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Precalving Nutrition/birth Weight Interaction and Rebreeding Efficiency

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INTRODUCTION

Profitability of calf production can be greatly increased by improvements in reproductive efficiency. Losses in income are associated with nonpregnant cows, calves that are born late in the calving season and death of calves at birth. Too many heifers and cows exposed to bulls during a breeding season do not become pregnant and wean a calf the next year. A major reason for the inefficiency is that cows are not pregnant at the end of breeding because many have not been in estrus and bred by the bulls. In addition, some cows do not start estrous cycles until late in the breeding season, so if they become pregnant calves will be born late the next year. Calves lost at birth are usually associated with difficult or delayed parturition.

Two major factors that regulate reproductive performance of beef cows are nutrition and suckling. Nutrient intake influences body energy stores. Body energy stores can be mobilized when a cow receives less than the required amounts of nutrients during pregnancy or lactation. Body fat stores regulate the secretion of hypothalamic (brain) and pituitary hormones to control the functions of the ovary. If cows are too thin at calving, the hormonal signals necessary to stimulate the ovary and start estrous cycles are not released and cows don't exhibit heat until late in the breeding season, or not at all. The suckling stimulus also delays the release of hormones necessary for the reinitiation of estrous cycles after calving. Cows that lose their calves at birth usually come into heat sooner than cows with suckling calves. Under range conditions we need to utilize cows to convert forage to milk for growth of calves. There are few management options that can be used to increase reproductive performance by altering suckling. The practical approach to increase pregnancy rate, and time during the breeding season that cows become pregnant, is by strategic use of supplemental feeding during pregnancy.

BODY CONDITION SCORE

Nutritional status or body energy stores of a cow can be evaluated by estimating body condition score (BCS). It is well established that BCS of cows at calving is related to reproductive performance (Wiltbank et al., 1962; Dunn and Kaltenbach, 1980; Richards et al., 1986, Selk et al., 1988; Houghton et al., 1990). We found that BCS of cows at the time of calving is the most important factor that can be used to predict whether cows will become pregnant during the breeding season. In general, if cows calve in the spring with a BCS of 5 (1 = emaciated and 9 = obese) and maintain weight after calving acceptable pregnancy rates (80 - 90%) will be obtained. If cows calve with BCS between 4 and 6, the effect of a one unit change in BCS is greater than for cows that are thinner or fatter at calving.

Weight and BCS changes before calving also influence the interval from calving to the

first estrus. We found that the percentage decrease in body weight from November until just prior to calving in March was correlated with the number of days to first estrus ® = .61) and days to conception ® = .62). Dunn and Kaltenbach (1980) found that for each 2.2 pounds loss of body weight before calving, the percentage of cows that showed estrus by 60 days after calving decreased by .5%.

Body weight changes during pregnancy may influence postpartum reproductive performance independent of BCS. Cows that were fed to maintain body weight during the last half of pregnancy had a 13% greater pregnancy rate than cows with a similar BCS at calving, but had lost and regained weight (Selk et al., 1988).

NUTRITIONAL EFFECTS ON FETAL DEVELOPMENT

Many factors influence the birth weight and survival of calves. Reduced nutrient intake during the last third of pregnancy may cause reduced birth weights as well as calf mortality, reduced milk production and decreased postnatal calf growth. Studies indicate that beef cows that have been fed restricted diets during late gestation often have calves with lighter birth weights compared to cows with adequate nutrition. These observations have stimulated some cattlemen to reduce feed intake of cows, especially first calf heifers, during pregnancy in an attempt to decrease calving difficulties.

We determined the influence of BCS and nutrient intake of mature Hereford cows during late pregnancy on fetal growth and uterine and placental development (Rasby et al., 1990). Seventeen mature cows at approximately 180 days of gestation were assigned to treatments to achieve thin or moderate BCS by 260 days of pregnancy, when they were slaughtered and evaluated. At 260 days, the thin cows had a BCS of 3.7 and moderate cows had a BCS of 5.7 (Table 1). Body weights were 922 ± 35 lb for thin and 1122 ± 33 lb for moderate cows. Weights and lengths of the calves at slaughter were not significantly different for thin and moderate cows. The uteri were heavier in the moderate than the thin cows but the total placental fluid volume was not altered by treatment. However, the fetal membranes and cotyledons weighted more in thin than in moderate cows. Increased growth of the placental membranes and cotyledons in the thin cows compared with the moderate cows occurred and may be the reason why calf weights were not altered at 260 days by the reduced nutrients available to the thin cows. Since fetal-placental changes occur in cows during late gestation to compensate for reductions in energy intake and body energy reserves, major reductions in nutrient intake are required to reduce the birth weight of calves.

