for 93 days. Steers were fed once daily at 3:00 p.m. On day 84, steers were weighed individually, and blood was collected 16 hours after feeding.

For all experiments, plasma glucose values were linearly regressed against performance and carcass traits to obtain correlation coefficients. The correlation coefficient explains the amount of variation in performance or carcass traits that is explained by differences in glucose concentration.

Results and Discussion

Table 1 summarizes data from Experiment 1. Plasma glucose values (postfeeding)

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ranged from 62 to 279 mg/dl and averaged 110 mg/dl. Significant relationships occurred between plasma glucose and fat thickness and kidney-heart-pelvic fat. Hot carcass weight, ribeye area, and marbling score were not significantly related to plasma glucose.

Table 1. Coefficients of Correlation (R) Between Plasma Glucose and Carcass Traits in Finishing Heifers Fed Different Levels of Fat and Choline (Experiment 1)

Item	R	P-Value ^a
Hot carcass weight	.04	.50
Ribeye area	.00	.98
Fat thickness	.20	<.01
Kidney, pelvic, and heart fat	.14	.02
Marbling score	.12	.06
% USDA Choice	.04	.50

^aP-value <.05 indicates a significant linear relationship between the variable and plasma glucose concentration.

Correlations of performance and carcass traits to plasma glucose of finishing steers that were fed different sources and levels of protein are shown in Table 2 (Experiment 2). Fasting plasma glucose values ranged from 38 to 104 mg/dl and averaged 67 mg/dl. Average daily gain, feed efficiency, and intake for the finishing period were significantly related to blood glucose. Carcass traits such as carcass weight, ribeye area, fat thickness, and kidney-heart-pelvic fat also were related significantly to blood glucose. These data led us to believe that plasma glucose concentration could be used as a predictor of performance and carcass traits.

In Experiment 3, fasting blood glucose levels ranged from 66 to 115 mg/dl and averaged 91 mg/dl. Marbling score was related negatively to plasma glucose levels ($P < .03$), but none of the other performance traits or carcass characteristics were related. This is contrary to our observations from Experiments 1 and 2 and may have been due

to factors that influence glucose metabolism, such as health of the individual, feed consumption patterns, or other nutritional factors that need to be studied further.

Table 2. Coefficients of Correlation (R) among Plasma Glucose and Performance and Carcass Traits in Finishing Steers Fed Different Sources and Levels of Protein (Experiment 2)

Item	R	P-Value ^a
Average daily gain	.41	<.01
Gain:feed	.29	.02
Dry matter intake	.38	<.01
Hot carcass weight	.53	<.01
Ribeye area	.36	<.01
Fat thickness	.22	.06
Kidney, pelvic, and heart fat	.36	<.01
Marbling score	.15	.22
% USDA Choice	.16	.19

^aP-value <.05 indicates a significant linear relationship between the variable and plasma glucose concentration.

Table 3. Coefficients of Correlation (R) among Plasma Glucose and Performance and Carcass Traits in Finishing Steers (Experiment 3)

Item	R	P-Value ^a
Average daily gain	.14	.21
Gain:feed	.20	.08
Dry matter intake	.02	.89
Hot carcass weight	.03	.82
Ribeye area	.04	.74
Kidney, pelvic, and heart fat	.05	.69
Marbling score	-.09	.03
% USDA Choice	.03	.78

^aP-value <.05 indicates a significant linear relationship between the variable and plasma glucose concentration.