Growth and Development of Beef Heifers From Weaning to 18 Months of Age

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INTRODUCTION

The proportion of fat, lean, and bone, in the carcass are important to the producer, packer, retailer, and particularly the consumer. Current trend in consumer demand reflect emphasis on smaller, leaner cuts of beef.

An important factor affecting carcass composition is animal maturity. The producer has shown an interest in marketing cattle at an earlier age to meet demand for retail cuts which possess an absolute minimum of external fat and to provide meat cuts that will meet price competition. Because of this aversion to fat and the need for economic production, it becomes increasingly important to obtain fundamental information on the growth and development of the major carcass issues. The ultimate goal would be to establish a point during the growth cycle where maximum muscle development and a minimum of fat deposition is obtained for the least cost of production. A current investigation at the Oklahoma State Agricultural Experiment Station provides some information relative to these production goals.

PROCEDURE

Twenty-four Hereford heifers were used to investigate the effects of advancing age on the changes in carcass composition. Six heifers were assigned at weaning to each of four groups. The first group was slaughtered when the animals in the group averaged 9 months of age and was used as the basis to study subsequent changes in carcass composition. The remaining animals were group-fed a fattening ration consisting of shelled corn, cotton seed meal & hulls, alfalfa hay and molasses until the assigned slaughter age was reached (12, 15, & 18 months).

Slaughter and carcass data included; weight of offal products, yield of wholesale cuts, carcass measurements, dressing percent, grade, marbling score, physical separation of one side, and a chemical analysis of the boneless tissue.

RESULTS

Trends in consumer demands emphasize the importance of the relative proportion of fat and lean in the carcass. While specie, age, and plane of nutrition are of fundamental importance, breed, sex, exercise, and other factors may also influence the kind and amount of the major tissue components in the carcass. The main aspect considered in this investigation was that of age.

It is evident from table 1 that the slaughter weight at 9 months of age was light. This may well be expected in Fall dropped calves from cows on a low plane of nutrition. Consequently, the calves grew more slowly than what would seem desirable. It is also of interest to note the small change in carcass weight which took place during the first three month period. After the recovery period all tissues appeared to make normal growth. Consequently, these data should be interpreted as the minimum growth which would occur rather than maximum.

Carcass grade and marbling scores reflect that only a small amount of fat was present in the muscle tissue. It may also be noted that animals slaughtered at 15 months of age possessed equally as much marbling as those slaughtered at 18 months of age. The outside fat cover on these carcasses increased independently of marbling.

Table 1. Changes in Carcass Measurements as Influenced By Animal Age at the Time of Slaughter

	9 Mo.	12 Mo.	15 Mo.	18 Mo.
Slaughter wt. (lb)	451.8	519.7	712.2	844.3
Carcass wt. (lb)	257.2	305.4	440.9	549.3
Dressing (%)	56.8	58.7	61.9	65.1
Carcass grade	Std.	G—	G+	G+
Marbling score	Traces	Traces	Sm. Amt.	Sm. Amt.
Rib eye area (sq. in.)	6.1	6.6	8.5	9.7
Fat area (sq. in.)	1.3	1.8	2.8	4.5
Fat thickness (in.)	0.2	0.4	0.6	0.9

Table 2. Percentage Yield of Wholesale Cuts as Influenced by Animal Maturity

	9 Mo.	12 Mo.	15 Mo.	18 Mo.
Major Cuts				
Chuck	24.9	24.2	24.0	23.3
Rib	7.9	7.7	8.2	8.4
Loin	14.2	14.3	14.2	14.5
Rump	5.3	5.7	6.1	5.4
Round cushion	15.8	15.1	13.4	12.4
Minor Cuts				
Hind shank	4.8	4.7	4.2	4.0
Flank	6.9	7.4	8.3	8.9
Kidney knob	3.4	3.6	4.1	5.0
Plate	7.2	7.4	8.6	9.5
Brisket	5.0	5.2	5.2	5.1
Foreshank	4.6	4.8	3.8	3.6

A study of the wholesale cuts as influenced by animal age tended to point out where some of the tissues changes occur. When the carcass is sectioned into major and minor cuts (table 2) one quickly observes that the rib and chuck increased with advanced age. This is in part due to the more rapid deposition of fat in these cuts. Note on the other hand a decrease in the cushion round. The deposition of fat in and on these cuts is much more slower than is true for the other wholesale cuts. A consideration of the minor cuts reflect much the same composition. Lean cuts such as the foreshank and hindshank decrease on a percentage basis while fat cuts as the flank, plate, and kidney knob increase rapidly. It is readily evident from these data that care must be taken when evaluating an animal totally on the weight of its major or minor wholesale cuts.

Another approach to the evaluation of a carcass has been to determine its total composition of lean, fat, and bone. A glance at table 3 will reflect the changes in total tissue composition as it is influenced by age. Bone changes little on a percentage basis, but on a weight basis it almost doubles during the last 9 month period. Fat on the other hand increased slowly for the first 3 months than quite rapidly during the last 6 months. (figure 1) This provides ample evidence that fat is a late maturing tissue in relation to lean or bone. At 9 months of age the carcass possessed 71 pounds of lean or lean made up 55.7 per cent of the carcass. Even though lean growth increased during the following 9 month period, fat was deposited at a more rapid rate. These facts indicate that if economy of production is tied closely to quality lean production, one would expect to produce beef most economically at an early age. Now turn to figure 2, and note the change when quantity of tissue is expressed in terms of percent. Bone varies slightly while fat increases and lean decreases as fat deposition becomes rapid.

