Evaluation of Condition Scoring of Feeder Calves as a Tool for Management and Nutrition

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Summary

Two experiments were conducted to evaluate the effects of body condition scores of beef calves on performance efficiency and carcass characteristics. In Experiment 1, 111 steer calves were stratified by breed and condition score (CS) and randomly allotted to 14 pens. The study was analyzed as a 2 x 3 factorial design, with two breeds (Angus and Simmental) and three initial CS (4.4, 5.1, and 5.6). In Experiment 2, 76 steer calves were allotted to six pens by CS. The resultant pens averaged 3.9, 4.5, 4.7, 5.0, 5.1, and 5.6 in CS. Calves in both studies were fed a corn-based finishing diet formulated to 13.5% crude protein. All calves were implanted with Synovex-S® initially and reimplanted with Revalor-S®. In Experiment 1, 29-day dry matter intake (lb/day) increased with CS (17.9, 18.1, and 19.1 for 4.4, 5.1, and 5.6, respectively; $p < .04$). Daily gain (29 days) tended to decrease with increasing CS (4.19, 3.71, and 3.26; $p < .13$). Days on feed decreased with increasing CS (185, 180, and 178d; $p < .07$). In Experiment 2, daily gains also increased with decreasing initial CS for the first 114 days ($p < .05$) and tended to increase overall ($p < .20$). In Experiment 1, calves with lower initial CS had less external fat at slaughter (.48, .53, and .61 in. for CS 4.4, 5.1, and 5.6, respectively; $p < .05$). This effect was also noted at slaughter ($p < .10$), as well as at 57 days ($p < .06$) and at 148 days ($p < .06$) as measured by real-time ultrasound. Measurements of intramuscular fat and marbling were not different in either study. These data suggest that CS of feeder calves may be a useful tool for adjusting energy requirements of calves based on body condition. Also, feeder cattle may be sorted into outcome or management groups earlier than currently practiced using body condition and/or real-time ultrasound.

Introduction

The 1996 NRC Model for adjusting nutrient requirements of beef cattle allows “fine-tuning” feed requirements for a host of factors including: age, breed, condition, sex, frame size, stage of production, activity, temperature, wind speed, mud, hair coat and hide conditions, and acclimatization. Many of these factors can have very large effects on maintenance requirements, feed intake, and daily gain of calves.

One factor used to adjust requirements in two ways is body condition score. Body condition is used as a general measure of previous nutrition to account for compensatory gain. The general effect of body condition score on maintenance energy requirements is a 5% change for each body condition score. Body condition also is used to adjust internal insulation factors during cold stress.

Condition scoring is a common procedure for sorting beef cows and heifers into groups for common nutrition programs in the fall of the year. However, condition scoring of feeder cattle is uncommon. In fact, very little research has been conducted on condition scoring of feeder cattle. The NRC model uses research on body fat composition to adjust maintenance requirements and the relationship between body fat and condition score determined from beef cow research. This study was designed to evaluate the use of condition scoring to fine-tune nutrient guidelines for weaned calves and feeder cattle to take full advantage of new NRC models in the future.

Materials and Methods

Experiment 1

One-hundred-eleven steer calves raised at the Iowa State University McNay Research Center and two sire breeds (Angus, n=62 and Simmental n=50) were stratified by condition score (CS) and breed and randomly allotted to 14 pens. The final allotment by breed and CS is shown in Table 1.

Table 1. Allotment of steers in Experiment 1.

Sire Breed	Condition Score		
	4.4	5.1	5.6
	Number of Pens		
Angus	3	3	2
Simmental	2	2	2

Calves had been weaned 30-60 days and adapted to a moderate energy diet. Condition scoring was a visual assessment of body condition using the 1 to 9 scale commonly used with beef cows. The calves were implanted on day 1 with Synovex-S® and reimplanted at 58 days with Revalor-S®. All calves were fed the same diet, shown in Table 2. This diet was formulated to provide 13.5% crude protein, 17% NDF, .4% Ca, .4%P, and .64 Mcal/lb. NEg.

