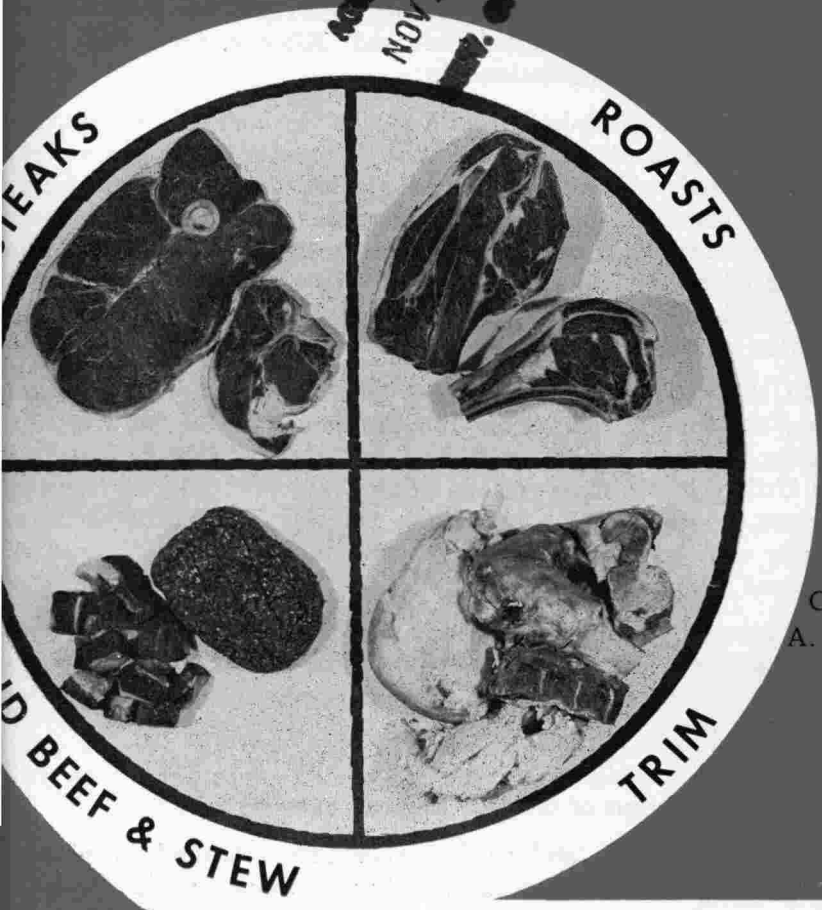
Effect of Weight, Grade, and Sex of Beef Carcasses on Yield of Packaged Beef for the Freezer

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"...a beef carcass divided into fourths..."

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SUMMARY

CARCASSES of 75 steers and 68 heifers, representing five USDA grades and four weight groups, were used to depict the relationships between yield of cuts for the locker and selected characteristics.

- Increases in carcass weight were accompanied by increases in carcass length, fat thickness over the rib eye, and rib-eye area. Heifers were fatter and had less rib-eye area than steers.

- Carcass length was not consistently greater in either sex. As carcass grades increased from Utility to Prime, fat thickness increased and carcass length decreased. Rib-eye area and grade showed no consistent relationship.

- The number of ½-inch round steaks, ¾-inch loin steaks, and total steaks generally increased with increases in carcass weight. Grade had little effect on number of steaks. Steer carcasses yielded a slightly greater number of round steaks than heifer carcasses, but heifer carcasses yielded a greater number of loin steaks. Number of total steaks showed a highly significant relationship to carcass length with longer-bodied carcasses tending to produce a greater number of steaks.

- On the average, the carcasses consisted of about one-fourth steaks, one-fourth roasts, one-fourth lean cuts for stewing and grinding, and one-fourth waste, bones, and fat. As grade increased from Utility to Prime, per cent of steaks decreased and per cent of waste, bones, and fat increased. However, per cent of roasts and per cent of lean cuts for stewing and grinding showed no consistent trend with grade.

- As carcass weight increased, average per cent of steaks decreased and per cent of waste, bones, and fat tended to increase. Per cent of roasts and lean cuts showed no definite relation to weight.

- Steers had a higher per cent of total steaks and lean cuts but a lower per cent of waste, fat, and bones than heifers.

- Longer carcasses and/or fatter carcasses tended to yield a lower per cent of total steaks, although there was a tendency for longer carcasses to produce a greater number of steaks. However, when the effects of carcass weight were minimized, carcass length had practically no effect upon the per cent of steaks.

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Effect of Weight, Grade, and Sex of Beef Carcasses on Yield of Packaged Beef for the Freezer

J. W. Cole, C. B. Ramsey, and A. R. Cavender[1]

CONSUMERS prefer beef which is tender, juicy, and flavorful. However, they generally show a strong aversion to excessive fat, which plays a definite role in determining the yield of lean in a carcass or cut (Butler, **et. al.** 1956; Cole, **et. al.**, 1962; and Ramsey **et. al.**, 1962). The per cent of a carcass which can be processed for the locker also is a primary concern. Most consumers realize that a considerable amount of fat, bone, and other waste must be discarded when a carcass is separated into ready-to-cook cuts.

Information which would help the prospective beef purchaser decide which carcass would best fit his needs should be valuable. Therefore, this study was undertaken to determine the effects of weight, grade, and sex and certain carcass measurements of beef carcasses available in the Knoxville area on the yield of retail cuts for the freezer.