Table 1. Placental and fetal characteristics of cows in thin or moderate body condition on day 260 of gestation.

Characteristic	Body Condition Thin	Moderate	SE
Number of cows	8	9	--
Body Weight, lb	923	1112	79
Body Condition Score	3.7	5.7	.1
Uterine weight, lb	8.67	9.67	.37
Placentala weight, lb	2.84	2.34	.20
Cotyledonary wt, lb	4.12	3.17	.33

[a]Chorioallantois minus cotyledons.

NUTRITIONAL EFFECTS ON CALVING DIFFICULTY AND REBREEDING OF HEIFERS

An early study (Turman et al., 1965) evaluated the effects of nutrient intake of Hereford heifers on calving difficulty and rebreeding. Heifers grazed native grass pastures and were supplemented with cottonseed meal and milo during the winter before calving in March and April. Heifers were allotted to one of three treatments and amounts of supplements were fed so that low heifers lost 20% of the fall weight; moderate heifers lost 10% of the fall weight; and high heifers maintained weight. The loss of weight included the loss of weight associated with calving (weight of calf, placental tissues and fluids).

Body weights of the heifers during the early part of the breeding season were influenced by the winter supplementation program (Table 2). Heifers on the moderate weight change treatment weighed about 100 lbs more than the low heifers, and heifers on the high treatment weighed 158 lbs more than the low heifers. Although body weights of the heifers, and maybe birth weights of the calves, were influenced by nutrient supplementation during late pregnancy, calving difficulty was similar for heifers on all treatments. About one half of the heifers on all treatments calved without assistance. Pregnancy rate during rebreeding after the first calf was similar for heifers on all treatments, however, the days from calving to conception was influence by body weight of the heifers at calving. Heifers on the low treatment became pregnant at an average of 88 days after calving, whereas heifers on the moderate treatment were pregnant by 80 days and high heifers were pregnant by 74 days postpartum.

Based on this study that evaluated the effects of weight of heifers at calving (BCS of the heifers and birth weight of the calves were not given) it appears that calving difficulty may not be reduced by reducing the nutrient intake of heifers during late pregnancy.

Table 2. Effect of body weight of two-year-old heifers at calving on calving difficulty and rebreeding.

	Prepartum weight gains		
Characteristic	Low	Moderate	High
Number of heifers	36	39	40
Daily weight gain, lb	0	.5	1.0
Body weight after calving, lb	767	863	925
Heifers assisted at calving, %	58	52	48
Pregnancy rate, %	84	91	84
Calving to pregnancy, days	88	80	74

Adapted from Turman et al., 1965.

BODY CONDITION AT CALVING, CALF SURVIVAL AND REBREEDING PERFORMANCE OF FIRST CALF HEIFERS

It is well established that BCS at calving is the major factor that influences the percentage of cows that become pregnant during the breeding season. Nutrient intake during late gestation can influence calf birth weight, and calf birth weight is positively associated with calving difficulty (Bellows et al., 1971). Sometimes cattlemen reduce feed intake of first calve heifers in an attempt to decrease birth weight of the calves and to decrease calving difficulty. We conducted an experiment to determine the influence of BCS of 2 year old heifers at calving on birth weight of calves, calving difficulty and rebreeding performance (Wettemann et al.,1986).

Eighty-one Hereford and Angus x Hereford heifers that calved at 2 years of age were fed to gain or lose weight during late pregnancy so that they would have BCS of 4, 5 or 6 at calving. At calving dystocia scores were assigned (1 = no difficulty, 2 = minor difficulty, 3 = calf puller used, 4 = cesarean section, 5 = abnormal presentation) and calves were weighed. Heifers were randomly assigned to one of two nutritional treatments at calving; either to gain or maintain body weight for 69 days post partum. To evaluate the effects of the postpartum nutritional treatments, heifers were divided into two groups; those with a BCS < 5 at calving and heifers with a BCS ≥ 5.