The calves were weighed at approximately 30-day intervals. At 165 days on feed, all cattle were evaluated for fat thickness using real-time ultrasound with the Aloka 500k® machine. Steers with greater than .4 inches fat thickness were slaughtered. All other cattle were fed for an additional 24 days. Routine carcass measurements were collected 24 hours postmortem. Additionally a ribeye slice was collected for determination of intramuscular fat.

Table 2. Diet fed in Experiment 1.

Ingredient	Percent, DM Basis
High-moisture corn	76.4
Haylage	13.1
Soybean meal	6.4
Cracked corn[1]	3.0
Ground limestone	0.7
Urea	0.4

[1]Carrier for Bovatec® (first 30 days, 30g/t), then Rumensin® (25g/t).

Data were analyzed using the general linear models procedure of SAS as a 2 x 3 factorial with breed and condition score as the main effects. Pens were considered the experimental unit.

Experiment 2

Seventy-six steers sired by Angus bulls from the Rhodes Research Farm were allotted by condition score (1-9 scale) to six pens. The resultant condition scores by pen were: 3.9, 4.5, 4.7, 5.0, 5.1, and 5.6. The calves had been weaned 30-60 days and adapted to a moderate energy diet. All calves initially implanted with Synovex-S® and were reimplanted at 114 days on feed. All calves were fed the same diet (Table 3) formulated to provide 13.3% CP, 18.1% NDF, .4% Ca, .4% P, and .62 Mcal NEg/lb. (DM Basis). Calves were weighed at approximately 30-day intervals. Fat thickness was measured three times throughout the feeding period using real-time ultrasound (Aloka 500k®). RTU measurements were at 57, 148, and 184 days on feed. Steers with greater than .4 inches of fat thickness as determined by RTU at 184 days were marketed. The remaining steers were fed an additional 22 days. Routine carcass measurements and ribeye slices (for ether extract determination) were taken as in Experiment 1.

Data were analyzed by linear regression of pen means of condition score (X) against performance and carcass measurements (Y).

Table 3. Diets fed in Experiment 2[a].

Ingredient	Ration 1	Ration 2
	——%, DM Basis——	
Corn	42.6	60.5
Earlage	41.5	——
Corn silage	——	24.3
Supplement 3[b]	13.3	12.8
Supplement 1[c]	2.6	2.4

[a] Ration 1 fed for 100 days, then switched to Ration 2.
[b] Supplement 3 is a 32% protein (Soybean meal, based supplement with 200g/t of Morensin)
[c] Supplement 1 is a urea-corn mixture to provide 48% CP (44% from NPN).

Results and Discussion

Experiment 1

The main effects of condition score on performance parameters are shown in Table 4. Condition score did affect initial weight, with fleshier calves being heavier ($p < .03$). Dry matter intake for the first 29 days was also greater with higher condition scores, perhaps a function of the heavier initial weights. This runs counter to the accepted notion that lower-condition cattle have higher feed intake as part of the compensatory gain effect of restricted prior nutrition. NRC (1996) adjustments for body condition effects on dry matter intake amount to a 5-7% decrease for each condition score greater than 5 to 6. It is important to note that calves in this study were from the same research herd, fed the same diet, and under the same management. Differences in body condition at 600-650 lbs. partly reflect genetic differences in appetite which may be more of an effect than previous nutrition. Lower condition score calves tended to gain faster ($p < .13$) for the first 29 days, regardless of lower feed intakes. Feed conversion was not statistically different, however, due to large variation. Figure 1 shows cumulative feed conversion for the three condition scores. While significant differences were not detected, numerical differences generally agree with the 5% change in NEm requirements for each condition score used in the 1996 NRC model. The breed x condition score interaction was not significant for any criteria, except days on feed. Days on feed for Simmental-sired calves averaged 189, 181, and 186 for condition scores 4.4, 5.1, and 5.6. Days on feed for Angus-sired calves averaged 180, 180, and 172 for condition scores 4.4, 5.1, and 5.6. The main effect of condition score on days on feed was significant ($p < .07$), with higher condition score calves having fewer days on feed.

