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Comparison of growth rates in the tissues of primal cuts of Canadian composites

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Abstract

Beef composites (C) have combined favourable traits of pure breeds. The objective was to compare the growth rates (GR) of muscle (M) and fat (F) in the primal cuts of serially harvested Beefbooster® C types (SM = C of small breeds, AH = C of Angus and Hereford and GLC = C with Gelbvieh, Limousin or Charolais terminal sires) from 274 - 456 days (d) of age to determine harvest times that reflect an increase M and a decrease F. Analysis of covariance obtained the slopes (GR/d) for M and F within each cut and C type. In the SM and AH the GR of overall F in all primal cuts exceeded that of M by 24.8 g/d and 4.91g/d respectively, while in GLC the gain of M exceeded that of F by 6.77 g/d. We suggest that the SM and AH could be harvested at least 30 d earlier than GLC thereby increasing the proportion of carcass M and decreasing F.

Keywords: Composite, beef cattle, muscle, fat, growth rate, primal cuts, harvest time
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Introduction

Canadian slaughter cattle comprise of crosses of early maturing British types, crosses of late maturing Continental types and British x Continental crosses. Composites (C) comprise of a combination of these types. There is a move to reduce saturated fats (such as beef fat) in human diets, as they are associated with heart disease, cancer, stroke, diabetes and atherosclerosis (De Smet *et al*., 2004; Doyle 2004). It has been suggested that reducing the slaughter weight can reduce the proportion of fat in beef (Steen & Kirkpatrick, 2000). When the rate of fat deposition exceeds that of muscle, the efficiency of muscling declines and feed is primarily utilized to produce fat, which requires a higher energy input (McDonald *et al*., 1988).

Materials and Methods

Three types of composite (C) steers [SM (n = 37), AH (n = 69) and GLC (n = 71)] were serially slaughtered at six age/weight groupings from 274 - 456 d. The SM contained C of small breeds, AH-C based on Angus or Hereford, GLC-C with Gelbvieh, Limousin or Charolais. Steers started on a diet containing 88% barley silage, 10.4% barley grain and 1.6% feedlot supplement and over the next 34 days adjusted to a diet containing 73.3% barley grain, 22% barley silage, 1.6% molasses and 3.1% feedlot supplement. The left side of each carcass was split into nine primal cuts and dissected into muscle (M), fat (F) and bone (B), and weights recorded. Analysis of covariance (GLM of SAS 1990) determined the growth rate GR (slope) of total tissue (M+F+B), M and F using age as a covariate. Comparisons of GR were made between C and cuts at $P < 0.10$. The objective was to compare the growth rates of M and F in the cuts of three C steers, and based on the GR of tissues determine if harvesting times can be altered and produce beef that has proportionately more M and less F.

Results and Discussion

The carcass traits and proportions of M, F and B are shown in Table 1. Dressing percentage increased, as steers got older or heavier, percent M decreased and F increased with age (Berg & Butterfield, 1976). The interaction of composite type x age and cut x age was significant ($P < 0.01$); hence separate slope models were fitted to the dependent variables. The GR of total tissue (M+F+B) was 356.0, 468.3 and 393.5g/d for

Table 1 Carcass traits (adjusted least squares means ± standard error of the mean, s.e.m.) of composite types in six age/weight groupings

Trait	Type X	1		2		3		4		5		6	
		Lsmean	s.e.m.	Lsmean	s.e.m.	Lsmean	s.e.m.	Lsmean	s.e.m.	Lsmean	s.e.m.	Lsmean	s.e.m.
Slaughter wt	SM	246.81[6]	11.12	369.29[6]	14.47	412.60[6]	16.23	425.52[6]	21.98	471.65[6]	22.78	452.20[6]	15.55
(kg) [n]	AH	314.01[11]	8.25	440.33[11]	10.88	500.12[11]	11.97	529.24[12]	14.65	544.89[12]	15.74	588.75[12]	10.88
	GLC	320.23[11]	8.30	466.24[12]	10.32	496.77[12]	11.23	510.00[12]	15.42	554.95[12]	15.85	570.19[12]	10.94
Dressing (%)	SM	55.24	0.70	56.19	0.64	57.00	0.57	58.39	0.59	58.37	0.51	57.99	0.49
	AH	55.81	0.52	57.08	0.48	56.99	0.42	58.19	0.39	59.07	0.35	59.17	0.34
	GLC	56.78	0.52	57.76	0.45	58.66	0.40	58.93	0.41	58.69	0.36	59.90	0.34
Muscle (%)	SM	62.11	0.77	57.20	1.21	55.80	1.01	55.88	1.09	54.34	1.17	49.81	1.11
[Left side]	AH	62.22	0.57	58.83	0.91	56.96	0.75	54.78	0.73	54.91	0.81	53.86	0.78
	GLC	63.86	0.57	60.56	0.86	59.61	0.70	58.96	0.77	57.00	0.82	56.49	0.78
Fat (%)	SM	19.57	1.08	27.26	1.48	29.39	1.15	29.92	1.24	31.01	1.36	36.59	1.29
[Left side]	AH	18.12	0.80	24.78	1.11	27.04	0.85	30.61	0.83	30.37	0.94	31.83	0.90
	GLC	17.01	0.81	23.40	1.05	24.79	0.80	25.60	0.87	27.54	0.95	29.35	0.91

