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Effects on carcass traits of beef ration energy level and length of feeding

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Effects on Carcass Traits of Beef Ration Energy Level and Length of Feeding

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Summary

We used 150 Angus yearling steers of similar background from the Livestock and Meat Industry Council cattle-flow project. Each was assigned to one of 12 treatments (10 per treatment) involving low-, medium-, and high-energy rations (calculated to supply 34, 45, and 58 megacalories per 100 lbs. ration for net energy of production). Times on rations were 56, 91, 119, 147, and 175 days. Ten steers were fed a submaintenance ration of prairie hay 28 days before slaughter, and 10 served as controls (slaughtered when study started).

The 14 treatments provided a wide variety of carcass and product characteristics, which will help us determine minimum feed-energy input and length of feeding needed to produce beef acceptable for display and eating. Blade tenderization was also utilized to evaluate its effect on product quality.

Slaughter and carcass weights and dressing percentages increased with ration energy and time on feed. Higher ration energy resulted in higher marbling scores and quality grades for cattle fed 91 or 119 days, but not for those fed 56 or 147 days.

Cattle on the submaintenance ration for 28 days showed a darker, firmer lean, reduced marbling and quality grade, less fat and smaller rib eye area than controls.

Fat thickness increased with longer time on feed and with higher ration energy. Rib eye area was the same for cattle on medium- and high-energy rations after 56 or 91 days and did not increase in cattle fed more than 119 days. Kidney-pelvic-heart (KPH) fat increased with longer feeding after 56 days but did not differ between medium- and high-energy rations after 119 or 147 days. Cattle on low- and medium-energy rations didn't differ from each other in yield grade after 56 or 91 days on feed, but otherwise longer feeding and higher ration energy resulted in higher yield grades.

Introduction

Fluctuations in feed grain supply, demand, and price will continue and will focus interest on alternate feeding systems and reduced feeding time.

This study was to determine the minimum feed energy input needed (in terms of both ration energy and length of feeding) to produce acceptable

beef cuts, judged by display life and desirability and eating characteristics.

We also determined the effect of blade tenderization on these characteristics. This treatment might reduce ration energy inputs for acceptable beef.

Only carcass quality and yield grade characteristics are reported. Further results will be reported when available.

Experimental Procedure

We put 150 Angus yearling steers of similar background on feed after a 21-day adjustment period. Ten cattle were randomly assigned to each of 15 treatments (Table 23.2). One group was slaughtered at the start of the experiment (control) and another group (submaintenance) was fed only prairie hay 28 days, then slaughtered. Other groups were assigned to low-, medium-, and high-energy rations of approximately 35, 45, and 58 megacalories per 100 lbs. of feed calculated on the basis of net energy for production (Table 23.1). Rations were calculated to produce gains of about 0.5, 1.0, and 1.5 kg. per day (1.1, 2.2, and 3.3 lbs. per day), respectively, for low-, medium-, and high-energy rations. All cattle for a given energy level were fed in one group, and cattle were pre-assigned for slaughter after 56, 91, 119, 147 or 175 days on feed.

Cattle were withdrawn from feed 18 to 24 hours before slaughter and transported to a commercial packing plant. Carcass quality and yield grade characteristics were determined after a 24-hour chill. Round and rib wholesale cuts were transported to the Kansas State University Meat Laboratory for fabrication and sampling 7 days post slaughter.

Results and Discussion

Initial and final live weights, total gain, and average daily gains are summarized for each slaughter group in Table 23.2. The low- and medium-energy groups exceeded daily gains projected from net energy intake for each slaughter period. The high-energy group gained faster than projected the first 56 days, but slower than expected to each succeeding slaughter date.

Slaughter and hot carcass weights and dressing percentages are given in Table 23.3. Carcass weight and dressing percentages increased with time on feed, as expected, except for little increase after 147 days. Carcass weight and dressing percentage increased with higher ration energy regardless of time on feed.

Data are not included for the low-energy group fed 147 days. Six cattle died in that group; gains for the remaining 4 were very poor after 119 days on feed.

Carcass quality grade (Table 23.3) increased with time on feed and with ration energy level for cattle fed 91 or 119 days. The control group averaged midpoint Standard; the submaintenance treatment decreased in quality grade slightly. Even with the high-energy ration, cattle averaged only high Standard after 56 days, midpoint Good after 91 days on

feed, high Good after 119 and 147 days, and low Choice after 175 days. Visual marbling scores closely paralleled quality grade. The results were about as expected except grades were not so high as anticipated for high-energy groups on feed longer times. We determined the effect of quality levels on tenderness, juiciness, and flavor, as judged by a taste panel, and both fresh and frozen steak display characteristics. We have not yet analyzed those data. We also studied the influence of mechanical (blade) tenderization on taste panel judgments and display characteristics.

