Carcass Characteristics of Ram Lambs at Four Slaughter Weights

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Story in Brief

Over a 3-year period, 144 crossbred ram lambs from three lambing seasons were slaughtered at 100, 120, 140 and 160 lb to study changes in carcass characteristics as slaughter weight increased. Lambs to be slaughtered were trucked from the Southwestern Livestock and Forage Research Station, El Reno, Oklahoma, to the Oklahoma State University Meat Laboratory. After slaughter, the carcasses were evaluated for USDA carcass quality and yield grades. They also were evaluated for composition by measures of lean, fat and bone and for tenderness by the Instron conversion of the Warner-Bratzler Shear.

The rate of lean growth in terms of pounds continued to increase at a rather constant rate throughout the range of slaughter weights. For each 20-lb increase in live weight, rib eye area increased about .25 square inches and retail cut weight about 4.0 lb. Fat thickness, kidney and pelvic fat, USDA yield grade and total fat trim all increased steadily as live weight increased. Fat thickness increased .05 inches and total fat trim 4.2 lb for each 20-lb increase in live weight. In addition, bone weight increased .9 lb with each 20-lb increase in live weight. Fat accounted for 6.6 percent more of the carcass from ram lambs at 160 lb slaughter weight than at 100 lb, and lean accounted for 5 percent less. The largest change in percentage composition occurred between 100 and 120 lb when retail cuts were found to decrease from 46.5 to 43.3 percent of the carcass. Dressing percent, however, increased with heavier live weights. This higher dressing percent largely offset the higher fat content at heavier weights to account for the yield of retail cuts on a live weight basis being similar for those lambs in the three heavier weight groups.

Observation of Warner-Bratzler Shear force means indicates that the largest change in tenderness occurred between 100 and 120 lb slaughter weight. However, shear force values for all weight groups were found to be at a highly acceptable level from a tenderness standpoint.

Introduction

The continuous decline in lamb production in the United States during recent years has led to the absence of lamb in many retail meat counters, where lamb promotion tends to be discouraged because of the lack of an adequate supply. Given the current limited number of lambs produced annually one of the obvious ways to increase the supply of lamb is to feed lambs to heavier market weights. The superiority of ram lambs over ewe and wether lambs in live performance and carcass merit is well recognized. However, the pattern of the growth and development of ram lambs fed to heavy market weights is not well understood. Also, possible changes in tenderness in ram lambs of these weights have not been evaluated.

The objectives of this study were (1) to study changes in carcass composition in ram lambs over a range of weights and (2) to determine what changes, if any, occur in tenderness as measured by the Warner-Bratzler Shear as ram lambs are taken to heavier slaughter weights.

Materials and Methods

Crossbred ram lambs produced from Suffolk, Hampshire, Suffolk x Hampshire or Hampshire x Suffolk sires mated to dams of various levels of Rambouillet, Dorset and Finnsheep breeding were selected from an 8-month lambing interval project in progress at the Southwestern Livestock and Forage Research Station. This study evaluated 144 lambs produced in four groups over three different seasons. When 12 lambs similar in weight averaged 70 lb, they were started as a pen on a finishing ration of 45 percent alfalfa, 50 percent milo and 5 percent molasses. When a pen of 12 lambs averaged 100 lb, the lambs were sorted into upper, average and lower one-third weight groups, and one lamb from each group was chosen at random for slaughter. The same procedure was followed at average pen weights of 120 and 140 lb, and the last three lambs were slaughtered when their average weight reached 160 lb. This procedure allowed each lamb an equal chance of being one of the lambs slaughtered at any weight. Because lambs were slaughtered when the average pen weight reached a certain point, this method also spread the individual weights over a wide range. All lambs were shorn sometime before slaughter, and the slaughter weight for all lambs was determined by adding fleece weight to actual live weight. Therefore, dressing percentage was calculated as if the lambs had not been shorn.

