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INFLUENCE OF DIETARY ENERGY LEVELS ON REPRODUCTIVE FUNCTION AND FERTILITY IN YEARLING BEEF HEIFERS [1,2]

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Summary

Fifty-nine heifers were allotted to be fed at two different energy levels. One group gained 1.77 lb/hd/day, and the other 1.25 lb/hd/day. Estrus was synchronized with the MGA/prostaglandin system. After MGA removal, ovarian development was monitored daily by ultrasound (10 per group) until estrous was detected following the PGF injection. Heifers were inseminated artificially based on estrus behavior. Faster gaining heifers had higher final body condition scores and greater changes in body condition score. The high energy diet caused a slight (P=.11) decrease in AI pregnancy rate for purebred heifers.

(Key Words: Beef Heifers, Energy Levels, Ovarian Function, Fertility.)

Introduction

Proper development of replacement heifers can improve reproductive efficiency. Heifers that conceive early in the breeding season tend to rebreed the following year and have a more productive lifetime. Dietary management can influence the reproductive efficiency of heifers. Underfeeding has long been recognized as detrimental to reproductive efficiency, but the impact of overfeeding has not been studied extensively. Our purpose was to determine the influence of two levels of dietary energy on expression of estrus, ovarian function, concentrations of progesterone, and corresponding AI conception rates.

Experimental Procedures

Fifty-nine heifers (40 commercial, 19 purebred) were stratified by weight and body condition score (BCS) within breed into two different treatments. Heifers were targeted to gain 3.3 lb/hd/day (excess) or 1.2 lb/hd/day (optimum). Estrus was synchronized by feeding MGA for 14 days, with a prostaglandin injection 17 days after removing MGA. From the time MGA was withdrawn until breeding, the ovaries of the 19 purebred heifers were scanned daily by transrectal ultrasonography. Blood samples were collected daily in the scanned heifers to determine progesterone concentration. From the scans, the corpus luteum and number and size of follicles were counted and scored as medium (5 to 10 mm diameter) or large (>10 mm). The size of the ovulatory follicle also was recorded. Both commercial and purebred heifers were inseminated artificially based on observed estrus. Commercial heifers then were placed with a bull for the remainder of the breeding season, whereas the purebred heifers continued to be inseminated for an additional 45 days, then were

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placed with a bull for an additional 10-days. Pregnancy determination and calving data were used to calculate conception date.

Results and Discussion

Heifers targeted to gain 3.3 lb/hd/day actually gained only 1.77 lb/hd/day. Heifers on the optimum energy level were targeted to gain 1.2 lb/hd/day and actually averaged 1.25 lb/hd/day. These averages were diminished because the purebred heifers lost weight during the scanning period. Although the desired average daily gain was not achieved, excess energy increased (P<.01) final average daily gain, final body condition score, and change in body condition score for both commercial and purebred heifers (Table 1).

Dietary energy level had no effect on serum progesterone concentrations, follicular development, or CL size at the time of prostaglandin injection (Table 2).

Excess energy decreased AI pregnancy rates (P=.11) in purebred heifers but had no effect in commercial heifers. Combining results for the purebred and commercial heifers resulted in a decrease in first-service conception rates for heifers on the excess energy level (Table 3).

Serum progesterone concentrations in the purebred heifers are shown in Figure 1. Although no treatment effects occurred the progesterone profile illustrates the expected response following MGA feeding and an injection of prostaglandin.

Table 1. Average Daily Gain and Body Condition Scores for Purebred and Commercial Heifers Fed Excess or Optimal Dietary Energy Levels

Trait	Excess Energy	Optimum Energy
Purebred heifers (n=19)		
Overall average daily gain	1.41[a]	1.03
Final body condition score	5.8[a]	5.4
Change in body condition score	.50	-.14
Commercial heifers (n=39)		
Overall average daily gain	1.98[b]	1.41
Final body condition score	6.5[b]	5.7
Change in body condition score	1.00[b]	.24
Overall heifer averages		
Overall average daily gain	1.77	1.25
Final body condition score	6.3	5.4
Change in body condition score	.89	.12

[a]Different (P<.01) from optimum energy treatment.
[b]Different (P<.05) from optimum energy treatment.

