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Effect of prepartum protein level on calf birth weight, calving difficulty, and reproductive parameters of first calf heifers and mature beef cows

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Abstract

Two trials were conducted to determine if precalving protein intake would influence calf birth weight and calving difficulty. In Trial 1 (1983), 38 spring-calving Simmental heifers and 49 cows were allotted to three, 112 day isocaloric prepartum nutritional treatments: 75 (low), 100 (control) or 150 (high) percent of daily crude protein requirements (1976 NRC) for heifers or cows in the last trimester of pregnancy. In Trial 2 (1984), 22 heifers and 51 cows were allotted to control and high protein treatments only. After calving, cows were fed to meet NRC requirements. In Trial 1, the low protein level decreased prepartum weight gain but had no effect on postpartum weight change, pre-or postpartum condition change, postpartum interval (PPI), percent cycling is the first 21 days of the breeding season, first service or overall conception, milk production, calving difficulty, calf birth or 205 day weight. In both trials, high protein intake increased prepartum weight gain and condition score, shortened the PPI and increased percent cycling in first 21 days of breeding season but had no effect on the first service or overall conception, milk production, calving difficulty calf birth or 205 day weight.

Keywords

Cattlemen's Day, 1985; Kansas Agricultural Experiment Station contribution; no. 85-319-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 470; Beef; Protein; Birth weight; Reproduction

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Effect of Prepartum Protein Level on Calf Birth Weight, Calving Difficulty, and Reproductive Parameters of First Calf Heifers and Mature Beef Cows

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Summary

Two trials were conducted to determine if precalving protein intake would influence calf birth weight and calving difficulty. In Trial 1 (1983), 38 spring-calving Simmental heifers and 49 cows were allotted to three, 112 day isocaloric prepartum nutritional treatments: 75 (low), 100 (control) or 150 (high) percent of daily crude protein requirements (1976 NRC) for heifers or cows in the last trimester of pregnancy. In Trial 2 (1984), 22 heifers and 51 cows were allotted to control and high protein treatments only. After calving, cows were fed to meet NRC requirements. In Trial 1, the low protein level decreased prepartum weight gain but had no effect on postpartum weight change, pre- or postpartum condition change, postpartum interval (PPI), percent cycling in the first 21 days of the breeding season, first service or overall conception, milk production, calving difficulty, calf birth or 205 day weight. In both trials, high protein intake increased prepartum weight gain and condition score, shortened the PPI and increased percent cycling in first 21 days of breeding season but had no effect on first service or overall conception, milk production, calving difficulty, calf birth or 205 day weight.

Introduction

Energy levels prior to parturition can significantly influence calf birth weight, calving difficulty, and calf losses shortly after birth. The effects of prepartum protein intakes on these factors is unknown. Therefore, our objective was to determine if prepartum protein intake influences calf birth weight, calving difficulty, or reproductive performance in first calf heifers and mature beef cows.

Experimental Procedures

In trial 1, 38 spring calving Simmental heifers and 49 cows bred to the same sires by AI and natural service were allotted by weight, age, percentage Simmental breeding, and expected calving date to one of three isocaloric diets containing 75% (low), 100% (control) or 150% (high) of the NRC (1976) daily crude protein recommendations for the last 112 days prior to average calving date. In trial 2, 22 heifers and 51 cows were allotted to control and high levels only. Daily crude protein intake for low, control and high protein intake heifers and cows was 1.7, 2.3, 3.4 and 1.1, 1.4, 2.1 lb, respectively. Daily total digestible nutrient (TDN) intake was 13.8 and 11.3 lb for heifers and cows, respectively. In both trials, initial body weights and condition scores (average of three evaluators) were determined. Two-day average body weights were monitored at 21-day intervals until calving, within three days prepartum, within 24 hours postpartum and at weaning. Condition scores were reevaluated at calving and weaning. Calving difficulty was scored and calf birth weight taken within 24 hours after parturition. At calving, cows and calves were placed on native range and fed supplemental

alfalfa hay and milo to meet or exceed all postpartum nutritional needs (1976 NRC). Gomer bulls assisted twice daily observation to determine postpartum interval to first estrus. Breeding season consisted of a 42 day AI period followed by 21 days of exposure to clean up bulls. Pregnancy was determined by rectal palpation, and reproductive data included postpartum interval, percentage cycling in first 21 days of breeding season, first service and overall conception rate. Milk production was measured twice by the weigh/suckle/weigh technique and calf weaning weights were adjusted for age of dam, and calf age and sex.