The birth weight response of calves to treatments were different for the two years of the study (year x BCS interaction). In year 1, birth weights were similar for heifers with BCS of 4, 5 and 6 at calving (Table 3). However during the second year, birth weights were the least for BCS 4 heifers and greatest for heifers with a BCS of 6. The reason for this difference between years is not apparent. It might be related to the amount of nutrients available to the heifers each year during late pregnancy. Calving difficulty was not influenced by BCS of the heifers at calving. About one-third of the heifers in each BCS group required assistance at calving. The percentages of live calves at birth and at weaning were not influenced by BCS of the heifers at calving.

Table 3. Influence of BCS of 2-year-old heifers at calving on birth weights, calving difficulty and calf survival[a]

Trait	Body Condition Score 4	5	6
Number of heifers			
Year 1	10	21	8
Year 2	8	23	11
Total	18	44	19
Live calves at birth,%	94	84	95
Birth weight of calves, lb			
Year 1	68.3±2.4	66.2±2.0	67.6±1.9
Year 2	60.8±2.3	68.0±1.8	71.8±2.4
Dystocia score, average of 1-4 scores	1.2±.1	1.4±.1	1.3±.1
Heifers requiring assistance at birth, %	33	32	35
Live calves at weaning,%	83	84	89
Heifers pregnant at the end of the breeding season, %	65	78	89

[a]Year did not influence any of the traits except birth weight, so values are the mean ± SE for both years for all traits except birth weight.

Reduced nutrient intake of first calf heifers during late pregnancy may decrease growth of the calves and birth weights. However, the reduction in birth weights for the heifers during the second year of the study was not associated with a decrease in calving difficulty. This experiment was part of a Regional Research Project (S-204) and results at two other stations also indicated that BCS at calving (range 4-6) does not influence calving difficulty (Spitzer et al., 1986; Morrison et al., 1986). Differences in birth weights of calves from heifers on low or high nutrient intake during late pregnancy without an effect on calving difficulty score have been observed by others (Bellows and Short, 1978; Anthony et al., 1986).

The effect of feed intake during late pregnancy is minimal if any in cows compared with the response observed in heifers (Bellows and Short, 1978).

Body weights of the heifers during the first 12 weeks post partum are in Figure 1. The greatest increase in weight was for heifers calving with a BCS < 5 and assigned to the diet to gain weight. Heifers on the gain treatment gained about 100 lbs after calving. At 120 days post

partum, the rebreeding performance was similar for heifers that calved with a BCS ≥ 5 and were fed to maintain or to gain weight (Figure 2) (91 vs 94%). However there were significantly more pregnant heifers in the group that calved with a BCS < 5 (66%) and gained weight compared to the heifers that calved with a BCS <5 (36%) and maintained weight.

These results indicate that feeding greater amounts of energy after calving can improve the pregnancy rate or shorten the interval from calving to conception in thin heifers, but it will not compensate entirely for the poor condition of heifers at calving. In other words, increasing the plane of nutrition for heifers with BCS of 3 or 4 after calving will not allow them to rebreed as well as heifers that calve with a BCS of 5 or greater. There does not appear to be an advantage, as far as reproduction is concerned, to feeding greater amounts of energy to heifers after calving if they calve in good body condition. Since only about 53% of the heifers that calved in good body condition and gained weight were pregnant by 90 days post partum, it is a good practice to have heifers calve earlier than the cow herd so that they will breed back and calve at similar times the next year.

A recent study in Louisiana also evaluated the effect of BCS at calving on calving difficulty and rebreeding performance (Morrison, 1993 personal communication). Four-hundred-seventy-six 2 year old heifers, with less than 50% Brahman breeding, were fed diets during gestation to achieve BCS of 4, 5, 6, or 7 at calving. BCS at calving did not influence birth weights of calves or calving difficulty score, however reproductive performance was reduced in heifers calving in thin body condition.

