BODY COMPOSITION GRAZING OR FEEDLOT STEERS DIFFERING IN AGE AND BACKGROUND

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Story in Brief

Body composition was determined on 20 steers (four from each group) allotted to one of five management schemes: early weaned (EW; early weaned and placed into a feedlot at 3.5 months); normal weaned (NW; weaned and placed in a feedlot at 7.9 months); wheat pasture (WP; weaned at normal age but grazed on wheat pasture for 112 days prior to placing in a feedlot at 11.6 months); short grazed (SG; weaned at normal age but wintered on native range and then grazed on managed native range for 68 days prior to placement in a feedlot at 15.4 months); long grazed (LG; as SG but grazed native range for 122 days prior to placement in a feedlot at 17.4 months). At finished weight, carcass composition again was determined on 55 steers. Body composition (fat, water, protein, energy) of the empty body was calculated from carcass specific gravity. Protein and water content of steers decreased with length of grazing. Effects of grazing treatments on percentage body composition and total fat weight at finished weight were almost the opposite of those on entry into the feedlot with EW steers having a higher percentage of fat and a lower percentage of protein than other steers. However, weight of protein remained higher for cattle that had grazed than for cattle placed directly into the feedlot when they were weaned. Rate of gain of protein, water and ash in the feedlot were greater for cattle that had been pastured but their rate of fat deposition tended to be lower. Body composition at slaughter was markedly altered by the pre-feedlot backgrounding system.

(Key Words: Feedlot Steers, Body Composition, Background, Age.)

Introduction

Beef cattle are grown and finished through a variety of systems. Dairy calves often are weaned early and placed directly in a feedlot. Larger framed beef calves often are placed in feedlots at weaning time. Other cattle will graze

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during the winter on wheat pasture or on grass for various lengths of time prior to being placed in a feedlot. Rate and efficiency of gain often differ among cattle with such different backgrounds and ages. The objective of this experiment was to evaluate the body composition at the start and end of the feedlot period and to calculate rate of gain of various components.

Materials and Methods

Five different growing systems were tested as presented in Table 1. In the first system, calves were early weaned at about 3 months of age (EW) and placed directly in a feedlot. The second group (NW) was weaned at 7 months, preconditioned at the ranch of origin for 30 days and placed in a feedlot. The third group (WP) was the same as the NW group except that they grazed wheat pasture for 112 days prior to entering the feedlot. Instead of grazing wheat pasture, the fourth group (SG) was wintered on native forage plus two pounds of high protein cubes until spring grass became available. They grazed spring native grass until early July. The fifth group (LG) was handled the same as SG except that they were grazed into September. Growing systems and feeding methods are described in more detail in another paper in this report. All calves were from crossbred Angus dams and sired by Angus bulls but were from two different ranches in Oklahoma hereafter designated as A and G. Quality of pasture and genotype (milk production and frame size) differed between the two ranches of origin.

Four head from each production system were slaughtered to determine body composition at the time the steers entered the feedlot. A sixth group was slaughtered at the end of the dry winter phase before the start of SG and LG grazing in the spring. At the end of the finishing period, several steers from each origin and background were slaughtered when the average steer in each 7-head pen reached .50 in of sc. fat as appraised visually. From these data, one can calculate the compositional changes and the rates of deposition of body fat, protein, water and ash (bone) and energy in the carcass. Empty body weight was calculated by adding carcass weight to the weights of the emptied internal organs, the hide, head and feet. After the left side of each carcass was chilled for 72 hr, it was weighed in air and again after being suspended in a tank of water ($4^{o}C$). These weights were used to calculate specific gravity from which chemical composition of the empty body was estimated using the procedures of Garrett and Hinman (1969).

Specific statistical contrasts included a comparison of EW with all other steers, NW versus grazed steers (WP, SG & LG), EW versus NW, WP versus steers that grazed native range (SG & LG) and SG versus LG to test effects of length of native pasture grazing. Contrasts were all tested using the origin by treatment interaction as a conservative error term.

Table 1. Characteristics and body compositions of animal groups. Pre-feedlot.