PROCEDURE

One hundred forty-three sides of carcasses from 75 steers and 68 heifers representing five USDA grades were used in this study. Most of the sides were obtained from experiment station and custom-slaughtered animals processed at the University of Tennessee Meats Laboratory. The remainder of the sides were purchased from local meat packing plants. U.S. Prime, Choice, Good, Standard, and Utility grades were represented.

Carcasses within each grade were divided into four groups by total carcass weight. These weight groups were: 200-300, 300-400, 400-500, and 500 pounds and above. All weight groups were

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not represented in all grades because certain weight groups were not available in the Knoxville area. It is doubtful if these missing groups would be available in other areas, particularly the Southeastern United States.

Aging

The carcasses were aged in 36-40°F. coolers. Aging time was

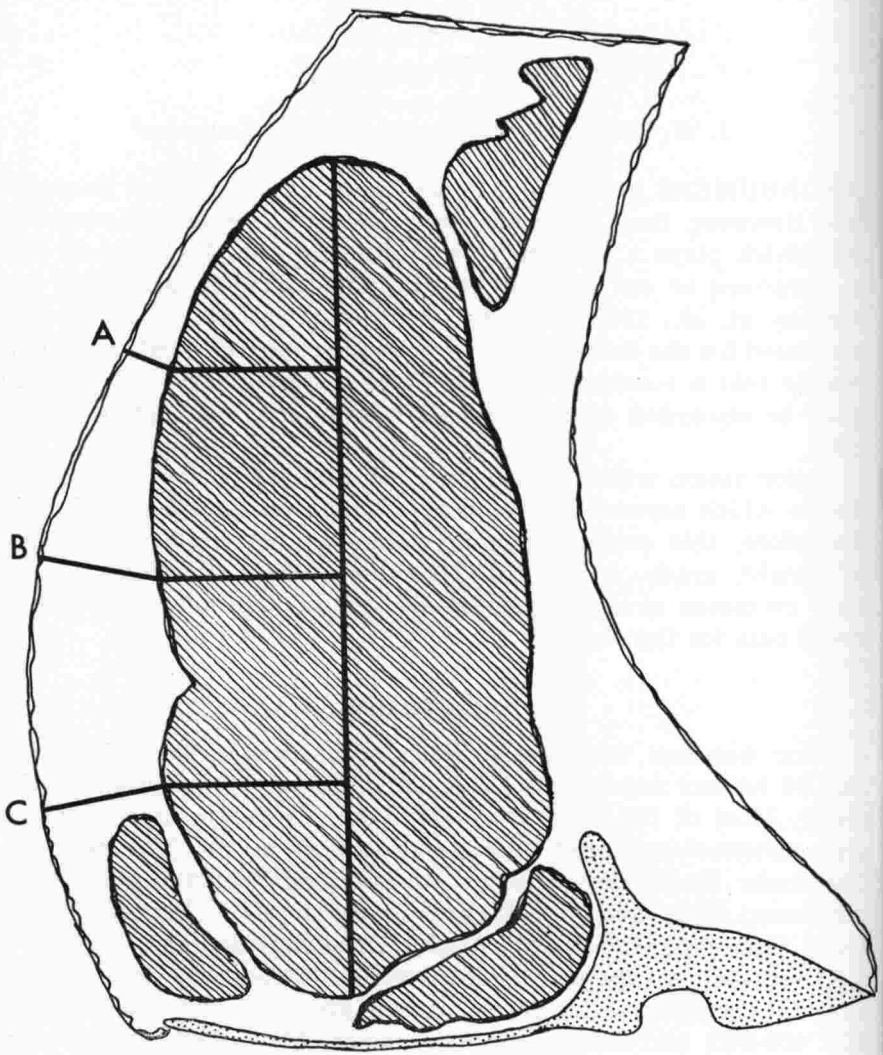


Figure 1. Tracing of cross section of beef rib steak showing points (A, B, and C) where fat thicknesses were measured.

not held constant. Carcasses which had a fairly thick exterior fat cover (which acted as a protection against dehydration and action of microorganisms upon the lean) were allowed to age for a longer period than were the less highly-finished carcasses. Aging time ranged from approximately 3 days to 3 weeks.

Carcass Measurements

Carcass length was measured as the distance in inches between the anterior edge of the first rib and the anterior edge of the aitch bone. The carcass side was separated into fore- and hindquarters between the last two (12th and 13th) ribs. Then a tracing was made of the cut surface of the rib-eye muscle and fat layer over the muscle. An example of this tracing is shown in Figure 1.

A compensating planimeter was used to measure the area of the rib-eye muscle from the tracing. Fat thickness over the rib-eye muscle was measured at points A, B, and C as outlined by the Reciprocal Meat Conference (1951). The points were selected by first drawing a line through the longest axis of the rib-eye muscle. Perpendiculars then were drawn on this line at points one-fourth, one-half, and three fourths its length and terminated at the edge of the muscle. Three other lines were drawn perpendicular to the outside surface of the fat to meet the first three perpendiculars. An average of the three fat thickness measurements in millimeters (0.1 in. = 2.54 mm.) was used in statistical analyses.

Cutting

One side of each carcass was divided into wholesale cuts as described by the Reciprocal Meat Conference (1953) except that a conventional square cut chuck was made. A cutting diagram is shown as Figure 2. The usual retail cuts were obtained from the wholesale cuts by using a knife and power band saw.

The rump was separated from the round parallel to and as close as possible to the posterior edge of the aitch bone. The rump was trimmed by removing the sacral and caudal vertebrae and part of the pubis and head of the femur.

