2000 Animal Science Research Report
Pages 160-163

Nutritional Effects on Estrus and Ovarian Activity of Spring Calving First-Calf Heifers

N.H. Ciccioli and R.P. Wettemann

Story in Brief

The effects of body condition score (BCS) at calving and weight gain after calving on reproduction were evaluated using 34 Hereford x Angus spring calving heifers. Cows were fed to calve with a BCS of 4 or 5. At parturition, cows were blocked by calving date and BCS, and randomly allotted to gain .45 kg/d (M) or .90 kg/d (H) for 75 d. Blood samples were collected thrice a week to determine plasma progesterone concentrations. Estrus was monitored with the HeatWatch^{Ò}system. All cows were artificially inseminated between 12 and 20 h after onset of estrus. Transrectal ultrasonography was used to measure the diameter of the dominant follicle at the first postpartum estrus. Within the range of BCS in this study, BCS at calving did not influence reproductive performance. Cows on the H diet had greater BCS and calf growth than cows on the M diet. The first postpartum estrus was usually preceded by an increase in progesterone in plasma for a short duration. The interval from calving to first estrus and ovulation was 23 d earlier in H cows than in M cows. Maximum diameter of the ovulatory follicle and the number of mounts at first estrus were great when cows were fed the H gain diet after calving. Pregnancy rate was not significantly affected by nutritional treatments. Increasing weight gain of first-calf cows after parturition results in a larger ovulatory follicle at the first estrus, more mounts at estrus, and a shorter interval from calving to first estrus with ovulation. Additional studies are needed to determine if nutrition influences fertility at the first postpartum estrus.

Key Words: Postpartum, Nutrition, Ovary, Estrus, Beef Cow

Introduction

Length of the interval from parturition to first estrus, or the postpartum anestrus interval (PPI), can greatly influence the profitability of a cow-calf system. Maximum production per cow depends on the ability to produce a calf every 365 d. Thus, lactating beef cows must become pregnant within 85 d after calving. The PPI is influenced by several environmental factors, including nutritional availability. If nutrient intake is inadequate, the length of PPI will be extended (Randel, 1990) and efficiency will be decreased.

Failure to return to estrus after calving is the main cause of reproductive inefficiency in first-calf heifers. The combined actions of growth and first lactation establish high nutritional demands that are often difficult to supply under grazing conditions. First-calf heifers usually have a longer PPI than mature cows (Bellows and Short, 1978). Body condition score (BCS) at calving is the most important factor determining whether cows will become pregnant during the breeding season (Selk et al., 1988). Postpartum weight gain influences ovarian activity of first-calf heifers during a restricted breeding season (Vizcarra et al., 1998). The objective of this experiment was to evaluate the effects of BCS at calving, and two levels of nutrient intake after calving, on luteal activity, estrous behavior, size of the dominant follicle at first estrus, and fertility in lactating first-calf heifers.

Materials and Methods

Thirty-four Hereford and Hereford x Angus heifers maintained on pasture were fed, during the last 90 d of gestation, to calve with a BCS of 4 to 5. At calving, in February and March, cows were blocked by calving date and BCS and assigned to one of two nutritional treatments for approximately 75 d. Cows were group-fed and targeted to gain .45 kg/d (Moderate=M) or .90 kg/d (High=H). During treatments all cows were fed prairie hay free choice. M cows were supplemented with 2 kg/head/d of range cubes (38% CP) whereas H cows had free access to a high-energy diet (12% CP). Body weights and BCS were recorded monthly. Calves were also weighed within 24 h of parturition. Cows were bled three times a week from 30 d postpartum to 21 d after the first estrus to determine luteal activity. The luteal phase was classified as normal (³ 11 d with progesterone ³ .5 ng/ml) or short (£ 10 d with progesterone ³ .5ng/ml). Estrous behavior was continuously checked with the HeatWatch^{O} system [1] . Onset of estrus was defined as the first of two mounts detected within 4 h, and end of estrus was identified as the last mount, with a mount within 2 h before, followed by a quiescent period of at least 12 h. The dominant follicle was defined as the follicle that was at least 10 mm in diameter and it was the largest follicle present in either ovary at estrus. Size of the dominant follicle was determined at 4 to 14 h after the onset of estrus by transrectal ultrasonography. All cows were artificially inseminated between 12 and 20 h after onset of estrus. Pregnancy rate was determined at 35 to 55 d post-insemination by ultrasonography and confirmed by calving date. Two by two factorial analyses of variance were used to test the effects of BCS at calving and postpartum nutrition on reproductive characteristics. Fisher's exact test was used to compare pregnancy rates.

Results and Discussion

Body condition score (4 vs 5) at calving did not affect any reproductive variables that were studied. Spring calving first-calf heifers should calve at BCS 6 to ensure efficient rebreeding (Spitzer et al., 1995). Cows in this study were thinner than optimal and should respond to postpartum nutritional treatments.