Treatment	Early weaned (EW)	Normal weaned (NW)	Wheat pasture (WP)	Early intensive (SG)	Season long (LG)
Grazing	None	None	Wheat	Native grass	Native grass
Days fed	287	198	134	123	101
Number, head	28	28	28	28	28
Weaning age, mo	3.5	7.9	7.9	7.9	7.9
			Feedlot entry		
Weights and age					
Age, mo	3.5	7.9	11.6	15.4	17.4
Shrunk, lb	314	540	765	847	918
Empty, lb[bc]	331	462	654	673	732
Component weights of empty body, lb					
Protein[bce]	62.2	74.2	103.5	100.6	120.1
Fat[bcde]	30.3	106.4	158.6	192.1	155.2
Water[bce]	221.1	260.1	362.5	350.3	422.2
Energy, mcal[bcde]	290	650	950	1087	978
Body composition, % of empty body					
Protein[be]	18.7	16.0	15.8	14.9	16.4
Fat[bd]	9.3	23.1	24.2	28.5	21.3
Water[be]	66.6	56.2	55.3	52.1	57.5
Energy, mcal[bd]	1.943	3.104	3.197	3.559	2.953
			Post Feed Lot		
Weights					
Shrunk, lb[a]	1154	1178	1259	1259	1222
Empty, lb[bd]	1041	1089	1167	1182	1048
Component weights					
Protein[bc]	142.6	155.0	180.4	181.9	163.4
Fat	362.7	350.3	302.2	310.6	264.9
Water[bc]	492.2	537.2	630.6	635.6	571.7
Energy, mcal	1934	1911	1769	1808	1563
Body composition, % of empty body					
Protein[bc]	13.7	14.3	15.5	15.4	15.6
Fat[bc]	34.8	32.1	25.8	26.3	25.1
Water[bc]	47.3	49.4	54.2	53.7	54.7
Energy, mcal[bc]	4.085	3.856	3.328	3.374	3.273

[a] Calculated as hot carcass weight/.64.
[b] Early weaned differs from others (P<.05).
[c] Pastured differs from others (P<.05).
[d] Early intensively grazed differs from season long grazed (P<.05).
[e] Wheat pasture differs from grass background (P<.05).

Results and Discussion

Daily gain of the body components prior to feedlot entry are shown in Table 2. There was no consistent relationship between energy gain and empty body weight gain. During late summer, LG cattle lost energy while maintaining weight gain. Empty body fat content decreased from 29 percent on July 5 to 21 percent on August 30. During this time, steers lost a mean of .66 lb/d while gaining body protein at a rate of .35 pounds per day.

Gain of empty body weight, composition and component weights are presented in Tables 1 and 2. Data from the animals selected for slaughter may differ from means for all cattle being fed even though the selected animals were those animals nearest the mean from each pen or group.

Body composition on entry into the feedlot differed markedly between groups with different backgrounds (Table 1). Empty body weight was greater for groups placed into the feedlot after grazing grass or wheat pasture than for groups placed into the feedlot at weaning time. The weights of protein, fat and water in the empty body were less for groups placed in the feedlot at weaning. Protein and water weight in the empty body increased with starting weight, and fat also increased sequentially except that it was less for steers that had grazed season long than for steers that had intensively grazed managed native grass.

Expressed as a percentage of empty body weight, protein and water were higher and fat was less for early weaned calves than for other calves. Protein and water percentages decreased while fat and energy contents increased with age and time backgrounded except for the calves that had grazed for the full season. Those calves had body compositions quite similar to calves weaned at 7 months.

Final empty body weights paralleled final shrunk weights, being least for EW calves and less for LG than SG steers. Weights of protein and water were less and fat tended to be greater for EW than other steers and for NW than grazed steers, but energy content of the total carcass was not different among groups despite differences in weight and maturity.

At exit from the feedlot, the percentage of the empty body that was protein and water were less while fat was more for EW steers than other steers and for NW steers than for steers that had grazed. Energy content of the empty body was higher for steers placed directly into the feedlot than for steers that had grazed.