Table 2. Influence of Dietary Energy on Concentration of Progesterone in Serum, CL Size, and Number and Size of Follicles

Item	Excess Energy	Optimum Energy	P-value
Prior to prostaglandin inj.			
Progesterone level (ng/ml)	3.3	3.6	.7
Diameter of CL (mm)	20.9	19.4	.4
No. of medium and large follicles	3.7	2.9	.25
Diameter of largest follicle (mm)	9.3	7.9	.24
At time of AI breeding			
No. of medium follicles	3.0	2.0	.19
Diameter of ovulatory follicle	10.9	10.3	.62

Table 3. Influence of Dietary Energy Levels on Response to Synchronization, AI Conception, and Overall Pregnancy Rates

Treatment	% Response to Synchronization	% Conceived through AI	% Overall Pregnancy
Excess Energy			
Purebred	7/10(70%)	3/7 (42.3%)	9/10(90%)
Commercial	18/19 (94.7%)	13/l8 (72.2%)	18/19 (94.7%)
Combined	25/29 (86.2%)	16/25 (64.0%)	27/29(93.1%)
Optimum Energy			
Purebred	7/9 (77.8%)	6/7 (85.7%)	9/9 (100%)
Commercial	19/20 (95.0%)	15/19 (79.0%)	20/20 (100%)
Combined	26/29 (89.7%)	21/26 (80.8%)	29/29 (100%)

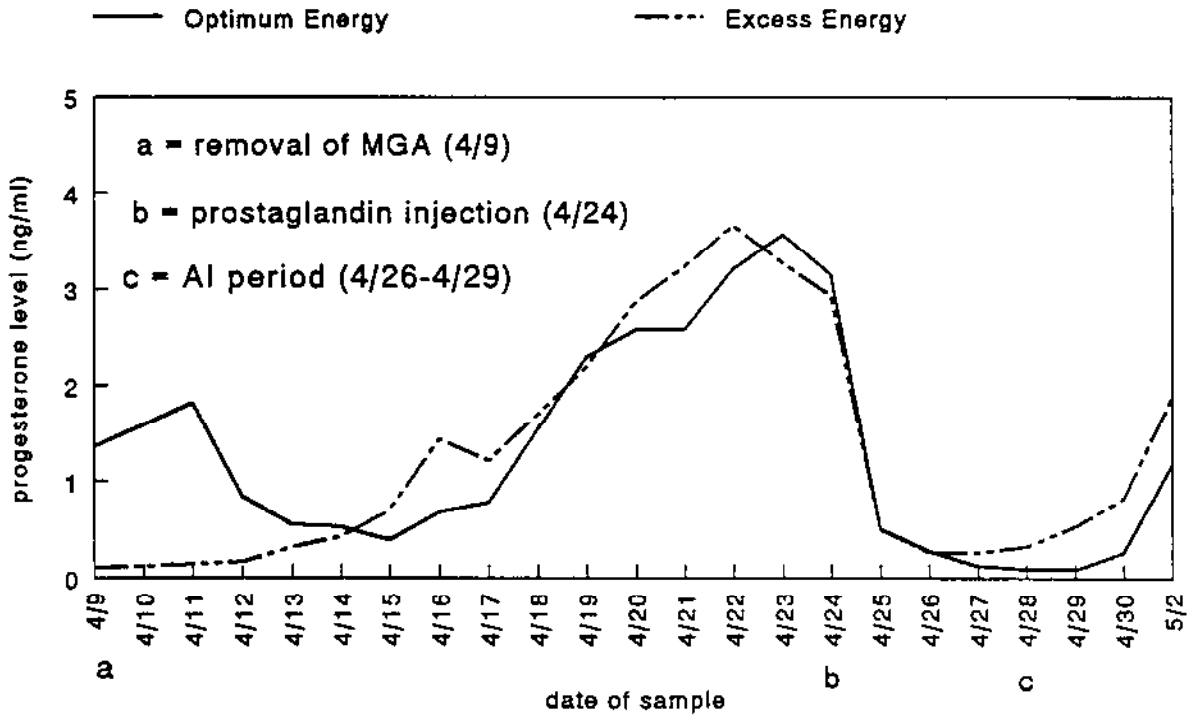

Figure 1. Average Progesterone Levels by Treatment for Purebred Heifers during Ultrasound Scan Period