Effects of Programmed Feeding to a Constant Average Daily Gain vs. Ad Libitum Feed Intake on Performance and Carcass Characteristics of Finishing Beef Steers

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Summary

Thirty-two Angus steers were used in a 140-d feeding trial to examine the effects of ad libitum feed intake or a programmed rate of gain on feedlot performance and carcass characteristics. Ad libitum-fed steers had greater (P < .06) DMI, ADG, and feed efficiency from d 0 to 28, 0 to 56, and 0 to 84 than programmed-fed steers; however, no differences in ADG, DMI, or feed efficiency were detected for the remainder of the feeding trial. Feeding regimen did not affect (P > .10) hot carcass weight, dressing percent, longissimus muscle area, marbling score, or yield grade. These data indicate that programmed feeding can be used to effectively manage intake by finishing beef cattle.

Introduction

Programmed feeding of beef cattle has been used by the cattle feeding industry to improve feed efficiency and economic return. The basic approach in programmed feeding involves calculating the quantities of feed required for maintenance and for a desired rate of gain using net energy equations (NRC, 1996). Commercial cattle feeders most often use programmed feeding methods to grow cattle until they reach a desired target BW (approximately 317.5 and 340.2 kg for heifers and steers, respectively). Once cattle reach the target BW, they are fed ad libitum to Choice grade. Although feed efficiency can improve with programmed feeding (Hicks et al, 1990), there is limited information available on what the target BW at the beginning of ad libitum feeding should be. In addition, effects on carcass quality when cattle are programmed for the entire feeding period are not well defined. Therefore, our objective was to compare performance and carcass characteristics of beef steers that were either fed ad libitum or fed to achieve a programmed specific rate of gain for the entire finishing period.

Materials and Methods

Thirty-two Angus steers were assigned randomly to one of two feeding regimens and fed a steam-flaked corn-based diet. Each feeding regimen was replicated in four pens with four steers per pen. Feeding regimens were: 1) control (ad libitum consumption throughout feeding trial); 2) programmed (calculated rate of gain at 1.59 kg/d, adjusted every 28-d period for increased BW).

On arrival at the Burnett Center, all steers were weighed, ear tagged, dewormed, and vaccinated (BRSV, IBR, and PI-3; seven-way clostridial). The steers were gradually worked up to a 90% concentrate diet, implanted with Ralgro at the start (d 0) of the experiment, and reimplanted at d 56 with Revalor–S. Steers were weighed at 28-d intervals throughout the trial.

The finishing diet was formulated to meet or exceed NRC (1996) recommendations for CP, Ca, and P. Ingredient composition of the 90% concentrate diet (DM basis) was as follows: alfalfa hay, 5.09%; cottonseed hulls, 5.09%; cottonseed meal, 5.01%; steam-flaked corn, 73.41%; molasses, 4.07%; yellow grease, 3.86%; urea, 0.92%; and premix (vitamins, minerals, Rumensin, and Tylan), 2.55%. Analyzed chemical composition of this diet (DM basis) was: CP = 12.36%, ADF = 7.44%, ash = 3.60%, Ca = .52%, and P = .26%. Average DM content of the diet was 80.65%. Control steers were fed ad libitum using a slick-bunk management system. Intake by programmed steers was calculated to achieve an ADG of 1.59 kg per steer daily, based on unshrunk BW, and NEm and NEg of the finishing diet.

Performance data were obtained and evaluated for each 28-d period of the trial. Carcass data were obtained by the Beef Carcass Research Center (Canyon, TX). Data were analyzed as a completely random design (pen as experimental unit) by analysis of variance using GLM procedure of SAS (1998). Differences between treatments were detected by using the treatment F-test in the analysis of variance.

Results and Discussion

Performance Data. Daily gain, DMI, and feed:gain data are shown in Table 1. Performance data are shown for each 28-d period, along with cumulative data for d 0 to 28, 0 to 56, 0 to 84, 0 to 112, and the overall trial (d 0 to 140).

Initial and final BW data were similar between treatments (Table 1). For d 0 to 28, 29 to 56, 0 to 56, and 0 to 84, DMI was greater (P < .02) by steers fed ad libitum than by steers fed to achieve a programmed rate of gain; however, this effect was not evident during d 0 to 112 or the overall 140-d period (P >.10).

Daily gain by steers fed ad libitum was greater (P < .01) for d 0 to 28 and d 0 to 56; however, daily gain during d 57 to 84 was greater by the programmed-fed steers (P < .005). Reasons for the decrease in daily gain by steers fed ad libitum during d 57 to 84 are not clear. However, it is possible that this response was a result of reimplanting on d 56, with a tendency for decreased DMI by steers fed ad libitum during d 57 to 84 compared with programmed steers. No differences (P > .10) in performance were detected in the final two 28-d periods or for the overall 140-d feeding period. Feed:gain was superior (P < .06) for steers fed ad libitum during d 0 to 28; however, programmed steers had superior (P < .009) feed:gain during d 57 to 84 and d 0 to 84 (P < .02). For d 0 to 112, and for the overall experiment, no differences were detected in feed:gain between treatments.