Daily weight gains for steers (shrunk and empty body weight) and specific components during the feedlot phase are shown in Table 2. Empty body weight gain tended to be less than shrunk weight gain for EW steers but more than shrunk weight gain for SG and LG steers. This probably is due to greater dressing percentage with increased fat deposition plus decreased gut fill and partly because empty body measurements were made on only a subset of the steers. No reason for the large discrepancy between empty and shrunk body weight gain for SG steers is apparent although, due to changes in the ratio of

Table 2. Daily gain (LB OR MCAL) of various components while on grass prior to entry in feedlot

Component	NW[a]	DW[b]	WP[c]	SG[d]	LG[e]	2LG[f]
Grazing or growing period						
Empty body gain	.96	.53	1.77	1.81	1.48	1.06
Protein	.09	.06	.27	.25	.30	.35
Fat	.56	.27	.48	.61	.05	.66
Water	.29	.18	.94	.87	1.05	1.29
Ash	.03	.02	.08	.08	.08	.09
Energy, mcal	2.64	1.33	2.76	3.28	.97	-1.96

Component	EW	NW	WP	SG	LG
Weights			Feedlot period		
Shrunk wt[gi]	2.93	3.22	3.70	3.36	3.02
Empty body[gj]	2.61	3.23	3.79	4.43	3.13
Components of empty body					
Protein[ghj]	.296	.416	.570	.707	.429
Fat	1.22	1.25	1.06	1.03	1.09
Water[ghj]	1.00	1.43	1.99	2.48	1.48
Ash[ghj]	.10	.13	.17	.21	.13
Energy, mcal	6.04	6.49	6.05	6.26	5.79

[a] Gain between early weaning and normal weaning (on cow).
[b] Gain during dry wintering phase.
[c] Gain on wheat pasture.
[d] Gain during intensive early stocking (April 15-July 5th).
[e] Gain during season long grazing (April 15-August 30th).
[f] Gain last half of season long grazing (July 5- August 30th).
[g] Early weaned differs from others ($P<.05$).
[h] Pastured differs from others ($P<.05$).
[i] Wheat pasture differs from grass background ($P<.05$).
[j] Early intensively grazed differs from season long grazed ($P<.05$).

carcass to non-carcass components, empty body weight gain can exceed shrunk weight gain. Rate of protein deposition was almost twice as great for pastured steers than for EW steers. However, rate of fat deposition and energy retention was not markedly different among these groups. This indicates that protein requirements for maximum rate of gain would be twice as great for backgrounded than for early weaned steers placed directly into the feedlot, whether expressed as grams per day or per calorie of diet. Based on the similarities in energy gain despite differences in protein and empty body weight gain, one might suggest that feed intake by steers is limited by the capacity of cattle to use excess calories to deposit fat and that higher weight gains of backgrounded cattle can be explained by greater rates of protein and water deposition.

Feed to gain ratio was much poorer for LG than EW cattle in this study as reported elsewhere in this research report. LG steers differed from EW steers in a number of characteristics. The closest relationship between carcass measurements and feed to gain ratio was for the amount of protein present at the empty body when steers entered the feedlot. The amount of protein in the empty body at the start of the feeding period was inversely related to efficiency of feed use (r^2=.66). This would indicate it is very costly energetically for a growing animal to maintain lean body mass.

For years, researchers have debated whether body composition can be altered by feeding systems or growing practices. By restricting calorie intake during the pre-feedlot phase in this study, fat content of carcasses at slaughter was reduced and weight at equal fat thickness over the rib was markedly increased. This indicates that body composition can be altered and presumably mature size can be increased by restricting energy intake during the post-weaning growth period. Background and age of cattle may be as important as condition score for estimating feed intake, rate of gain, feed efficiency and body composition. Unfortunately, maximum economic return is obtained from production of cattle with greater fat deposition in carcasses than consumers desire.

Literature Cited

Garrett W. N. and N. Hinman. 1969. Re-evaluation of the relationship between carcass density and body composition of beef steers. J. Anim. Sci. 28:1.