The round was sliced into ½-inch steaks perpendicular to the femur until the patella was exposed. A heel pot roast — also called heel of round roast, or Pike's peak roast — was then removed, leaving the shank meat on the tibia and fibula.

The full loin was cut into ¾-inch steaks. Steaks with over

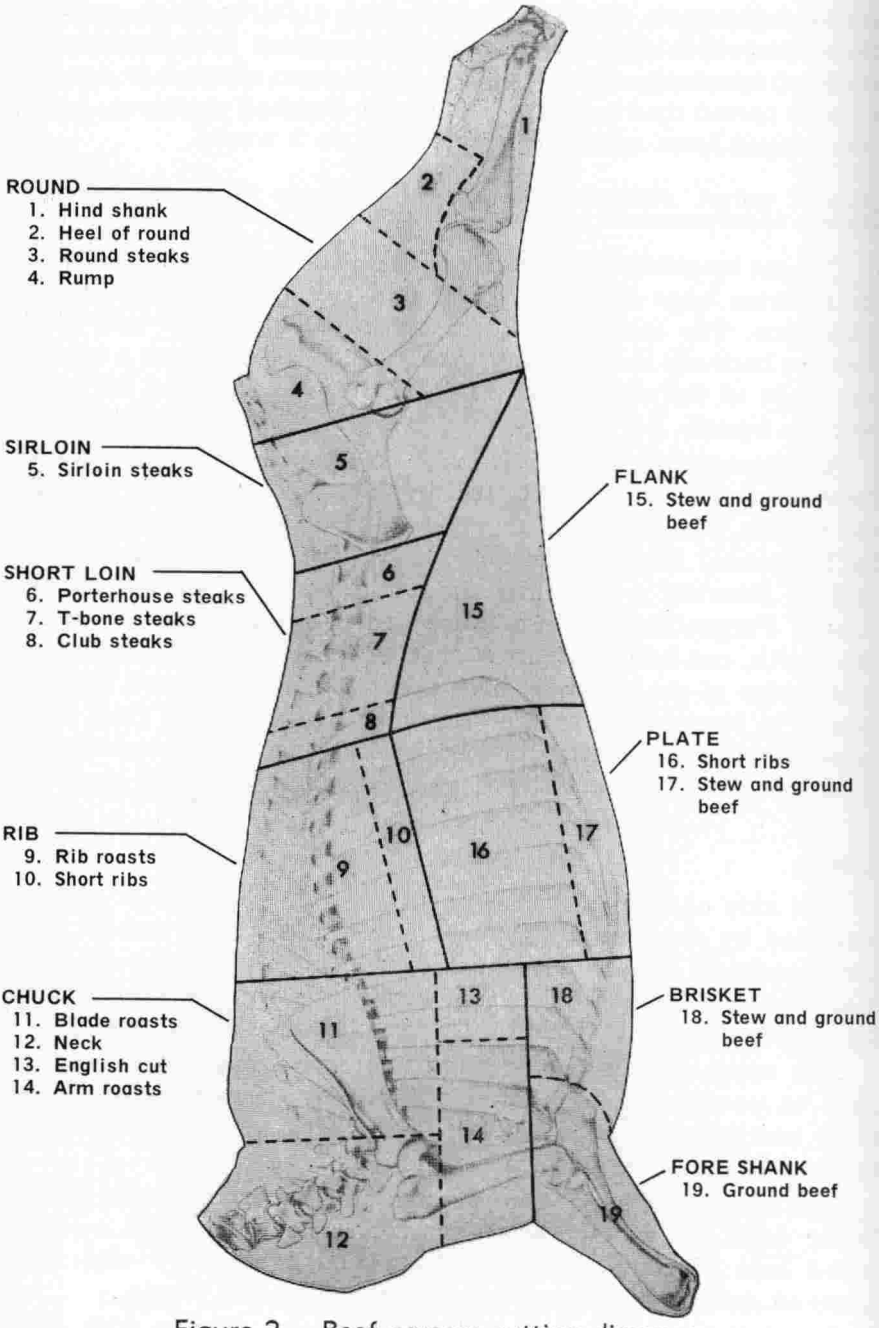


Figure 2. Beef carcass cutting diagram.

3/8-inch of outside fat were trimmed so that not over 3/8-inch of fat remained on the steak. All steaks were counted and weighed.

Excess cod or udder fat was trimmed from the flank and the portion of the 13th rib in this cut was removed. The trimmed cut was weighed as boneless flank.

Seven-inch standing rib roasts were cut from the wholesale rib. A portion of the spinal processes was trimmed from the roasts. The remaining thin portion of the wholesale rib was cut into short ribs. The plate also was cut into short ribs until the rib cartilages were exposed. The remainder of the plate was boned and put into miscellaneous lean trim and bone.

The English cut area of the chuck was made into short ribs. Arm pot roasts were removed from the arm end of the chuck until the humerus-scapula joint was exposed. Blade (or chuck) roasts then were cut from the blade end until only the thinner neck meat remained. This was boned and weighed as boneless neck. The sections of ribs were removed from the arm pot roasts, as well as parts of the spinal processes from the blade roasts. Fat was not trimmed from these roasts or the rib roasts.

Foreshanks and hind shanks were boned and the meat weighed as boneless shank. The brisket was boned and trimmed of excess fat before weighing.

All bones from the side, with the exception of those portions remaining in retail cuts, were weighed as a unit. Miscellaneous lean trim was composed of the boneless, trimmed navel section of the plate, the skirt or diaphram muscle, the hanging tendon, and lean pieces trimmed from the various retail cuts.