Results and Discussion

No treatment by age of dam interactions existed for any variables analyzed, so heifer and cow data were combined. The low protein group gained less weight while the high protein group gained more than controls during the 112 day precalving period. Low and control protein cattle gained weight precalving, but their initial weights exceeded postpartum weights, and these groups lost condition prepartum indicating that the weight gain was due to fetal growth. Postcalving, the high protein cattle lost more or gained less weight than controls, while all groups lost condition during the lactation phase (Tables 8.1 and 8.2). Weight and condition changes prepartum would suggest possible calf birth weight differences, but protein intake had no effect on calf birth weight, calving difficulty or gestation length (Table 8.3). Cattle fed excessive protein could have been rebred earlier as this treatment shortened the postpartum interval and increased the percentage cycling in the first 21 days of the breeding season. Protein intake had no significant effect on first service or overall conception, milk production or adjusted 205 day calf weight (Table 8.4). These data suggest that the NRC protein requirements of gestating beef cows should be supplied. Excessive protein did not result in increased calf birth weight or calving difficulty, and the slight enhancement in reproductive performance is probably not cost effective.

Table 8.1. Body Weights and Weight Changes for Heifers and Cows on Various Prepartum Protein Levels

Item	Trial 1 - Protein Levels			Trial 2 - Protein Levels	
	Low	Control	High	Control	High
No. Heifers, Cows	13, 16	12, 16	13, 17	11, 26	11, 25
Initial Weight, lb	1214	1227	1213	1190	1183
Prepartum Weight, lb	1277[a]	1350[b]	1368[b]	1300	1351
Prepartum Weight Change, lb	63[a]	123[b]	155[c]	110[a]	168[b]
Postpartum Weight, lb	1128[a]	1198[ab]	1217[b]	1140	1182
Fall Weight, lb	1140	1175	1141	1176	1186
Lactation Weight Change, lb	13[a]	-23[a]	-76[b]	36[a]	5[b]

[abc]Values with different superscripts differ significantly ($P<.05$) within a trait and trial.

Table 8.2. Condition Scores[c] and Condition Score Changes for Heifers and Cows on Various Prepartum Protein Levels

Item	Trial 1 - Protein Levels			Trial 2 - Protein Levels	
	Low	Control	High	Control	High
Initial Condition Score	5.4[a]	5.4[a]	4.9[b]	5.6	5.7
Calving Condition Score	4.5[a]	4.7[ab]	5.1[b]	4.8	5.5
Prepartum Condition Score Change	-.8[a]	-.7[a]	.2[b]	-.7[a]	-.2[b]
Fall Condition Score	4.3	4.5	4.5	4.6	4.6
Lactation Condition Score Change	-.2	-.2	-.5	-.3[a]	-1.0[b]

[ab]Values with different superscripts differ significantly (P<.05) within trait and trial.
[c]1 = extremely thin, 5 = average, 9 = extremely fat

Table 8.3. Calving Data for Heifers and Cows on Various Prepartum Protein Levels

Item	Trial 1 - Protein Levels			Trial 2 - Protein Levels	
	Low	Control	High	Control	High
Birth Weight, lb	89.4	87.2	89.2	95.5	97.0
Calving Ease Score[a]	2.17	1.88	1.70	1.85	1.77
Calving Difficulty Incidence, %	48.3	32.1	36.7	30.6	25.7
Gestation Length, days	286.0	286.4	285.4	287.0	287.3

[a]1 = unassisted 3 = mechanical calf jack 5 = malpresentation
2 = slight assistance 4 = cesarean section 6 = calf death resulting from difficulty

Table 8.4. Reproductive Data, Milk Production and Calf Weights for Heifers and Cows on Various Prepartum Protein Levels

Item		Trial 1 - Protein Levels				Trial 2 - Protein Levels	
		Low	Control	High		Control	High
Postpartum Interval, Days		72.8[ab]	78.5[a]	62.3[b]		61.1	51.9
% Cycling in First 21 Days of Breeding Season		73.1[a]	70.8[a]	90.0[b]		56.5[a]	79.2[b]
Conception:							
First Service, %		29.4	45.5	58.8		47.1	32.4
Overall, %		76.9	76.6	77.0		75.3	85.0
Milk Production, lb/24 hr:	(68)[c]	19.7	18.2	15.1	(80)[c]	17.8	18.7
	(103)	22.9	17.4	19.0	(109)	17.4	17.9
Adj. 205 Day Calf Weight, lb		483.0	485.7	487.6		511.0	583.8

[ab]Values with different superscripts differ significantly (P<.05) within trait and trial.
[c]Days postpartum.