

EFFECT OF RESTRICTED INTAKE ON CYCLIC OVARIAN ACTIVITY AND ESTRUS IN HEREFORD COWS

M.W. Richards¹, R.P. Wettemann², and H.M. Schoenemann³

Story in Brief

Multiparous Hereford cows (n=22) in moderate to good body condition were randomly allotted to maintain or lose weight under drylot conditions. Maintain cows received adequate feed to maintain initial body weight and lose cows were fed to lose 1% of their initial weight each week until cyclic ovarian luteal activity stopped. When approximately 75% of the lose group became anestrus, they received additional feed to gain weight until they resumed cyclicity. Body weights and body condition scores were recorded weekly and ovarian activity was assessed by evaluation of progesterone concentration in weekly plasma samples. Lose cows had reduced weight by 7 wk and reduced body condition by 14 wk when compared with maintain cows. Ovarian luteal activity ceased after 26 wk of reduced nutrient intake in 91% of the cows; cows had lost 24% of their initial weight and had a body condition of 3.5. Lack of ovarian activity was associated with absence of behavioral estrus. Estrous cycles resumed 9 wk after the beginning of increased nutrition; at which time, they weighed 12% less than at the start of the trial and had a body condition of 4.6. We conclude that anestrus occurs when nonlactating, Hereford cows lose weight and have a body condition of about 3.5. Fertile estrous cycles can be reinitiated by increased nutrient intake.

(Key Words: Anestrus, Beef Cow, Body Condition, Reproduction)

Introduction

Anestrus is a major cause of reduced pregnancy rates in cattle. The anestrus condition frequently results from reduced nutrient intake and depleted energy reserves. Although the precise physiological mechanisms controlling estrous cycles in domestic livestock are not clear, it appears that gonadotropin (pituitary hormone) secretion is altered. Reduced gonadotropin secretion results in decreased follicular development, absence of estrous activity, ovulation failure and subsequent inhibition of ovarian luteal activity.

The mechanisms whereby reduced nutrient intake alter brain function and subsequent steroid hormone synthesis have not been elucidated. Reduced pituitary function could lead to abnormal ovarian luteal activity. The objective of this study was to investigate the effects of reduced nutrient intake on estrous cycles and ovarian function in nonlactating, Hereford cows.

¹Graduate Assistant ²Regents Professor ³Former Research Associate

Materials and Methods

Twenty-two nonpregnant, nonlactating Hereford cows were randomly assigned to maintain (M) or lose (L) body weight. Cows were in moderate to good body condition (BCS=5.5+6; body weight (BW)= 926 lb) at the beginning of the trial. A complete ration (12% CP and 2.25 Mcal ME/kg of DM) was fed individually each day in a drylot for 41 weeks; groups were then pastured jointly on native range and supplemented with 2 lb/hd/d of a 40% protein cube.

Maintain cows were fed to maintain their initial BW and continue normal estrous cycles throughout the experiment. Lose cows were fed to lose approximately 1% of their initial BW weekly until 75% of the cows became anestrus; then, L cows were fed approximately 160% of the M amount. Lose cows received the gain ration until 70% of the anestrus cows resumed cyclic ovarian activity or expressed estrus.

Weights and body condition scores were recorded for all cows weekly for 45 consecutive weeks. Weight change percent was calculated as a percentage of a cow's initial weight. A minimum of 2 people assessed body condition weekly using the system where 1=emaciated and 9=obese. Weekly blood samples were taken via jugular venipuncture during the lose period. Twice weekly samples were taken during the regain period. Plasma samples were cooled on ice immediately after collection. Within 4 hr of collection, samples were centrifuged, plasma was decanted and stored at -20 C until assayed for progesterone by radioimmunoassay.

Androgenized cows fitted with chin-ball markers, weekly tail chalking, and visual observation were used to determine estrus. After the drylot period cows were pastured with fertile bulls fitted with chin-ball markers for 42 d of natural service. Pregnancy was diagnosed via rectal palpation 60 d after the end of breeding.