Waste included those portions of the carcass, exclusive of bones and fat, which usually are discarded when a carcass is cut into wholesale and retail cuts. The major items were bruises, peritoneum, and backstrap (**ligamentum nuchae**). All averages for weight groups and for grades were obtained by averaging the averages for the individual subclasses within the respective weight or grade groups.

RESULTS AND DISCUSSION

The 143 carcasses, representing the U.S. Prime, Choice, Good, Standard, and Utility grades, were divided into four weight groups as shown in Table 1. Grade and weight groups were subdivided into steer and heifer groups (designated male and female in the table). All carcasses represented the A, B, or C maturity groups

Table 1. Number and Average Weight of Carcasses by Grade, Weight Group and Sex.[1]

Grade	Weight groups (lb.) 200-300 M	200-300 F	300-400 M	300-400 F	400-500 M	400-500 F	500+ M	500+ F	Total no. and av. wt. by grade M	Total no. and av. wt. by grade F
Prime										
No.	—	—	—	—	—	4	4	4	4	8
Av. wt.	—	—	—	—	—	476	595	562	595	519
Choice										
No.	—	—	3	4	6	8	7	4	16	16
Av. wt.	—	—	367	316	444	452	557	584	456	451
Good										
No.	4	4	7	5	13	4	4	4	28	17
Av. wt.	261	260	359	366	456	469	530	539	402	409
Standard										
No.	6	4	4	6	4	4	5	5	19	19
Av. wt.	263	242	350	339	422	436	550	521	396	385
Utility										
No.	4	4	4	4	—	—	—	—	8	8
Av. wt.	246	250	334	346	—	—	—	—	290	298
Total no. and										
av. wt. by	14	12	18	19	23	20	20	17		
wt. groups	257	251	352	342	441	458	558	552		

1. Sex designated "M" (steers) and "F" (heifers).

(USDA 1956). Since no carcasses of D, E, or F maturity were used, U.S. Commercial and "hard-boned" Utility grade carcasses were not used in the study.

Only 29 of the 40 possible weight, grade, and sex subclasses were filled. With the exception of the 300-400 pound Choice male subclass, there were at least 4 and not more than 13 carcasses in each of the 29 subclasses. Carcasses were not available in the Prime grade for the 200-300 pound M and F, 300-400 pound M and F, or 400-500 pound M groups. The lightest Choice M and F and two heaviest Utility M and F groups also were either unavailable or available in too few numbers. Only the Good and Standard grades were represented by all weight groups. There were 12 Prime, 32 Choice, 45 Good, 38 Standard, and 16 Utility carcasses in the study.

Carcass Weight

Average weights of the carcasses by grade and sex within weight groups also are given in Table 1. Since a 100-pound range was allowed for each weight group, average weights by grade and sex within weight group varied considerably among subclasses.

Overall average weight by grade for both steers and heifers decreased as the grades decreased from Prime to Utility. This decreasing trend was caused in part by the absence of the lighter-weight carcasses in Prime and Choice grades, whereas the heavier weight carcasses were missing in the Utility grade. Since the carcasses used were fairly representative of the available supply, this apparent increase in carcass weight with a corresponding increase in grade probably is approaching the norm. The relationship of weight and grade generally is the result of higher-grading cattle usually being fed longer than lower-grading cattle.

CARCASS MEASUREMENTS

The three carcass measurements taken were length, fat thickness over the rib eye at the 12th rib, and area of the rib-eye (**longissimus dorsi**) muscle.

Carcass Length

Weight group averages of carcass length for both steers and heifers showed that length increased as carcass weight increased (Table 2). For steers, average carcass lengths for the 200-300 pound through 500+ pound weight groups were 40.1, 43.1, 44.8, and 47.0 inches, respectively. Corresponding lengths for heifers

were 40.9, 42.9, 45.5, and 47.1 inches. Differences in carcass length of steers and heifers were small and not consistently in favor of either sex within grade or weight subclasses.

Within weight groups no consistent pattern of carcass length among grades was evident. However, in the three heaviest weight groups, length generally increased as grades lowered from Choice to Good and from Good to Standard. Prime carcasses were either about the same length as, or longer than, Choice carcasses within weight groups. Analysis of variance within weight groups showed highly significant differences in carcass length among grades except in the 200-300 pound weight groups.

Fat Thickness

Large differences were found in thickness of fat over the rib-eye muscle at the 12th rib (Table 2). Within weight groups there was a trend for fat thickness to decrease as grades lowered. This trend was strongest in the three heaviest weight groups. Highly significant differences existed among grades within each weight group.

Within the two lightest weight groups, sex of the animal did not have a significant effect on fat thickness even though weight group averages showed that the heifer carcasses were fatter. However, in the two heaviest groups, heifer carcasses were significantly fatter than steer carcasses. Grade averages for all weight groups combined showed that heifers were fatter than steers in every grade. The greatest difference was in the Choice grade with steers averaging 14.9 mm. and heifers 20.0 mm. Fat thickness of steer carcasses decreased from 23.8 mm. in the Prime grade to 14.9 mm. in Choice, 10.9 mm. in Good, 5.5 mm. in Standard, and 3.0 mm. in Utility. Corresponding values for heifer carcasses were 25.5, 20.0, 13.3, 8.6, and 4.4 mm.