Carcass maturity of the submaintenance group was greater than (more mature) or equal to maturity in any other treatment. The darkest lean resulted when cattle were on submaintenance rations. No consistent effects were found for rations energy level on bone, lean, or overall maturity.

Fat color, scored visually, was yellower for submaintenance cattle and cattle fed low-energy rations for 56 or 91 days than for those fed more and longer. But the degree of yellowness noted should pose no merchandising problem. Ration energy level or time on feed did not affect fat color for those on feed 119 days or longer.

Table 23.4 shows yield-grade data. Adjusted fat thickness followed expected trends with reduced fat on the submaintenance group compared to controls. Higher ration energy and longer time on feed increased fat as expected.

Rib eye area was reduced by the submaintenance ration. The low-energy ration, even after 56 days, produced rib eye area similar to that by controls. After 56 or 91 days, rib eye area was the same for cattle on medium- or high-energy rations but less for those on low energy. Rib eye area did not increase after 119 days regardless of energy level, which confirms the idea of relatively early muscle growth.

Kidney-pelvic-heart (KPH) fat percentage was less for submaintenance cattle and for all cattle fed 56 days than for controls. It increased with time on feed, but did not differ between cattle on medium- or high-energy feed 119 or 147 days.

Because of reduced rib eye area, carcass yield grade increased slightly (lower cutability) for the submaintenance group. Grades of all cattle fed 56 days were similar to the controls' grade. Yield grade of cattle on low- or medium-energy rations did not differ after 56 or 91 days; otherwise, longer time on feed and higher energy rations produced higher yield grades.

Table 23.1. Components of rations (% on as-fed basis) used to study energy levels and length of time on feed.

Ingredient	Energy level[a]		
	Low	Medium	High
Corn	17.9	27.1	38.6
Wheat	17.9	27.1	38.6
Sorghum silage	16.8	16.5	16.3
Prairie hay	42.9	24.2	0
Supplement[b]	4.6	5.0	6.4

[a]Calculated to contain 35, 45, and 58 megacal/100 lbs. on NEp basis.
[b]Included soybean meal, ground limestone, dicalcium phosphate, salt, trace minerals, and vitamins.

Table 23.2. Weight gains by finishing steers on indicated ration energy levels for times shown.

Energy supplied	Days fed	No. steers	Pounds: Initial wt.	Final wt.	Gain	ADG
Submaint.	28	10	641.0	634.0	(-7.0)	(-.25)
Low	56	10	626.7	735.0	108.3	1.93
Medium	56	10	621.2	781.2	160.0	2.86
High	56	10	604.4	804.6	200.2	3.58
Low	91	10	619.3	777.0	157.7	1.73
Medium	91	10	627.6	860.8	233.2	2.56
High	91	10	626.0	883.8	257.8	2.83
Low	119	10	623.5	832.2	208.7	1.75
Medium	119	10	634.2	930.6	296.4	2.49
High	119	10	613.6	968.8	355.2	2.98
Medium	147	10	618.9	1004.2	385.3	2.62
High	147	10	625.2	1058.6	433.4	2.95
High	178	10	616.8	1095.6	478.8	2.74

Table 23.3. Live and carcass weights as influenced by ration energy level and length of feeding.[1]

Energy supplied	Days	No. of steers	Slaughter wt., lbs.[2]	Hot carcass wt., lbs.	Hot dressing % [2]
Control		10	636 ± 49	355 ± 26	55.7
Submaint.	28	10	634 ± 37	336 ± 26	53.0
Low	56	10	735 ± 52	385 ± 31	52.4
Medium	56	10	781 ± 42	413 ± 22	52.9
High	56	10	805 ± 48	439 ± 31	54.6
Low	91	10	777 ± 66	425 ± 38	54.7
Medium	91	10	861 ± 64	472 ± 43	54.8
High	91	10	884 ± 73	512 ± 55	58.0
Low	119	10	820 ± 57	453 ± 44	55.2
Medium	119	10	931 ± 69	538 ± 48	57.8
High	119	9	965 ± 77	569 ± 47	59.0
Medium	147	10	1004 ± 95	597 ± 56	59.4
High	147	10	1059 ± 59	642 ± 39	60.6
High	175	10	1095 ± 68	676 ± 53	61.7

[1]Mean ± standard deviation.

