Changes in Beef Carcass Composition with Changes in Animal Weight and Finish (Project 639)

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Information on animal growth and development, although complex and not fully understood, is necessary to determine the stage at which a beef animal will produce the most desirable carcass. True growth involves an increase in the structural tissues (muscle, bone and organs) and should be distinquished from increases by fat deposition. Optimum time to slaughter animals is when muscle growth and quality are at their most desirable combination .

Procedure

Sixty-four half-sib Angus steers were placed on full feed immediately after weaning, then groups of eight were slaughtered periodically from 0 to 224 days later. Table 24 shows all slaughter and carcass data. The trial ended with the last two groups of animals grading choice at live weights of 785 and 835 pounds each. The yield grade (cutability) indicates the percent of boneless, closely trimmed retail cuts from the wholesale round, loin, rib and chuck from the beef carcass.

Skeletal, organ and muscle weights and muscle areas were obtained as measures of animal growth. Ether extract (fat) within the muscle was determined as a measure of quality. Ether extract indicates the amount of marbling found in a beef carcass; hence, it should correlate with grade and eating characteristics.

Results and Discussion

Bone circumference, length and weight data in table 25 are all indicators of skeletal growth. The general pattern for all of these traits is to increase or growth up to group 7, then to level off. Undoubtedly, there would have been additional skeletal growth, at a very decreased rate. The kidney, heart, liver and hide all show growth patterns similar to skeletal component growth. Leveling-off of skeletal and organ growth at about 700 pounds appears early but it is well recognized that animals vary greatly in maturity.

Meat animals are bred and fed for the quantity of consumer-acceptable muscle they produce. Table 26 shows weight changes in some of the larger, more economically important muscles in the beef carcass. The three muscles of the round increased to group 7, then changed very little, the same pattern established by skeletal and organ components. The longissimus dorsi increased considerably during the last feeding period, again indicating that growth was not complete for that one muscle. Muscle cross sectional area growth patterns paralleled muscle weights.

The ether extract or fat within muscles, as shown in table 27, gave anticipated results, that is, as skeletal and muscle growth tended to slow

down, fat deposition within the muscle rapidly increased. Total fat deposition includes intramuscular or marbling fat and also subcutaneous, intermuscular and internal fats. All four of these fats are being deposited during growth of other carcass components. The rate of which each grows and develops is all that changes. The edible portion of the carcass decreases with fat deposition, as shown in table 1, which indicates that fat deposition occurs throughout the animal's growth.

Optimum slaughter time for this group of animals would have been after 196 days of feed and at 785 pounds. Muscle growth was at a maximum and carcasses graded choice. Animals of different genetic background, feeding, management and rate of maturity would be expected to react differently.

Table 24

Slaughter and Carcass Data For Animals Differing in Weight and Finish

Group	Days in feedlot	Av. daily gain lbs.	Slaughter age, days	Slaughter weight lbs.	Carcass weight lbs.	Carcass quality, grade	Yield[1] grade cutability	Carcass %[2]
1	0	0	240	351	188	Good	2.25	51.7
2	56	2.35	296	447	255	Good	2.28	51.6
3	84	2.42	324	493	298	Good	2.35	51.4
4	112	2.28	352	525	328	Good	3.02	50.0
5	140	2.37	380	631	391	Good	3.24	49.5
6	168	2.38	408	682	431	Good	3.12	49.8
7	196	2.50	436	785	488	Choice	3.70	48.4
8	224	2.32	464	835	522	Choice	3.84	48.1

1. Cutability score of the carcasses was determined on the basis of this U.S.D.A. equation: Cutability score = 2.50 + (2.50 X adjusted fat thickness, in.) + (0.20 X percent kidney, pelvic and heart fat) + (0.0038 X hot carcass weight, pounds) - (0.32 X area ribeye, sq. in.)

2. Estimated percent of carcass weight in boneless, closely trimmed retail cuts from the round, loin, rib and chuck.

Table 25

Skeletal Changes in the Beef Animal With Advancing Weight and Finish

Group	Cannon bone, circum. in.	Lenght of carcass, in.	Lenght hind leg, in.	Fore shank bone lb.	Total bone lb.
1	-	35.00	22.19	2.06	--
2	6.00	37.14	23.05	2.24	21.30
3	6.14	38.91	23.41	2.43	23.34
4	6.09	39.20	24.63	2.64	25.54
5	6.49	41.09	24.99	2.90	29.53
6	6.54	41.61	25.73	3.10	30.70
7	6.73	43.06	26.19	3.14	32.69
8	6.71	43.16	26.38	3.13	31.89

Table 26

Muscle Weight Changes in Animal Weight and Finish (All Weights in Pounds)

Group	Round muscles			(Loin muscle)
	Semimembranosus	Semitendinosus	Biceps femoris	Longissimus dorsi
1	3.15	1.40	2.85	3.03
2	3.95	1.88	3.83	4.05
3	4.60	2.20	4.35	4.95
4	4.61	2.36	4.26	4.51
5	5.09	2.53	4.41	5.46
6	5.95	2.86	5.03	5.96
7	6.20	2.93	5.53	6.43
8	5.94	2.99	5.50	6.85

Table 27

Ether Extract (Fat) Changes With Changes in Animal Weight and Finish (Percent Ether Extract on Dry Tissue Basis).

	Round muscles		Loin muscle		Chuck muscles	
Group	Semi-membranosus	Semi-tendinosus	Biceps femoris	Longissimus dorsi	Triceps brachei	Infra spinatus
1	5.75	6.81	5.82	5.60	5.25	6.80
2	5.77	7.00	6.55	6.80	6.93	11.92
3	6.70	7.57	7.27	7.90	7.97	11.22
4	7.67	8.68	9.22	11.50	10.73	18.14
5	9.45	10.13	10.72	13.35	11.79	19.66
6	8.95	9.62	9.77	13.80	10.92	21.30
7	13.00	12.62	14.14	20.10	15.48	27.41
8	16.10	17.25	18.31	23.95	17.50	29.80