Area of Rib-Eye Muscle

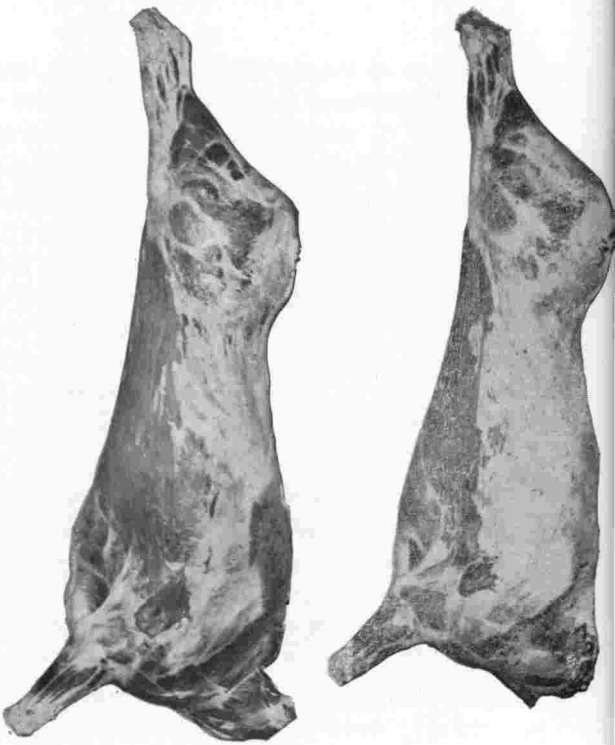
The area of the **longissimus dorsi** muscle at the 12th rib showed no consistent trend with carcass grade in any weight group (Table 2). However, area did show a rather consistent increase with increasing carcass weight. Steer averages for the 200-300 pound through 500+ pound weight groups were 7.4, 8.3, 10.0, and 11.0 square inches, respectively. Heifer carcasses had corresponding averages of 6.4, 8.1, 9.1, and 11.0 square inches.

Rib-eye area averages by grade for all weight groups combined

Table. 2. Average Carcass Length, Fat Thickness Over the Rib Eye, and Rib-Eye Area by Grade, Weight, and Sex.

Carcass characteristic and grade	Weight groups (lb.) 200-300 M	200-300 F	300-400 M	300-400 F	400-500 M	400-500 F	500+ M	500+ F	Grade averages M	Grade averages F
Carcass length[1]										
Prime	—	—	—	—	—	45.6	46.6	46.4	46.6	46.0
Choice	—	—	40.8	40.6	43.0	43.3	45.8	46.8	43.2	43.6
Good	38.8	41.1	42.0	42.6	45.4	46.0	46.8	46.9	43.3	44.2
Standard	41.0	40.2	43.7	43.2	46.0	47.0	49.0	48.3	44.9	44.7
Utility	40.6	41.4	45.8	45.3	—	—	—	—	43.2	43.3
Wt. group av.	40.1	40.9	43.1	42.9	44.8	45.5	47.0	47.1		
Fat thickness[1]										
Prime	—	—	—	—	—	20.7	23.8	30.4	23.8	25.5
Choice	—	—	15.9	15.8	12.8	17.9	15.9	26.2	14.9	20.0
Good	8.9	8.6	11.3	8.8	13.6	21.8	9.6	14.1	10.9	13.3
Standard	2.6	4.3	6.0	11.3	5.7	7.5	7.5	11.3	5.5	8.6
Utility	2.9	3.0	3.0	5.8	—	—	—	—	3.0	4.4
Wt. group av.	4.8	5.3	9.0	10.4	10.7	17.0	14.2	20.5		
Rib-eye area[1]										
Prime	—	—	—	—	—	9.4	10.4	10.6	10.4	10.0
Choice	—	—	8.7	7.6	10.7	9.1	10.7	11.4	10.0	9.4
Good	7.7	6.1	7.9	8.4	9.8	7.8	11.2	11.4	9.1	8.4
Standard	7.7	6.3	7.7	8.4	9.6	10.0	11.6	10.6	9.2	8.8
Utility	6.7	6.7	9.0	8.0	—	—	—	—	7.9	7.4
Wt. group av.	7.4	6.4	8.3	8.1	10.0	9.1	11.0	11.0		

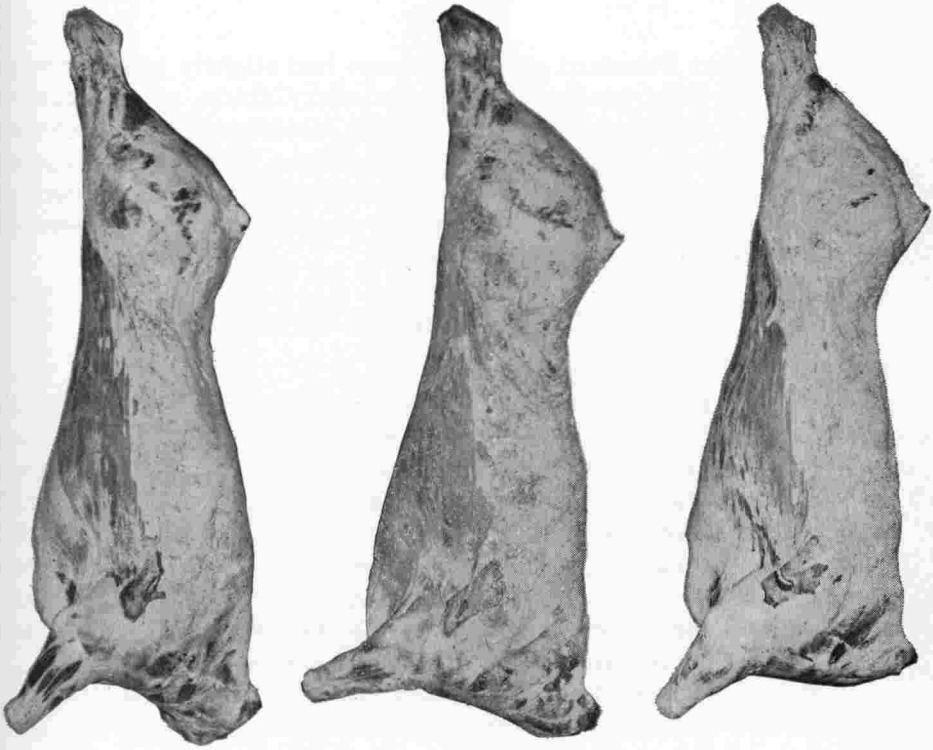
1. Body length in inches, fat thickness in millimeters and rib-eye area in square inches.



