Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 1 *Cattleman's Day (1993-2014)*

Article 853

1990

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EFFECTS OF DIETARY ENERGY ON REPRODUCTIVE FUNCTION AND PRODUCTION IN SUCKLED BEEF COWS[1]

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Summary

Twenty-eight Hereford × Angus cows were utilized to determine the effects of dietary energy level before and after calving on reproductive function and production in suckled beef cows. Low levels of dietary energy before calving resulted in losses of body composition prior to calving, reduced calf birth weight, lengthened intervals from calving to ovulation, and decreased milk production and calf weight at 70 d of age (P<.05). Low levels of dietary energy after calving decreased measures of body composition after calving, reduced the percentage of cows that ovulated following calving, and decreased cow milk production and calf weight at 70 d of age (P<.05). We conclude that dietary energy before and after calving impacts the reproductive function and production of suckled beef cows.

(Key Words: Prepartum, Postpartum, Energy, Reproduction, Ultrasound.)

Introduction

Along with many other factors, the length of the breeding season and the percentage of cows calving early in the calving season influence the efficiency of beef production. Both are factors that can be influenced by good reproductive management. However, a high percentage of cows must be cycling at the start of the breeding season.

Body condition at calving time, which is affected by nutrition, heavily influences the number of cows cycling at the start of the breeding season. The objectives of this study were to determine the influence of level of dietary energy before and after calving on reproductive function and production of suckled beef cows.

Experimental Procedures

Twenty-eight Hereford × Angus cows received either 70% (Low) or 150% (High) of NRC recommended level of dietary energy either before or after calving, resulting in four treatment combinations (L-L, L-H, H-L, H-H) in a 2×2 factorial arrangement. Diets were similar in content of protein, calcium, and phosphorus. Prepartum diets were fed for

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[1]Authors are grateful to S. C. Henderson-Perry, R. B. Hightshoe, T. Ridder, and B. Fox for assistance with data collection.
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approximately 110 d, and postpartum diets were fed for approximately 20 d after cows resumed cyclicity or up to a maximum of 150 d postpartum.

Ultrasonography was utilized to monitor ovarian follicle size, cervical and uterine involution, and time of ovulation. At 28-d intervals, cows were weighed and scored for body condition, and ultrasonography was used to measure subcutaneous fat and longissimus muscle area. Cows also were weighed and scored for body condition at calving. Cows were observed for estrus thrice daily. Milk production was determined at approximately 60 and 70 d postpartum. On the day preceding each milking, cows and calves were separated for 4 to 6 hr, then placed together until all calves completed nursing and separated again. Approximately 12 hr following the separation, cows were injected IM with 40 IU of oxytocin to stimulate milk letdown and were immediately machine milked. Samples from each milking were analyzed by the Kansas Dairy Herd Improvement Association to determine butterfat, lactose, protein, and somatic cell count. Calf weights were recorded at birth and 70 d of age.

Results and Discussion

Measures of cow performance for the four treatment combinations are shown in Table 19.1. Low levels of dietary energy both before and after calving decreased (P<.05) body weight, body condition, subcutaneous fat, and longissimus muscle area compared with cows fed high

Table 19.1. Effects of Pre- (PR) and Postpartum (PP) Dietary Energy on Cow Performance

Item	Treatment combinations				
	L-L	L-H	H-L	H-H	SE
Initial wt, lb	843	855	848	843	25
Prepartum[1] wt change, lb	−98[a]	−75[a]	133[b]	125[b]	9
Postpartum[2] wt change, lb	−66[b]	50[c]	−206[a]	−50[b]	15
Initial body condition[3]	5.0	5.0	5.0	5.0	0.0
PR change in body condition	−2.0[a]	−1.8[a]	1.9[b]	1.8[b]	.2
PP change in body condition	−.6[b]	1.7[c]	−3.4[a]	−.3[b]	.3
Initial subcutaneous fat, mm	3.2	3.7	3.2	3.2	.2
PR change in subcutaneous fat, mm	−1.0[a]	−1.2[a]	2.6[b]	2.3[b]	.3
PP change in subcutaneous fat, mm	−.6[b]	.8[c]	−3.3[a]	.5[c]	.3
Initial longissimus muscle area, cm^2	49.6	52.3	52.9	52.7	2.1
PR change in longissimus muscle area, cm^2	−16.5[a]	−17.9[a]	−2.6[b]	−3.7[b]	3.2
PP change in longissimus muscle area, cm^2	−9.9[b]	3.3[c]	−18.9[a]	−.5[c]	2.4

[1]Prepartum period=approximately 110 d.
[2]Postpartum period=from calving to 10 d after second postpartum ovulation or 150 d.
[3]Scale = 1 to 9; 1=emaciated, 9=obese.
[abcd]Numbers in the same row that do not share a common superscript differ (P<.05).

levels of energy during similar periods. Energy levels prior to calving also affected (P<.05) cow performance following calving. Cows fed low levels of energy before calving lost less body condition and weight when fed low levels after calving and gained more body condition and weight when fed high levels after calving, compared with cows receiving high levels of energy prior to calving.

The effects of dietary energy on reproductive function and production are shown in Table 19.2. Low energy levels prior to calving decreased (P<.01) calf birth weight, cow milk production, and calf weight at 70 d of age compared to cows fed high levels of energy before calving. Low levels of energy after calving also decreased (P<.001) cow milk production and calf weight at 70 d of age compared to cows receiving high levels after calving. Of the measures of milk composition, only percentages of protein and total solids were decreased (P<.01) in cows receiving low levels of energy after calving. Prepartum energy did not influence milk composition. The correlation between cow milk production and calf weight at 70 d was .89 (P=.0001). This correlation is somewhat higher than previous reports; however, because calves were maintained in drylot, milk was the only available source of calf nutrition, which probably explains this strong relationship.

An interaction between pre- and postpartum energy affected (P<.05) both cervical and uterine involution at various times after calving. However, rate of involution was fairly similar among all treatment groups following calving and appeared to be fairly complete by 30 d postpartum. Low levels of energy before calving increased (P=.02) the interval from calving to ovulation. The percentage of cows that ovulated by 150 d postpartum was decreased (P=.002) in cows receiving low compared to high levels of energy after calving. Only one cow exhibited standing estrus associated with the first ovulation following calving; however, all cows exhibited standing estrus at the second ovulation following calving. All cows that ovulated had a short luteal phase between the first and second ovulations.

Table 19.2. Effects of Pre- (PR) and Postpartum (PP) Dietary Energy on Reproductive Function and Production of Cows and Calves

Item	Treatment combinations				SE
	L-L	L-H	H-L	H-H	
Calf birth weight, lb	72.0[a]	77.0[a]	79.3[ab]	85.3[b]	2.7
Calf wt at 70 d of age, lb	112.0[a]	158.4[b]	168.5[b]	202.6[c]	9.0
60-70 d postpartum:					
24-hr milk production, lb	4.1[a]	14.1[b]	11.6[b]	19.9[c]	1.1
Milk fat, %	2.1	2.7	2.2	2.5	.2
Milk protein, %	2.3[a]	2.6[bc]	2.5[ab]	2.7[c]	.1
Milk lactose, %	4.9	4.9	4.9	5.0	.1
Milk total solids, %	9.8[a]	10.7[bc]	10.1[ab]	10.7[c]	.2
PP interval to ovulation, d	—	96[b]	73.5[ab]	74.0[a]	7.1
% cycling by 150 d PP	0[a]	83[b]	29[a]	100[b]	12.5

[abcd]Numbers on the same row that do not share a common superscript differ (P<.05).