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Effects of Supplementing Beef Cows with Lipid from Whole Corn Germ

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Summary

A two-year study was conducted with crossbred beef cows to determine whether supplementation with fat from whole corn germ either pre- or postpartum influenced ovarian activity before the breeding season, pregnancy rates, calving interval, calf performance, or serum leptin concentration. Supplements were fed for approximately 45 days before or 45 days after calving. Cows supplemented prepartum with fat from whole corn germ had shorter calving intervals. Ovarian activity before the breeding season, pregnancy rate, calf growth, and serum leptin were not different between groups.

Introduction

Profitability in the cow/calf sector of the beef industry is driven by reproduction. A cow must become pregnant within approximately 80 days of calving to maintain a 365-day calving interval. Leptin is a hormone produced by adipose tissue that is closely related to body condition. Cows with greater body condition have higher blood leptin concentrations. Leptin influences gonadotropin secretion, especially in nutrient-restricted cows. Dietary fat may influence leptin secretion and postpartum reproduction.

Supplemental feedstuffs are a necessity in most beef cow operations. When supplementing energy to beef cows, it is important to consider the possibility of negative associative effects on forage digestibility. Supplemental fat or starch may inhibit fiber digestibility if fed at high levels. However, previous research indicates there is potential for moderate levels of supplemental fat to elicit a favorable reproductive response compared to control supplements equal in energy.

The objectives of this study were to determine if supplementing cows with fat from whole corn germ for 45 days before or after calving affected cows exhibiting ovarian activity before the breeding season, pregnancy rate, calving interval, calf performance, or blood leptin concentrations.

Procedure

Composite MARC II (1/4 each Hereford, Angus, Simmental, and Gelbvieh) beef cows and cows sired by Hereford x Angus bulls and MARC II dams were used in a two-year experiment at the University of Nebraska–Lincoln Dalbey-Halleck experiment station. In each year cows (n=172 yr 1; n=170 yr 2) were assigned randomly to one of three treatments: control (CON; n=118) supplemented before and after calving with dry rolled corn, whole corn germ pre-calving (PRE; n=115), or whole corn germ post-calving (POST; n=109). Supplements were nearly equal in CP and TDN but divergent in lipid content (Table 1); and consisted of 4 lb DM dry rolled corn or 2.5 lb DM whole corn germ supplement daily. Whole corn germ is a by-product of the wet-milling industry that contains the corn oil. Whole corn germ is approximately 12.5% CP, 140% TDN, and 45% fat. Supplements were group-fed daily with at least three linear feet of bunk space per cow. Cows were fed a mixture of approximately one-third alfalfa hay and two-thirds bromegrass hay (as-fed basis) and were allowed *ad libitum* intake, such that minimal hay remained prior to the subsequent daily feeding.

Supplementation periods averaged approximately 45 days, and began January 29, 2002, in year 1 and January 20, 2003, in year 2. Corn germ was fed to PRE cows for 42 days from January 29 to March 11, 2002, and for 52 days from January 20 to March 12, 2003. During the period when PRE cows were supplemented with whole corn germ, CON and POST cows were managed as a single group and supplemented dry rolled corn. Whole corn germ was fed to POST cows for 42 days from March 12 to April 23, 2002 and for 50 days from March 12 to April 30, 2003. Average calving date in year 1 was March 12 $\pm$ 1.4 days and in year 2 was March 20 $\pm$ 1.5 d. During the period when POST cows were supplemented with whole corn germ, CON and PRE cows were fed the control supplement as a single group. From the end of the post-calving supplementation period to the beginning of the subsequent pre-calving supplementation period, cows and calves were managed together.

Body weight and condition score change were used as predictors of nutritional status. Cows were weighed in January at the initiation of supplementation, in April after the supplementation period, immediately prior to the breeding season, and at

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Table 1. Supplement and nutrient intake for cows fed control or whole corn germ supplement.