UTILITY STANDARD



Figure 3. Carcass grades increased from Utility to Prime as fatness increased and body length decreased. Percent of roasts and lean cuts for stewing and grinding showed no constant trend with grade. The percent of steaks decreased and the percent of waste, bones, and fat increased with grade increase.



GOOD CHOICE PRIME



revealed that Standard grade carcasses had slightly larger rib-eye areas than Good grade carcasses. In every grade, steer carcasses had larger average areas than heifer carcasses. The differences ranged from 0.4 square inch in the Prime grade to 0.7 square inch in the Good grade. However, the larger area for steers in the Prime grade may be the result of steers not being represented in the 400-500 pound weight group.

YIELD OF RETAIL CUTS

Number of Round Steaks

The average number of ½-inch round steaks from one side varied from 9.8 to 16.2 steaks in all weight, grade, and sex subclasses. Both of these extremes occurred in the Standard grade (Table 3). Number of round steaks generally increased with increasing weight. Weight group averages showed that the 200-300 pound group had approximately three fewer steaks per side than did the 500+ pound group. Steers and heifers averaged 10.9 and 10.4 round steaks, respectively, in the 200-300 pound group and 13.9 and 13.2, respectively, in the 500+ pound group.

By grades, round steak numbers were highest in the Standard grade and lowest in the Utility grade. However, there was little variation among grade averages. Steers had a slightly greater average number of round steaks than heifers in every grade.

Number of Loin Steaks

The average number of ¾-inch sirloin and shortloin steaks combined varied from 20.0 to 28.8 in subclasses. As with round steaks, average numbers tended to increase as weight increased. The heaviest weight group yielded an average of approximately three more steaks per side than did the lightest weight group. Average numbers did not vary greatly among grades and there was not a significant difference in numbers due to sex of the animal.

Total Number of Steaks

When the average numbers of round and loin steaks were summed to give an average total number of steaks, increases in carcass weight definitely were accompanied by increases in number of steaks. The 200-300 pound group (steer and heifer steak numbers averaged) yielded 33.0 steaks per side; the 300-400 pound group, 35.2; the 400-500 pound group, 38.0; and the 500+ pound group, 39.6.

Table 3. Average Number of Round, Loin, and Total Steaks by Grade, Weight, and Sex.

Kind of steak and grade	Weight groups (lb.) 200-300 M	200-300 F	300-400 M	300-400 F	400-500 M	400-500 F	500+ M	500+ F	Grade averages M	Grade averages F
Round										
Prime	—	—	—	—	—	11.5	12.8	11.8	12.8	11.6
Choice	—	—	12.0	11.5	12.2	11.4	13.7	12.8	12.6	11.9
Good	11.2	10.0	11.3	11.4	12.9	13.2	13.0	12.8	12.1	11.9
Standard	10.8	9.8	12.5	12.3	13.0	13.2	16.2	15.2	13.1	12.6
Utility	10.8	11.5	12.8	11.8	—	—	—	—	11.8	11.6
Wt. group av.	10.9	10.4	12.2	11.8	12.7	12.3	13.9	13.2		
Loin										
Prime	—	—	—	—	—	24.7	25.0	24.3	25.0	24.5
Choice	—	—	19.7	22.6	23.0	24.1	26.3	26.0	22.7	24.2
Good	23.8	20.0	22.9	22.4	25.6	26.8	25.0	26.5	24.3	24.0
Standard	24.0	22.2	24.0	24.0	23.8	25.0	27.6	27.4	25.6	24.7
Utility	21.5	22.5	25.7	24.5	—	—	—	—	23.6	23.5
Wt. group av.	23.1	21.6	23.1	23.4	25.3	25.2	26.0	26.0		
Total										
Prime	—	—	—	—	—	36.2	37.8	36.1	37.8	36.1
Choice	—	—	31.7	34.1	35.2	35.5	40.0	38.8	35.3	36.1
Good	35.0	30.0	34.2	33.8	38.5	40.0	38.0	39.3	36.4	35.9
Standard	34.8	32.0	36.5	36.3	41.8	38.2	43.8	42.6	38.7	37.3
Utility	32.3	34.0	38.5	36.3	—	—	—	—	35.4	35.1
Wt. group av.	34.0	32.0	35.3	35.2	38.5	37.5	39.9	39.2		

Within the three heaviest weight groups, there was a significant difference in total number of steaks among grades. With minor exceptions, the lower-grading carcasses yielded a greater total number of steaks than the higher-grading carcasses of similar weight. No significant nor consistent difference was found between total number of steaks for steers and heifers.