Age /weight groupings W (columns 1–6)

W Age/weight group:
1 = age 274 d & weight 294 kg;
2 =age 374 d & weight 425 kg;
3 = age 372 d & weight 470 kg;
4 = age 399 d & weight 488 kg;
5 = age 427 d & weight 524 kg;
6 = age 456 d & weight 537 kg.

X SM - composites of small breeds; AH - composites based on Angus or Hereford; GLC - composites based on Gelbvieh, Limousin or Charolais.

Table 2 Growth rates (GR) (b = slope) of muscle (M) (g/d) on the left side primal beef cuts of serially harvested composite cattle from 274 - 456 days

Type [X]	SM					AH					GLC				
Cut	Rate (b) g/d		s.e.m.	ST[Y]	SC[Z]	Rate (b) g/d		s.e.m.	ST	SC	Rate (b) g/d		s.e.m.	ST	SC
Round	32.57	[2]	2.94	a	n	48.01	[2]	2.80	B	n	36.20	[2]	3.15	ab	n
Loin	12.21	[4]		a	p	17.58	[4]		B	p	16.54	[3]		ab	p
Short loin	9.72	[6]		a	pq	12.61	[7]		A	p	10.31	[8]		a	p
Flank	10.66	[5]		a	p	13.97	[6]		A	p	13.61	[6]		a	p
Chuck	50.63	[1]		a	m	70.31	[1]		B	m	62.84	[1]		ab	m
Rib	12.89	[3]		a	p	17.98	[3]		B	p	16.22	[4]		ab	p
Plate	8.83	[7]		a	pq	14.20	[5]		B	p	12.26	[7]		ab	p
Brisket	6.47	[8]		a	pq	10.26	[8]		B	pq	9.71	[8]		ab	pq
Shank	3.95	[9]		a	q	5.29	[9]		A	q	5.43	[9]		a	q
∑ M all cuts	148.78			a		211.59			B		181.95			ab	

[X] SM - composites of small breeds ; AH - composites based on Angus or Hereford dams;
GLC – composites based on Gelbvieh, Limousin or Charolais dams.
[ ] ranks of growth rates in descending order across cuts within type.
[Y] GR slope (S) comparisons for type (T); a,b different letters denote significance (P <0.10).
[Z] GR slope comparisons for cut (C); m,n..different letters denote significance (P <0.10).

Table 3 Growth rates (GR) (b = slope) of fat (F) (g/d) on the left side primal beef cuts of serially harvested composite cattle from 274-456 days

Type[X]	SM					AH					GLC				
Cut	Rate (b) g/d		s.e.m.	ST[Y]	SC[Z]	Rate (b) g/d		s.e.m.	ST	SC	Rate (b) g/d		s.e.m.	ST	SC
Round	20.39	[5]	2.25	a	n	26.44	[3]	1.77	a	np	22.35	[3]	1.89	a	n
Loin	12.13	[8]		a	p	14.40	[8]		a	p	13.53	[7]		a	p
Short loin	13.63	[6]		ab	p	16.10	[7]		b	p	12.09	[8]		a	p
Flank	22.35	[2]		a	n	25.91	[4]		a	np	23.76	[2]		a	n
Chuck	46.11	[1]		a	m	56.30	[1]		b	m	45.98	[1]		a	m
Rib	21.07	[4]		ab	n	25.71	[5]		b	np	20.16	[5]		a	n
Plate	21.60	[3]		a	n	28.67	[2]		b	n	21.10	[4]		a	n
Brisket	13.38	[7]		a	p	19.89	[6]		b	p	14.72	[6]		a	p
Shank	2.89	[9]		b	q	2.99	[9]		b	q	1.59	[9]		a	q
∑ F all cuts	173.66			a		216.50			b		175.18			a	

[X] SM - composites of small breeds; AH - composites based on Angus or Hereford dams;
GLC - composites based on Gelbvieh, Limousin or Charolais dams.
[ ] ranks of growth rates in descending order across cuts within type.
[Y] GR slope (S) comparisons for type (T); a,b different letters denote significance (P <0.10).
[Z] GR slope comparisons for cut (C); m,n..different letters denote significance (P <0.10).