The effect of initial condition score on carcass characteristics is shown in Table 5. Calves that were leaner initially had less external fat ($p < .05$) and leaner yield grades ($p < .09$) at slaughter than calves with higher condition scores. However, measures of intramuscular fat (marbling score, ribeye fat %, and quality grade distribution) were not different. This suggests a difference in fat distribution with days on feed among condition scores.

Table 6 is a summary of performance and carcass characteristics by the main effect of sire breed. Simmental-sired steers were heavier initially and at slaughter with greater days on feed. Feedlot performance was not different between the two breeds, however. Simmental-sired steers were leaner at slaughter with less fat thickness, lower yield grades, but higher KHP fat %. Angus steers had higher intramuscular fat with higher marbling scores, fewer Select carcasses, and a higher percentage of carcasses graded Choice and average choice.

Experiment 2

Performance of calves fed in Experiment 2 is shown in Table 7. Generally, no statistical effect of condition score on dry matter intake or feed efficiency was noted. The effect of condition score on average daily gain for the first 114 days ($p < .05$) and overall ($p < .20$) was significant, however. As in Experiment 1, numerical trends in feed efficiency are not inconsistent with NRC (1996) adjustments for NEm requirements based on condition score.

Carcass characteristics and real-time ultrasound fat measurements are shown in Table 8. No differences were noted in carcass characteristics with the exception of external fat thickness ($p < .10$). In fact, fat thickness differences first measured at 57 days ($p < .06$) on feed were maintained through slaughter (an additional 130-140 days). Trends in external fat deposition by condition score are shown in Figure 2.

Implications

1. Body condition scoring of feeder calves may be a useful method of adjusting nutritional requirements for growth of feeder calves. Current methods of adjusting NEm requirements by the NRC (1996) appear appropriate. Adjusting dry matter intake expectations may be more appropriate in assessing compensatory intake of cattle procured from widely different management and nutritional environments. Calves under the same management and nutrition that are more fleshy may be that way because of a predisposition (perhaps genetic)

Table 4. Effect of condition score on cumulative performance in Experiment 1.

	Condition Score			Linear effect
Item	4.4	5.1	5.6	of CS
Initial wt., lb.	619±10	651±10	663±11	<.03
Cumulative performance				
-29 days				
DMI, lb.	17.9±.2	18.1±.2	19.1±.3	<.04
ADG, lb.	4.19±.27	3.71±.27	3.26±.30	<.13
Feed/gain	4.30±.91	4.95±.91	7.05±.99	NS
-58 days				
DMI, lb.	18.2±.4	18.6±.4	19.6±.5	NS
ADG, lb.	3.98±.10	3.83±.10	3.92±.11	NS
Feed/gain	4.58±.16	4.87±.16	5.01±.18	NS
-94 days				
DMI, lb.	18.8±.5	19.0±.5	20.3±.6	NS
ADG, lb.	3.88±.10	3.75±.10	3.99±.11	NS
Feed/gain	4.86±.15	5.09±.15	5.08±.16	NS
-129 days				
DMI, lb.	19.4±.6	19.7±.6	21.0±.6	NS
ADG, lb.	3.91±.11	3.64±.11	3.89±.12	NS
Feed/gain	4.96±.17	5.43±.17	5.40±.18	NS
-165 days				
DMI, lb.	19.7±.5	20.1±.5	21.3±.6	NS
ADG, lb.	3.73±.10	3.55±.10	3.76±.11	NS
Feed/gain	5.30±.17	5.70±.17	5.65±.19	NS
Overall				
DMI, lb.	19.9±.5	20.2±.5	21.4±.6	NS
ADG, lb.	3.66±.08	3.53±.08	3.69±.09	NS
Feed/gain	5.47±.14	5.73±.14	5.80±.16	NS
Days on feed	185±1	180±1	178±2	<.07
Final weight	1290±24	1283±24	1315±26	NS

for intake. 2. Calves that are leaner, with lower condition scores initially, were also leaner at slaughter, even with more days on feed. This suggests that technology currently being evaluated for sorting feedlot cattle into outcome groups may be useful much earlier in the feeding period than is common (i.e., reimplant time). 3. One particularly interesting observation is that while fat thickness at slaughter is reduced for cattle that have lower condition scores, measures of intramuscular fat do not differ. This may be significant in developing feeding/management systems for a particular quality grade endpoint.