Simple correlation coefficients between carcass length and total number of steaks per side were 0.63 for carcasses in the Choice grade, 0.87 for Standard, and 0.61 for Utility. The pooled within-grade coefficient was 0.70. All of these coefficients are significant ($P < .01$).

Due to the small number of carcasses and subclasses in the Prime grade, correlation coefficients were not calculated for this grade nor were these carcasses included in pooled within-grade coefficients. These coefficients indicate that the longer-bodied animals produce carcasses which tended to have a greater number of steaks. This tendency was strongest in the Standard grade. However, this relationship may have been influenced by carcass weight and grade. When weight group and grade averages are observed, carcass weight appears to exert as much influence on the total number of steaks as does carcass length.

Average number of total steaks varied considerably among weight, grade, and sex subclasses. The range was from 30.0 in the 200-300 pound Good heifer group to 43.8 in the 500+ pound Standard steer group. Total number of steaks in individual carcass sides varied from 26 in a Good grade heifer carcass weighing 270 pounds to 49 in a Standard grade heifer carcass weighing 550 pounds.

Per Cent of Round Steaks

The yield of trimmed round steaks, as a percentage of carcass side weight, increased with each lowering of carcass grade from Prime to Standard (Table 4). However, Utility grade carcasses had a slightly lower yield than Standard grade carcasses. On the average, the higher-grading carcasses were fatter and thus had the lower percentages of steak. In every weight and grade group, steer carcasses had a higher per cent of round steaks than heifer carcasses. However, the differences generally were small and were not significant.

Actual average amounts of round steaks varied from 10.6% and 11.6% for heifers and steers, respectively, in the 500+ pound

weight group to 12.1% and 13.1%, respectively, in the 200-300 pound group. Ranges were greater among grades.

Although increases in carcass weight tended to be accompanied by increases in steak numbers, per cent of steaks by weight tended to decrease.

Per Cent of Loin Steaks

Table 4 shows that the higher-grading carcasses of both steers and heifers yielded the lower percentages of trimmed sirloin and shortloin steaks. Prime steers yielded 12.9% of their carcasses as loin steaks; Choice, 13.3%; Good; 14.4%; Standard, 14.5%; and Utility, 14.1%. There was little difference between the Good and Standard grades and the Utility grade average was lower than either. Heifer carcasses had the same general loin steak percentage pattern as steers with the exception that the Utility grade was highest of all grades. Heifers produced a slightly higher overall percentage of loin steaks than steers. This relationship existed although heifer carcasses were fatter and had smaller rib-eye muscle areas than steers. The difference between heifers and steers was a reversal of the observation made with the per cent of round steaks.

There was a slight tendency for per cent of loin steaks to decrease as carcass weight increased. Weight group averages showed that the lightest weight group had approximately 1% more loin steaks than the heaviest group. Weight group averages for steers and heifers revealed that the advantage in favor of heifers was present only in the 200-300 and 300-400 pound weight groups. Steer and heifer averages for the two heaviest groups were identical.

Per Cent of Total Steaks

When the percentages of trimmed loin and round steaks were summed to give a percentage of total steaks, a definite relationship existed between the percentage of total steaks and carcass grade. Average total percentage of steaks increased as grades were lowered from Prime to Standard with both steers and heifers. Utility grade carcasses had a lower percentage than the Standard grade carcasses but a higher percentage than carcasses in other grades. Approximately one-fourth of the total carcass was represented by round, sirloin, and shortloin steaks. The per cent for steer carcasses ranged from 23.3 in the Prime grade to 28.0 in the

Table 4. Average Per Cent of Carcass Weight Represented by Round, Loin, and Total Steaks by Grade, Weight, and Sex.

Kind of steak and grade	Weight groups (lb.) 200-300 M	200-300 F	300-400 M	300-400 F	400-500 M	400-500 F	500+ M	500+ F	Grade averages M	Grade averages F
Round										
Prime	—	—	—	—	—	9.5	10.4	9.6	10.4	9.6
Choice	—	—	12.8	10.9	12.2	11.1	11.4	10.3	12.1	10.8
Good	13.2	11.5	12.4	11.9	13.1	11.6	11.4	11.0	12.5	11.5
Standard	13.4	12.6	13.6	13.2	13.5	11.4	13.4	11.5	13.5	12.2
Utility	12.8	12.3	13.6	11.6	—	—	—	—	13.2	11.9
Wt. group av	13.1	12.1	13.1	11.9	12.9	10.9	11.6	10.6		
Loin										
Prime	—	—	—	—	—	13.7	12.9	12.6	12.9	13.2
Choice	—	—	12.6	14.4	13.2	14.0	14.0	13.6	13.3	14.0
Good	14.8	14.3	14.7	14.4	14.4	14.3	13.8	14.5	14.4	14.4
Standard	14.8	15.2	14.1	15.3	14.4	13.9	14.9	14.9	14.5	14.8
Utility	14.3	15.3	14.0	14.7	—	—	—	—	14.1	15.0
Wt. group av.	14.6	14.9	13.8	14.7	14.0	14.0	13.9	13.9		
Total										
Prime	—	—	—	—	—	23.2	23.3	22.3	23.3	22.8
Choice	—	—	25.4	25.3	25.4	25.1	25.4	23.9	25.4	24.8
Good	28.0	25.8	27.1	26.3	27.5	25.9	25.2	25.5	26.9	25.9
Standard	28.2	27.8	27.7	28.5	27.9	25.3	28.3	26.4	28.0	27.0
Utility	27.1	27.6	27.6	26.3	—	—	—	—	27.3	26.9
Wt. group av.	27.7	27.0	26.9	26.6	26.9	24.9	25.5	24.5		

Standard grade. Heifer carcasses, by grades, averaged from 0.4% to 1.0% less steaks than steer carcasses.