Our data are not consistent with those of Hicks et al. (1990), who reported an overall improvement in feed:gain of 4.7% in programmed-fed cattle compared to controls. Performance responses to programmed feeding in the present study were similar to those in the trial of Loerch and Fluharty (1998). In the present trial and the trial of Loerch and Fluharty (1998), overall daily gain and feed:gain ratio for control and programmed-fed steers did not differ.

Carcass Data. Carcass measurements are shown in Table 2. None of the carcass characteristics evaluated in the present study were affected by feeding regimen (P >.10). Control steers graded 100% Choice, whereas programmed steers averaged 87.50%

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Choice, with one steer grading Prime and another Select.

Effects of programmed feeding on carcass measurements in the present study were not consistent with those of Hicks et al. (1990), who reported trends for decreased marbling scores and carcass quality grades when steers were fed at a programmed rate of gain (1.35 to 1.50 kg/d). Similar to our results, Loerch and Fluharty (1998) reported no differences in carcass characteristics of programmed- or ad libitum-fed finishing steers.

Implications

Our results suggest that programming intake to maintain a constant rate of gain (1.59 kg/d of unshrunk BW gain) did not adversely affect performance or carcass characteristics of finishing beef steers. Although not statistically significant, feed:gain was improved slightly with programmed feeding. Programmed feeding to a desired rate of gain might prove beneficial to the cattle feeding industry through ease of management in milling of feed and in the control of day-to-day intake variation.

Literature Cited

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Acknowledgements

Table 1. Effects of programmed feeding to a specific rate of gain vs ad libitum intake on performance by finishing beef steers

Item	Treatment Ad libitum	Programmed	SEM[a]	OSL[b]
No. of pens (steers)	4 (16)	4 (15)	-	-
Body weight, kg				
Initial	342.68	343.90	1.00	-
Final (d 140)	581.59	582.90	3.88	-
DM intake, kg/d				
0 to 28 d	7.97	6.92	.110	.001
29 to 56 d	8.36	7.80	.132	.02
0 to 56 d	8.17	7.36	.111	.003
57 to 84 d	8.29	8.50	.181	NS
0 to 84 d	8.21	7.74	.102	.02
85 to 112 d	8.63	8.97	.346	NS
0 to 112 d	8.31	8.05	.144	NS
113 to 140 d	8.94	9.17	.284	NS
0 to 140 d	8.44	8.27	.151	NS
Daily gain, kg				
0 to 28 d	2.07	1.52	.090	.005
29 to 56 d	1.82	1.77	.106	NS
0 to 56 d	1.94	1.67	.049	.01
57 to 84 d	1.34	1.95	.096	.005
0 to 84 d	1.74	1.77	.023	NS
85 to 112 d	1.60	1.45	.124	NS
0 to 112 d	1.71	1.69	.033	NS
113 to 140 d	1.71	1.79	.096	NS
0 to 140 d	1.71	1.71	.028	NS
Feed:gain				
0 to 28 d	3.87	4.61	.22	.06
29 to 56 d	4.68	4.42	.22	NS
0 to 56 d	4.21	4.40	.09	NS
57 to 84 d	6.31	4.37	.35	.009
0 to 84 d	4.71	4.39	.07	.02
85 to 112 d	5.48	6.23	.28	NS
0 to 112 d	4.88	4.77	.05	NS
113 to 140 d	5.27	5.17	.29	NS
0 to 140 d	4.95	4.85	.07	NS

[a]Pooled standard error of treatment means, n = four pens per treatment.

[b]Observed significance level for treatment effects. NS = not significant (P > .10).

Table 2. Effects of programmed feeding to a specific rate of gain on carcass characteristics of finishing beef steers

| | Treatment | | | |
	Ad libitum	Programmed	SEM[a]	OSL[b]
Hot carcass wt., kg	363.15	363.23	4.51	NS
Dressing percent	62.48	62.66	.31	NS
Longissimus muscle area, cm^2	82.65	82.84	2.01	NS
KPH, %[c]	2.28	2.13	.08	NS
Fat thickness, cm	1.63	1.65	.10	NS
Marbling score	450.63	486.25	8.95	NS
Choice, %	100.00	87.50[d]	-	NS
USDA yield grade	3.50	3.48	.10	NS

[a]Pooled standard error of treatment means, n = four pens per treatment.

[b]Observed significance level for treatment effects. NS = not significant (P > .10).

[c]KPH = kidney, pelvic, and heart fat.

[d]Fourteen steers graded Choice, one steer graded Prime, and one steer graded Select.