Table 5. Effect of initial condition score on carcass traits (Experiment 1).

	Condition Score			Linear effect
Item	4.4	5.1	5.6	of CS
Carcass wt., lb.	754±15	758±15	772±17	NS
Fat thickness, in.	.48±.03	.53±.03	.61±.03	<.05
Ribeye area, in^2	12.4±.2	12.9±.2	12.6±.2	NS
KHP fat, %	2.2±.1	2.2±.1	2.2±.1	NS
Yield grade	3.02±.10	3.03±.10	3.36±.11	<.09
Marbling score	1041±12	1046±12	1035±14	NS
% rib fat	4.46±.20	4.35±.20	4.19±.21	NS
Quality grade				
-Percent standard	5.0±2.5	0.0±2.5	0.0±2.8	NS
-Percent select	9.0±6.5	24.2±6.5	27.5±7.1	NS
-Percent choice	85.5±5.4	73.0±5.4	72.8±6.0	NS
-Percent ave. choice	21.7±7.2	20.0±7.3	15.5±7.9	NS

Table 6. Effect of sire breed on performance and carcass characteristics.

	Angus	Simmental	Significance
Initial weight	626±8	662±9	<.01
Final weight	1268±19	1325±21	<.08
Days on feed	177±1	185±1	<.01
Dry matter intake, lb.	20.9±.4	20.1±.5	NS
Average daily gain, lb.	3.64±.07	3.61±.07	NS
Feed/gain	5.73±.11	5.59±.13	NS
Hot carcass weight, lb.	748±12	775±14	NS
Fat thickness, in.	.62±.02	.46±.03	<.01
Ribeye area, in^2	12.3±.1	13.0±.1	<.01
KHP fat, %	2.1±.1	2.3±.1	<.06
Yield grade	3.39±.08	2.89±.09	<.01
% rib fat	4.73±.16	3.95±.18	<.02
Marbling score	1058±10	1024±11	<.05
Quality grade			
-Percent standard	0.0±2.0	3.7±2.2	NS
-Percent select	12.2±5.0	28.3±5.8	<.07
-Percent choice	88.1±4.3	66.2±4.8	<.01
-Percent ave. choice	28.0±5.7	10.2±6.5	<.07

Table 7. Period performance in Experiment 2.

	Pen mean condition score						Linear effect
Item	3.9	4.5	4.7	5.0	5.1	5.6	of CS
No. head	568	627	556	589	542	667	NS
Day 1-114							
-Dry matter intake, lb.	18.9	17.8	19.5	19.9	15.0	18.3	NS
-Average daily gain, lb.	3.17	3.16	2.85	3.08	2.90	2.57	<.05
-Feed/gain	5.99	5.64	6.86	6.47	5.19	7.13	NS
Day 114-Final							
-Dry matter intake	23.5	21.1	23.2	26.0	20.2	20.7	NS
-Average daily gain, lb.	4.30	3.92	3.67	4.15	3.87	4.03	NS
-Feed/gain	5.48	5.39	6.34	6.27	5.23	5.15	NS
Overall							
-Dry matter intake	21.1	19.4	21.2	22.7	17.4	19.4	NS
-Average daily gain	3.56	3.56	3.19	3.59	3.29	3.18	<.20
-Feed/gain	5.92	5.44	6.66	6.34	5.29	6.11	NS
Days on feed	189	185	191	190	195	188	NS
Final weight, lb.	1241	1286	1165	1271	1184	1265	NS

Table 8. Body composition and carcass characteristics (Experiment 2).