[2]Slaughter weight is directly from feedlot (no pencil shrink). Dressing % calculated from slaughter weight.

Table 23.4. How ration energy levels and time on feed affected yield grade factors.

Energy supplied	Days	n	Adjusted fat, in.	Rib eye area, in.[1]	% KPH fat	Yield grade
Control		10	.10 ± .03	9.47 ± .78	1.45 ± .16	1.43 ± .25
Submaint.	28	10	.03 ± .03	7.80 ± .78	1.00 ± .33	1.61 ± .22
Low	56	10	.06 ± .04	9.48 ± 1.00	.60 ± .21	1.17 ± .29
Medium	56	10	.08 ± .03	9.94 ± 1.21	.75 ± .35	1.24 ± .39
High	56	10	.10 ± .03	9.87 ± .64	.75 ± .26	1.39 ± .20
Low	91	10	.14 ± .06	9.22 ± .58	1.60 _ .32	1.87 ± .31
Medium	91	10	.16 ± .04	10.07 ± .87	1.95 ± .28	1.91 ± .28
High	91	10	.30 ± .12	10.37 ± 1.34	2.60 ± .46	2.39 ± .53
Low	119	10	.13 ± .05	9.81 ± .91	1.25 ± .26	1.67 ± .32
Medium	119	10	.23 ± .05	10.88 ± 1.07	1.85 ± .47	2.01 ± .34
High	119	9	.30 ± .09	11.53 ± 1.60	1.94 ± .39	2.13 ± .57
Medium	147	10	.32 ± .07	10.87 ± .88	2.65 ± .63	2.65 ± .50
High	147	10	.46 ± .09	11.15 ± .58	2.90 ± .46	3.19 ± .31
High	175	10	.57 ± .03	11.76 ± 1.20	3.40 ± .74	3.48 ± .69

[1]Mean ± standard deviation.

Table 23.5. How ration energy levels and time on feed affected carcass quality characteristics.[1]

Energy supplied	Days	No. of steers	Maturity, %[2] Bone	Lean	Overall	Fat color	Marbling quantity[4]	Quality grade[5]
Control		10	20 ± 0	56 ± 14	38 ± 7	1.7 ± .26	115 ± 40	58 ± 20
Submaint.	28	10	33 ± 7	74 ± 16	54 ± 9	2.2 ± .42	77 ± 48	38 ± 24
Low	56	10	28 ± 8	55 ± 18	42 ± 13	2.4 ± .52	105 ± 93	58 ± 68
Medium	56	10	27 ± 7	51 ± 12	36 ± 6	2.0 ± .32	135 ± 65	68 ± 34
High	56	10	29 ± 7	44 ± 12	36 ± 6	2.0 ± 0	151 ± 72	78 ± 39
Low	91	10	55 ± 5	56 ± 13	56 ± 7	2.4 ± .44	127 ± 43	64 ± 21
Medium	91	10	57 ± 7	55 ± 14	55 ± 8	2.0 ± 0	178 ± 111	100 ± 72
High	91	10	59 ± 10	52 ± 12	57 ± 12	2.2 ± .26	266 ± 86	172 ± 78
Low	119	10	39 ± 6	50 ± 12	44 ± 6	1.3 ± .26	156 ± 75	88 ± 57
Medium	119	10	35 ± 7	38 ± 13	36 ± 7	1.2 ± .26	229 ± 45	133 ± 38
High	119	9	43 ± 5	46 ± 13	44 ± 7	1.1 ± .22	305 ± 85	183 ± 55
Medium	147	10	50 ± 8	59 ± 23	54 ± 13	1.2 ± .35	291 ± 66	184 ± 38
High	147	10	53 ± 7	57 ± 24	55 ± 14	1.1 ± .21	308 ± 50	191 ± 33
High	175	10	55 ± 8	51 ± 6	53 ± 6	1.0 ± .16	358 ± 131	210 ± 57

[1] Mean ± standard deviation.
[2] Maturity as % in A maturity (higher no. = more mature).
[3] Fat color: 1 = very white, 2 = white, 3 = slightly yellow, 4 = yellow, 5 = very yellow.
[4] Marbling quantity scored as % within marbling degree (1 to 100 = prac. devoid, 101 to 200 = traces, 201 to 300 = slight, 301 to 400 = small, 401 to 500 = modest, etc.).
[5] Quality grade: 0 to 100 = Standard, 101 to 200 = Good, 201 to 300 = Choice, 301 to 400 = Prime.