Body weights were similar for H and M gain cows prepartum (402 ± 32 kg; mean ± SD, respectively) and during the first 5 wk postpartum (361 ± 36 kg). Cows on H gain were 65 and 100 kg heavier (P<.001) than cows on M gain at 9 and 13 wk postpartum, respectively. The effects of postpartum nutrient intake on BCS of cows and calf growth are summarized in Table 1. Body condition score was similar in both treatment groups at the beginning of the feeding period. A greater postpartum nutrient intake increased (P<.01) BCS at the end of treatment. Cows on the H nutrition gained 18% whereas M cows only gained 2.5% of their initial BCS during treatment. Calves suckling H cows were heavier (P<.01) than those suckling M cows, at the end of treatment. Average daily weight gain (ADG) were .3 kg greater (P<.01) for calves nursing the H gain cows compared with M gain cows. Postpartum energy intake can influence milk production and calf weight at 70 d of age (Perry et al., 1991). Calves also might have consumed some of the ration offered to the H cows.

Postpartum nutrient intake did not affect luteal function immediately before and after the first estrus. Eighty-seven percent of cows had a short luteal phase prior to the first estrus. After estrus, all cows had a normal luteal phase. A transient increase in plasma progesterone concentrations has been observed for 3 to 5 d before the first postpartum estrus in cows (Donaldson et al., 1970). This has been confirmed by this and other studies. Development of a transient increase in progesterone may be required to reinitiate normal estrous cycles after parturition.

Ovarian and behavioral characteristics and reproductive performance at first estrus in response to postpartum nutrition are in Table 2. Cows fed H nutrient intake postpartum had a dominant follicle that was larger (P<.05) in diameter and H cows had a greater (P<.06)

number of mounts at the first estrus. Size of the dominant follicle was associated (r =.48; P<.05) with the number of mounts received at estrus. The duration of estrus was not affected by nutritional treatments. The duration and number of mounts at the first estrus were considerably less compared with those (16 h and 46 mounts/cow, respectively) obtained with normal cyclic cows (White et al., 1999). Half of our first-calf heifers had less than 10 mounts at their first estrus. This result indicates that first-calf heifers could be difficult to detect in estrus using twice daily observations during the spring and summer. If this occurred, their PPI would be even longer. A greater nutrient intake after calving decreased (P=.06) the interval from calving to first estrus by 23 d. Pregnancy rate was not affected (P>.10) by nutritional treatments in this study.

In conclusion, increased nutrient intake after calving was associated with increases in body weight, BCS, calf growth rate and maximum size of the dominant follicle before the first estrus. Consequently, the PPI was shortened and mounting activity was more frequent in first-calf heifers fed to gain more weight after calving.

Literature Cited

Bellows, R.A. and Short, R.E. 1978. J. Anim. Sci. 46:1522.

Donaldson, L.E. et al. 1970. J. Endocrinol. 48:599.

Perry, R.C. et al. 1991. J. Anim. Sci. 69:3762.

Randel, R.D. 1990. J. Anim. Sci. 68:853.

Selk, G.E. et al. 1988. J. Anim. Sci. 66:3153.

Spitzer, J.C. et al. 1995. J. Anim. Sci. 73:1251.

Vizcarra, J.A. et al. 1998. J. Anim. Sci. 73:1251.

White, F.J. et al. 1999. J. Anim. Sci. 77(Suppl 1):224.

Table 1. Influence of postpartum nutrition on BCS of cows and calf growth rate.

	Postpartum nutrition		
Item	Moderate	High	SE[c]
No. of cows	15	17	
BCS			
at calving	4.2[a]	4.4[a]	.10
at 75 d postpartum	4.3[a]	5.2[b]	.09
change in BCS, %	+2.5[a]	+18.0[b]	.08
Calf body weight, kg			
at calving	31[a]	32[a]	.9
at 75 d postpartum	79[a]	102[b]	3.5
ADG, kg/d	.59[a]	.92[b]	.03

[a,b]Means within a row differ (P<.01).

[c]Standard error.

Table 2. Influence of postpartum nutrition on the diameter of ovulatory follicle (DF), mounting activity and reproductive performance of first-calf heifers at first estrus.

	Postpartum nutrition		
Item	Moderate	High	SE[c]
No. of cows	15	15	
Diameter of DF, mm	13.5[a]	14.6[b]	.3
No. of mounts	7.5[a]	13.0[b]	2.0
Duration of estrus, h	3.5[a]	4.3[a]	.8
Interval to first estrus, d	146[a]	123[b]	8
Pregnancy rate, %	80[a]	100[a]	

[a,b]Means within a row differ (P<.06).

[c]Standard error.

[1] DDx Inc., Denver, CO

2000 Research Report - Table of Contents