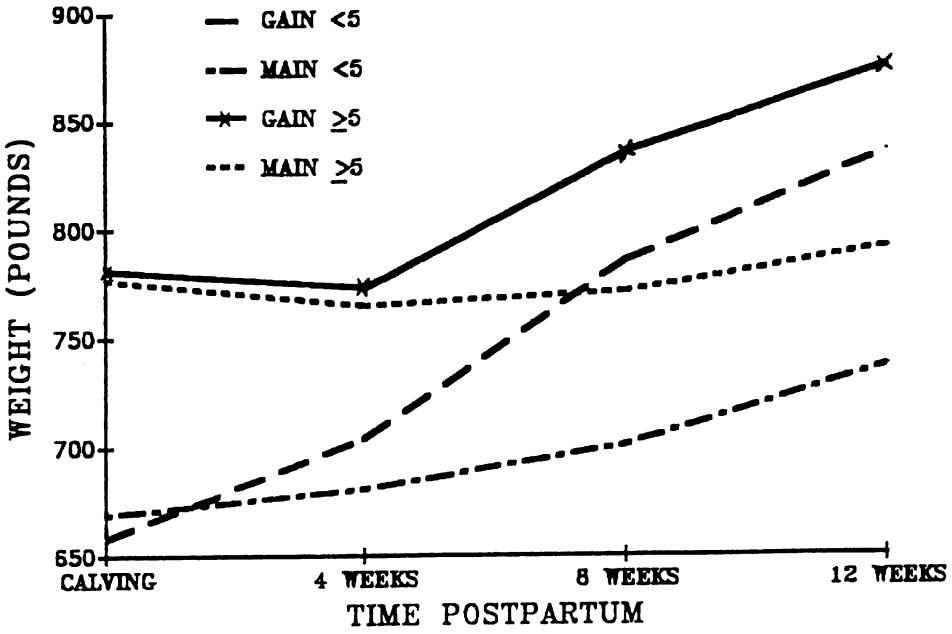

Figure 1: Postpartum weight of heifers with a body condition ≥ 5 or < 5 at calving and fed to gain or maintain weight.

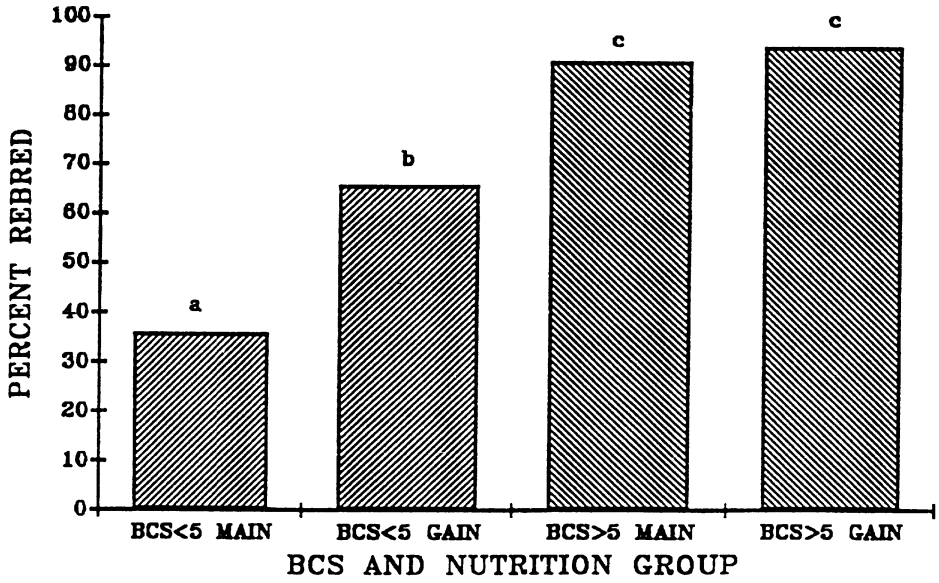

Figure 2: Percentage of heifers pregnant by 120 days after calving, when heifers calved with a BCS ≥ 5 or < 5 and were fed to gain or maintain weight. Bars with different letters (a, b, c) differ (P < .05).

CONCLUSIONS

1. Body condition score of cows at calving is the most important factor that determines if cows will become pregnant during the breeding season. To insure good reproductive performance spring calving cows should calve with a BCS of 5 and heifers should have a BCS of at least 5.5.

2. Growth of the placental membranes and cotyledons is increased when nutritional intake of cows is limited during late pregnancy. It takes severe nutritional restrictions to reduce birth weights of calves from cows, but moderate nutritional restrictions will reduce the birth weight of calves from first calf heifers.

3. Reducing the birth weights of calves from first calf heifers by nutritional restrictions does not decrease the incidence of calving difficulty but greatly reduces postpartum reproductive performance.

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