	Control	Whole Corn Germ
Supplement Intake, lb DM/day[a]	4.0	2.5
Ether Extract, lb/day[a]	0.15	0.88
Total Digestible Nutrients, lb/day[b]	3.60	3.53

[a]Calculated lab analysis of corn and whole corn germ supplements.
[b]Calculated using 1996 NRC value for dry rolled corn and commercial laboratory analysis for whole corn germ.

weaning. Weaning dates were September 24, 2002, and October 7, 2003. Body condition scores were assigned independently by two technicians on each of these dates and between supplementation periods. Calf birth weights and weaning weights were recorded. Weaning weight was adjusted to 205 days of age. No adjustment was made for age of dam because cow ages were equally distributed across treatments. Cows were exposed to fertile bulls for 62 days beginning May 23rd each year. Pregnancy was diagnosed via rectal palpation. Calving interval was calculated as the number of days between consecutive calving dates.

Blood samples were taken during the treatment periods to determine leptin concentrations. Samples were cooled immediately and serum was harvested and frozen at -20°C until further analysis. Two additional blood samples were collected 10 days apart immediately prior to the breeding season to determine ovarian activity. Cows with serum progesterone concentrations greater than 1 ng/mL in either sample had initiated estrous cycles. Leptin concentrations were assayed using a double-antibody radioimmunoassay validated for use in bovine serum.

Table 2. Effects of pre- or postpartum lipid supplementation on cow body condition score and weight from late gestation until weaning.

Date	Body Condition Score[c]			Weight, lb[c]		
Con	Pre	Post	Con	Pre	Post	
January	5.39	5.40	5.30	1189	1178	1189
March	5.36	5.21	5.29			
April	5.10	5.02	4.91	1033	1024	1015
May	5.38	5.28	5.32	1108	1095	1099
Calving[a]	5.36	5.21	5.24			
Weaning[b]	5.25	5.31	5.27	1150	1141	1143

[a]Body condition score measurement taken closest to calving date.
[b]Weaning measurements were taken September 24, 2002, and October 7, 2003.
[c]Con = control; Pre = supplemented with corn germ 45 days prepartum; Post = supplemented with corn germ 45 days postpartum.

Table 3. Effects of pre- or postpartum lipid supplementation on calf growth and cow reproductive performance.

	Treatment[c]		
Calf Performance	Con	Pre	Post
Calving Date, Day of Year	73[d]	79[e]	78[de]
Birth Weight, lb	88	88	84
Actual Weaning Weight, lb[a]	503	488	495
Adjusted Weaning Weight, lb[b]	516	516	516
Weaning Age, day	199[f]	193[g]	194[fg]
Cow Performance			
Cyclic at initiation of breeding, %	72.3	65.0	63.1
Pregnant, %	90.7	91.6	91.6
Calving Interval, day	373[h]	362[i]	371[h]

[a]Unadjusted weaning weight.
[b]Weaning weight adjusted for calf age.
[c]Con = control; Pre = supplemented with corn germ 45 days prepartum; Post = supplemented with corn germ 45 days postpartum.
[de]Within a row, means without common superscripts differ at $P = 0.12$.
[fg]Within a row, means without common superscripts differ at $P = 0.13$.
[hi]Within a row, means without common superscripts differ at $P = 0.07$.

Results

Treatment did not influence BCS nor weight at any sampling time, nor was there an effect of treatment by age interaction on BCS or weight (Table 2).

Calf growth and cow reproductive data are shown in Table 3. Birth weight, actual weaning weight, and weaning weight adjusted for calf age were similar among treatments. There was no difference among treatments for proportion of cows exhibiting ovarian activity prior to the breeding season or for pregnancy rate. There was a tendency ($P = 0.07$) for a treatment effect on calving interval. PRE cows had shorter calving intervals than POST or CON cows (CON = 373 $\pm$ 5.9 d, POST = 371 $\pm$ 6.2 d, PRE = 362 $\pm$ 5.9 d).

Circulating leptin concentration was not influenced by supplement at any time during the study and averaged 2.15 $\pm$ 0.75 ng/mL for CON, 1.88 $\pm$ 0.76 ng/mL for POST, and 1.91 $\pm$ 0.75 ng/mL for PRE groups.

In summary, supplementing cows with whole corn germ for 45 days prior to calving reduced calving interval. Cow weight and BCS, calf growth, proportion of cows exhibiting ovarian activity prior to the start of the breeding season, and pregnancy rate were not affected. Furthermore, supplementing cows with fat did not influence leptin concentrations.

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