Lambs ready for slaughter were shipped to the OSU Meat Laboratory and held overnight without feed. The live weight used to compute dressing percentage and other calculations was the Fort Reno weight (fleece included) obtained the day before slaughter. The right sides of the carcasses were cut into the major wholesale cuts using the standard cutting method, with minor modifications, described by the American Meat Science Association. The leg and shoulder were separated into lean, fat and bone portions, and the retail rack and loin were closely trimmed but left "bone-in." The boneless, closely trimmed weights of the leg and shoulder were combined with the closely trimmed, "bone-in" retail rack and loin weights to estimate the major portion of high-valued retail cuts in the carcass.

The neck, foreshank, breast and flank were all separated into lean, fat and bone. The riblets of the rack and flank portion of the loin were closely trimmed of all external fat but were left "bone-in." Fat trim from all cuts was used as the estimate of carcass fat, and the bone from all cuts boned out was considered the estimate of carcass bone.

A Warner-Bratzler Shear mounted on an Instron measuring device was used to evaluate tenderness. Two 1½-inch chops were taken from each carcass, one from the posterior end of the rack and the other from the anterior end of the loin. These chops were frozen, thawed at a later date and then cooked in a 275°F convection oven to an internal temperature of 155°F. After the chops had cooled overnight, two ½-inch cores were removed from each chop, and two shears were made on each core.

Results and Discussion

Carcass lean

Pounds of carcass lean as measured by the amount of closely trimmed, partially boneless retail cuts and rib eye area as described earlier in this report continued to increase throughout the range of slaughter weights studied. The data presented in Table 1 indicated that pounds of retail cuts in the carcasses increased 3.4, 4.0 and 4.6 lb, respectively, for each 20-lb slaughter weight increase above 100 lb. Rib eye area was found to increase about .25 square inches for each 20-lb increase in slaughter weight.

Carcass fat and bone

The amount of fat in the carcasses (Table 1) was found to increase 4.3, 4.2 and 4.2 lb, respectively, for each 20-lb slaughter weight increase above 100 lb. Fat thickness over the 12th rib and kidney and pelvic fat are important components in determining

the USDA Yield Grade in lambs. (Lower numerical yield grade values are associated with higher percentages of trimmed, boneless retail cuts in the carcass). In these ram lambs, fat thickness at the 12th rib increased quite steadily over slaughter weight groups at about .05 in. per 20-lb increase in slaughter weight. Similarly, pounds of kidney and pelvic fat increased quite steadily at about .55 lb per 20-lb increase in slaughter weight (Table 1). As expected in lambs of normal and uniform growth rates, pounds of bone increased steadily with heavier weight as did the soft tissues in the carcass (lean and fat). However, the percentage of bone in the carcass decreased gradually as heavier slaughter weights were reached (Table 2).

Carcass quality and tenderness

Quality grade as determined largely by firmness, feathering and fat streaking (these associated with fatness) and maturity generally contribute to the palatability of lamb cuts. As shown in Table 1, carcass quality grade increased gradually from near average choice to low prime as the ram lambs were fed from 100 to 160 lb live weight. Lower Warner-Bratzler Shear Force values are associated with more tenderness while higher values indicate that more force was required to shear the ½-inch cooked meat core. Thus, the higher values are interpreted as representing less tenderness in the meat product. The shear force value data presented in Table 1 point out that, in these

Table 1. Measures of carcass composition and quality among ram lambs at four slaughter weights

Slaughter wt (lb)	100	120	140	160
Carcass lean				
Retail cuts[a](lb)	23.4	26.8	30.8	35.4
Rib eye area[b]	2.16	2.41	2.67	2.92
Carcass fat				
Fat thickness[c]	.16	.22	.27	.32
Kidney/pelvic fat (lb)	1.39	1.93	2.48	3.02
USDA yield grade	2.9	3.3	3.7	4.1
Fat trim (lb)	10.2	14.5	18.7	22.9
Carcass bone				
Bone (lb)	6.4	7.3	8.2	9.1
Carcass quality				
Quality score[d]	11.8	12.2	12.6	13.0
Shear force (kg)	2.50	3.44	3.27	3.28

[a]Boneless leg, shoulder, bone-in rack and loin, riblets and flank portion removed, virtually all fat removed.
[b]12th rib, sq in.
[c]12th rib, in.
[d]Average Choice = 11, High Choice = 12, etc.