Changes in growth as reflected by various chemical measurements further substantiate the early growth of muscle. Table 4.

Table 3. Changes in Composition of Fat, Lean, and Bone as Influenced by Animal Age

Age Mo.	Lean lb	Fat lb	Bone lb	Lean %	Fat %	Bone %
9	71.0	32.5	24.5	55.7	25.0	19.3
12	80.0	43 8	26.9	53.1	28.9	18.0
15	104.1	74.8	41.2	47.3	34.0	18.7
18	124.6	102.6	45.8	45.9	37.3	16.9

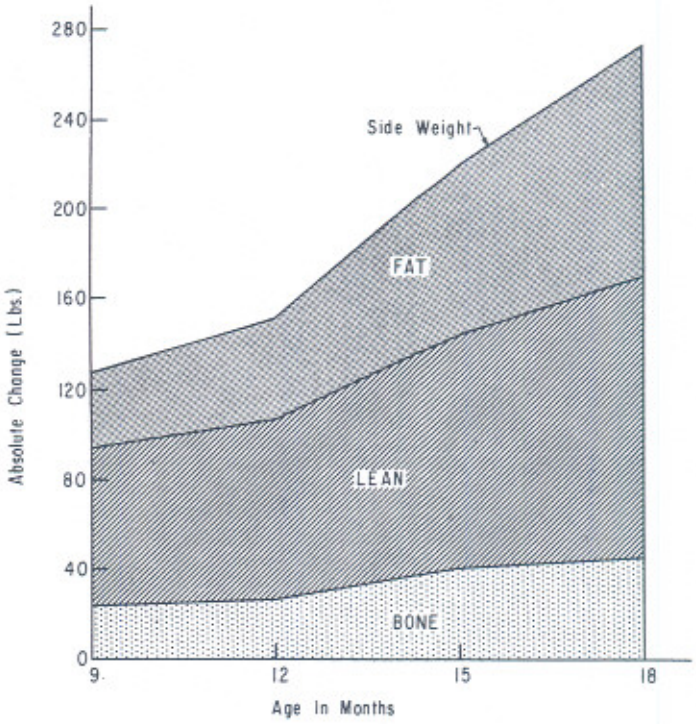

Figure 1. Influence of age on the Bone, Lean and Fat Weights of the side.

Table 4. Changes Due to Growth as Influenced By Various Chemical Components

Age Mo.	Protein lb.	Ether Extract lb.	Moisture lb.	Ash lb	Protein %	Ether Extract %	Moisture %	Ash %
9	17.3	23.4	56.9	0.8	17.6	23.1	57.8	0.9
12	20.7	30.5	66.6	1.0	17.5	25.6	56.2	0.8
15	26.2	54.8	88.6	1.1	15.4	32.3	52.2	0.7
18	30.0	79.3	103.3	1.4	14.2	36.8	48.6	0.6

SUMMARY

Hereford heifers were used to reflect the change in major tissue growth and development from 9 to 18 months of age. Bone is an early maturing tissue and made only a small change during the 9 month

period. Lean on the other hand made up 71 pounds of the carcass at 9 months of age and increased by 53 pounds during a following 9 month period. Fat, a late maturing tissue, increased rapidly throughout the fattening period.

When the quantities of fat, lean and bone are expressed in terms of percent, lean and bone in the carcass decreased while fat increased. The percent lean in a carcass from animals slaughtered at 18 months of age was approximately 10 percent less than at 9 months. Fat increased by 12.3 percent and bone decreased 2.4 percent.

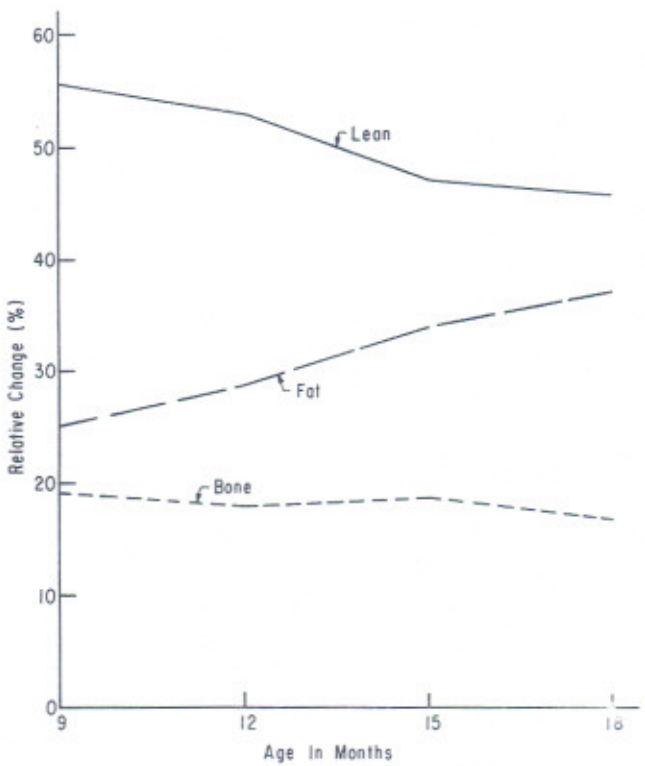

Figure 2. Influence of age on the weight of bone, lean and fat expressed as a percentage of the side weight.