	Pen mean condition score						Linear effect
Item	3.9	4.5	4.7	5.0	5.1	5.6	of CS
57 day RTU fat th., in.	.17	.17	.19	.17	.21	.24	p<.06
148 day RTU fat th., in.	.28	.25	.27	.31	.33	.34	p<.06
Final carcass							
-fat thickness, in.	.52	.49	.49	.56	.57	.59	p<.10
-ribeye area, in^2	12.4	12.5	12.1	12.6	12.0	12.3	NS
-KHP fat, %	2.3	2.2	2.1	2.2	2.0	2.1	NS
-Carcass wt., lb.	762	769	704	755	724	758	NS
-Dressing percent	61.4	59.8	60.4	59.5	61.1	60.0	NS
-Yield grade	3.21	3.09	2.95	3.18	3.24	3.35	NS
-Marbling score	1033	989	1003	1011	1079	1007	NS
-% ribeye fat	4.16	3.79	3.70	4.06	4.87	3.96	NS
Quality grade							
-% Standard	0	8	0	8	0	33	NS
-% Select	31	36	38	36	17	0	NS
-% Choice	69	58	62	58	83	67	NS
-% Ave. choice	23	8	7.6	16.6	41.2	44	NS
-% Prime	0	0	0	0	8	0	NS

Note that differences in fat thickness measured at 57 days on feed were generally maintained through slaughter.

Figure 1. Effect of initial condition score on cumulative feed efficiency in Experiment 1.

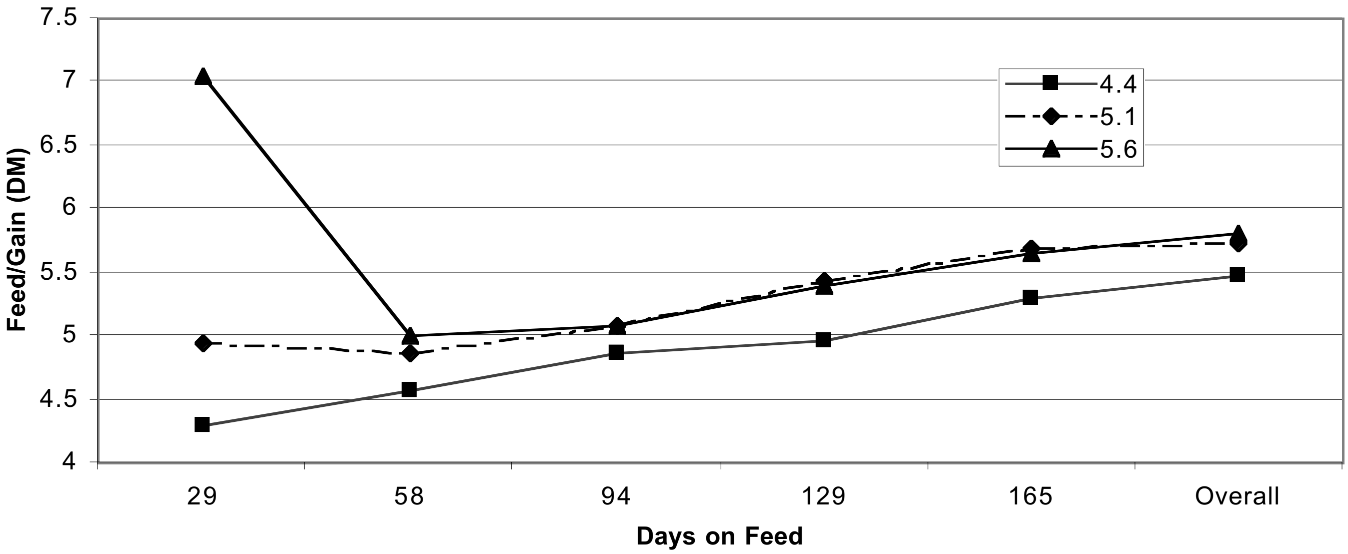

Figure 2. Trends in external fat development by initial condition score.