Table 2. Carcass components as a percentage of live and carcass weights

Slaughter wt (lb)	100	120	140	160
Dressing percent[a]	50.3	51.6	52.6	53.3
Retail cuts (% of carcass)[bc]	46.5	43.3	41.8	41.5
Fat (% of carcass)[c]	20.3	23.4	25.4	26.9
Bone (% of carcass)[c]	12.7	11.8	11.1	10.7
Retail cuts (% of slaughter wt)	23.4	22.3	22.0	22.1

[a]Hot carcass weight ÷ live weight x 100.
[b]Boneless leg, shoulder, bone-in rack and loin, riblets and flank portion removed, virtually all fat removed.
[c]Based on hot carcass weight.

studies, the greatest change occurred between 100 and 120 lb and that beyond the 120-lb slaughter weight, only minor differences in tenderness were observed. Shear force values for all slaughter weight groups were found to be well below the 4.0 kg shear force considered by some to be near the upper limit for "highly" acceptable tenderness.

Percentage changes in lean and fat

As is shown in Table 1, pounds of fat and pounds of retail cuts both increased steadily with heavier live weights, but the relative increase in fat was greater than that of lean. As shown in Table 2, the percentage of fat in the carcass was found to increase as live weight increased while the percentage of trimmed, boneless retail cuts decreased. The greatest percentage change in fat and retail cuts of the carcass occurred between 100 and 120 lb when the percent fat rose from 20.3 to 23.4, and the percent of retail cuts declined from 46.5 to 43.3. The percentage change in lean and fat was somewhat lower between the other slaughter weights but followed the same trend. However, as shown in Table 2, dressing percent also increased by 3 percent with increasing live weight from 100 to 160 lb. Part of this increase in dressing percent is due to more total lean as well as fat in relation to the "dress-off" items in the live animal. Therefore, the relative change in retail cut yield on a live weight basis was much less pronounced than the relative change noted on a carcass basis. The data used to prepare Figure 1 are presented in Table 2 and show that across slaughter weights, retail cut yield declined 5 percent on a carcass basis but only 1.3 percent on a live weight basis. Since the principal contributor to the value of a live lamb is the portion that can be sold retail, the live value per pound, according to these data, should not be greatly different as lambs go to heavier weights.

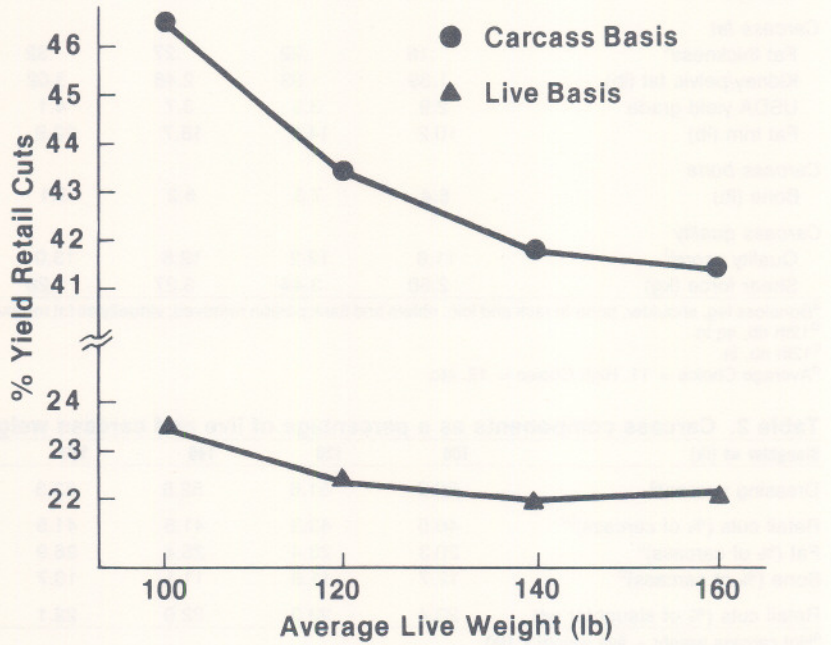

Figure 1. Decline in yield of very closely trimmed retail cuts with increasing live weight