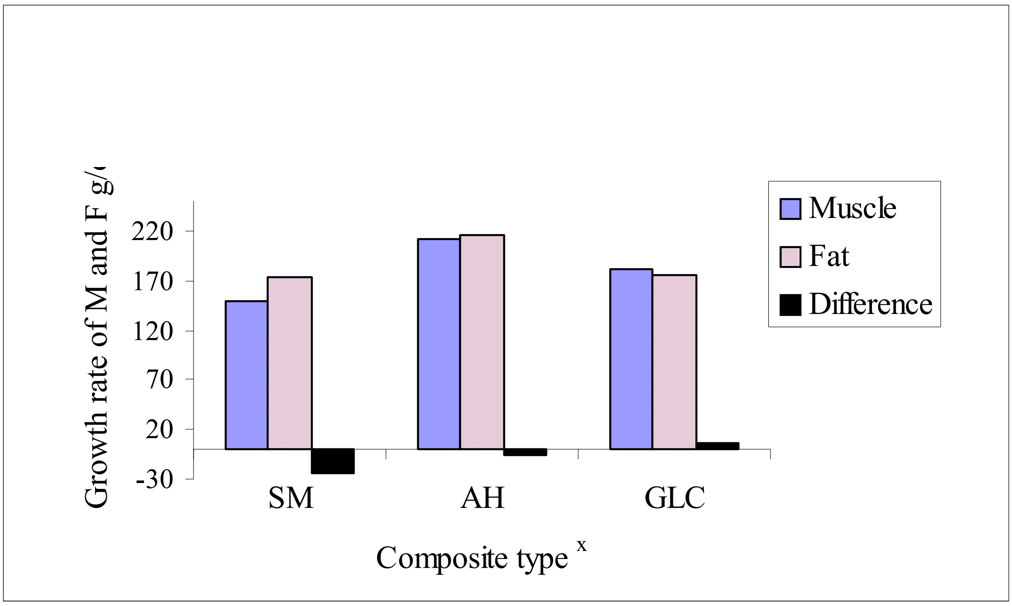

Figure 1 Growth rate of muscle (M), fat (F) and the difference in M-F in composites
[X] SM-composites of small breeds, AH-composites based on Angus or Hereford dams, GLC-composites.

SM, AH and GLC, respectively. Total muscle increased from 274 - 456 d in all cuts with the chuck followed by the round having the highest GR (Table 2). In each cut, the AH had numerically higher GR than SM and GLC were in between. The GR of muscle in the round, loin, chuck, rib, plate and brisket was higher in AH ($P < 0.10$) than SM and GLC was in between.

The GR of fat by C type and cut is shown in Table 3. The GR of F in the chuck was highest in all composites (45.98 – 56.30 g/d) and lowest in the shank, which is a primal cut that has mostly bone, followed by the loin (12.13 – 14.40 g/d) in SM and AH and the short loin (12.09 g/d) in GLC. The GLC had less F ($P < 0.10$) in the short loin, chuck, rib, plate, brisket and shank and the AH had a higher ($P < 0.10$) GR for F GR in the chuck, plate and brisket.

As steers matured, the GR of F exceeded the GR of M, and F was deposited at the expense of M. Also in the SM and the AH the GR of F in all cuts exceeded that of M by 24.8 g/d (M = 148.78 and F = 173.66 g/d) and 4.91g/d (M = 211.59 and F = 216.50 g/d), respectively, while in GLC the GR of M exceeded F by 6.77 g/d (M = 181.95 and F = 175.18 g/d) (Figure 1). Assuming that the pattern of bone growth is similar in the composites, SM followed by AH was growing more F than M compared to the GLC. We recognize that the SM and AH could be harvested earlier than GLC if percent muscling is the desired outcome.

Canadian and US cattle are currently fed to a degree of fatness that will increase the profitability by achieving some marbling. In Canada, the cost of excess fat is between $ 80 - $ 100/head. Leaner carcasses will provide more M than fatter carcasses. A very lean 136 kg side will yield 15% fat & bone (waste) and 102 kg or 85% M. On average, 136 kg side will yield 30% fat & bone and 95.3 kg or 70% M and a very fat, 136 kg side will yield 45% fat & bone and 74.8 kg or 55% M (Epley, 1989).

Conclusion

Based on the differential rates of muscling and fattening, we suggest that the SM followed by AH be harvested at least a month earlier than GLC thereby maximizing the proportion of carcass M and minimizing the proportion of F for beef consumers.

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