Results and Discussion

Lose cows were lighter ($P<.05$) than maintain cows by 7 wk of the trial (Table 1). By 30 wk the L group had lost 25.8% of their initial BW whereas M cows were similar to their initial weight (-1.7%). The effect of reduced nutrient intake on body condition was similar to its effect on weight change (Table 1). By 30 wk the L cows were 3 condition scores less than M cows (5.7 vs 2.7; M vs L, respectively; $P<.05$).

Reduced nutrient intake resulted in decreased ovarian function and estrous behavior. Cyclic ovarian luteal activity ended (progesterone concentration $<1\text{ng/ml}$ for 3 consecutive wk) in 91% of the L group by 30 wk of restricted nutrition while 100% of the M cows had normal ovarian function at wk 30 (Table 2). Ovarian luteal activity ceased 26 ± 2 wk after nutrient restriction began. Low cows had lost $24 \pm 3\%$ of their initial weight and had a BCS of $3.5 \pm .3$. Lack of ovarian luteal activity was associated with anestrus.

It took approximately 10 wk of a high level of nutrition for L cows to regain enough weight and body condition to be similar to M cows (Table 1). Seventy-three percent of the L group had resumed estrous cycles by wk 8 of the regain period. Mean return to estrus was 9 ± 4 wk from initiation of increased feeding. At resumption of estrous cycles, cows had regained $12 \pm 10\%$ of their initial body weight and had achieved a body condition of $4.6 \pm .5$.

Table 1. Effect of restricted nutrient intake on weight change percent and body condition score.

Week	Weight change percent		Body condition score	
	Maintain	Lose	Maintain	Lose
Lose period				
5	.2	-5.7	5.5	5.5
10	-.3 ^a	-9.0 ^b	5.3	4.9
15	1.9 ^c	-13.0 ^d	5.7	4.8
20	.0 ^c	-21.2 ^d	5.7 ^a	4.4 ^b
25	-2.5 ^c	-23.1 ^d	5.8 ^c	3.7 ^d
30	-1.7 ^c	-25.8 ^d	5.7 ^c	2.7 ^d
Regain period				
5	-2.2 ^c	-19.0 ^d	5.6 ^c	4.0 ^d
10	2.0	-10.4	5.6	4.8
15	11.6	.7	5.8	5.0
17	16.9	6.5	5.8	5.2

a,^bTreatment influenced the characteristic.

c,^dTreatment influenced the characteristic.

Table 2. Effect of nutrient intake on cyclic ovarian activity (OA).

Week	Percent with OA	
	Maintain	Lose
Lose period		
5	82	100
10	100	100
15	100	100
20	100	100
25	100	91
30	100 ^a	9 ^b
Regain period		
5	100 ^a	27 ^b
10	91 ^c	64 ^d
15	91	82
17	100	91

a,^bTreatment effect.

c,^dTreatment effect.

Plasma progesterone concentration greater than 1 ng/ml for 2 consecutive wk is an indication of ovarian luteal activity. Ovarian luteal activity occurred 10±5 wk after implementation of increased nutrition; at which point, cows had regained 16% of their initial weight and achieved a body condition of 4.9±1.2. First estrus was associated with ovarian luteal activity in 8 of the 8 cows that were positively identified as standing to be mounted by other animals. Six of 8 cows

had a normal cycle (17-24 d). Two of 8 cows had a cycle length of approximately 42 d. This extended length may be because the cows did not exhibit estrus or were not observed in estrus.

First service pregnancy rate was similar for both groups (82 vs 86, M and L, respectively). This indicates that infertility due to nutrient restriction can be reversed when cows gain enough weight and condition to resume normal estrous cycles.

Nutrient intake significantly influences cyclic ovarian activity and estrus in beef cows. Nonlactating, nonpregnant cows that were allowed to reach a body condition score of 3.5 ceased to exhibit normal estrous behavior. Normal estrous cycles were reinitiated by feeding nonlactating cows to achieve an average body condition score of 4.6.