Within the three heaviest weight groups, highly significant differences existed in total percentage of steaks among grades. Highly significant differences also were found between steers and heifers in the two heaviest groups. Average differences were in favor of the steer carcasses.

Percentage of total steaks tended to decrease as carcass weight increased. The advantage of the lightest weight group over the heaviest was over 2%.

Effects of Carcass Length and Finish On Steak Yield

Relationships between per cent of total steaks and two carcass measurements were studied. Carcass length and per cent of total steaks showed a low negative relationship within each of the grades, exclusive of Prime which again was omitted from correlation calculations. Thus, within grades there was a slight tendency for the longer carcasses to produce a lower percentage of steaks. The simple correlation coefficients within grades ranged from —.16 to —.29. None of the coefficients were statistically significant. The pooled within-grade coefficient ($r = -.19$) was significant ($P < .05$). However, carcass weight may have confounded the relationship between carcass length and percentage of steaks. When carcass weight effects were minimized by calculating a pooled within-weight and grade subclass correlation coefficient, carcass length and percentage steaks showed a very low association ($r = -.04$).

The relationship between the second carcass measurement, fat thickness over the rib-eye muscle, and percentage by weight of total steaks also was low and negative. This again indicated a slight tendency for percentage of steaks to decrease as fat thickness increased. Simple correlation coefficients ranged from —.07 to —.20 within-grades and were not statistically significant. The pooled within-grade coefficient ($r = -.13$) also was not significant.

Per Cent Roasts

The percentage of rib roasts, chuck roasts, or total roasts did not show a definite or consistent relationship to grade, weight, or sex of the carcasses (Table 5). Rib, chuck, rump, and heel of round roasts were included in the classification "total roasts."

Within weight groups, no significant differences in per cent of roasts were found among grades or between steers and heifers.

Table 5. Average Percent of Carcass Weight Represented by Rib, Chuck, and Total Roasts by Grade, Weight, and Sex.

Kind of roast and grade	Weight groups (lb.) 200-300 M	200-300 F	300-400 M	300-400 F	400-500 M	400-500 F	500+ M	500+ F	Grade averages M	Grade averages F
Rib										
Prime	—	—	—	—	—	16.3	18.1	15.5	18.1	15.9
Choice	—	—	16.2	16.7	16.7	16.8	16.8	17.6	16.6	17.0
Good	17.4	15.3	17.0	16.4	17.3	17.2	18.2	17.4	17.4	16.6
Standard	18.5	16.9	17.2	17.5	17.4	17.2	17.4	17.0	17.6	17.1
Utility	17.3	17.0	17.7	17.1	—	—	—	—	17.5	17.0
Wt. group av.	17.7	16.4	17.0	16.9	17.1	16.9	17.6	16.9		
Chuck										
Prime	—	—	—	—	—	7.1	6.7	7.2	6.7	7.2
Choice	—	—	7.2	7.4	6.1	7.0	6.6	7.3	7.2	6.7
Good	5.6	6.1	6.0	6.9	6.1	5.2	6.9	7.0	6.1	6.3
Standard	6.2	6.1	6.0	6.2	6.3	7.4	7.0	7.1	6.4	6.7
Utility	6.0	6.2	6.7	7.5	—	—	—	—	6.4	6.9
Wt. group av.	5.9	6.1	6.5	7.0	6.2	6.7	6.8	7.2		
Total[1]										
Prime	—	—	—	—	—	28.4	29.0	26.6	29.0	27.5
Choice	—	—	28.2	28.3	27.0	28.0	27.6	29.5	28.2	28.0
Good	28.2	26.8	27.8	28.2	27.9	26.6	29.8	29.3	28.4	27.7
Standard	29.9	28.6	28.3	28.6	27.0	29.8	28.9	28.5	28.5	28.9
Utility	29.0	28.9	29.9	29.8	—	—	—	—	29.4	29.3
Wt. group av.	29.0	28.1	28.6	28.7	27.3	28.2	28.8	28.5		

1. Includes rib, chuck, rump, and heel of round roasts.

Table 6. Average Percent of Carcass Weight Represented by Lean Cuts for Stewing and Grinding by Grade, Weight, and Sex.[1]

Grade	Weight groups (lb.)								Grade averages	
	200-300		300-400		400-500		500+			
	M	F	M	F	M	F	M	F	M	F
Prime	—	—	—	—	—	21.1	22.4	24.1	22.4	22.6
Choice	—	—	24.0	25.0	25.4	23.8	25.0	23.0	24.8	23.9
Good	24.5	24.3	24.9	24.6	25.0	23.3	24.1	24.8	24.6	24.3
Standard	24.1	23.4	24.6	24.2	25.8	24.0	26.1	25.3	25.1	24.3
Utility	25.9	24.4	25.4	24.1	—	—	—	—	24.7	24.3
Wt. group av.	24.8	24.0	24.7	24.5	25.4	23.0	24.4	24.3		

1. Includes short ribs, lean trim and boneless shank, brisket, flank, and neck.

Over one-fourth of the total carcass was composed of roasts. Grade averages for both steers and heifers ranged from 27.5% to 29.4%. Thus, on the average, total steaks and total roasts accounted for approximately 50% to 57% of the carcass within grade groups.

Per Cent of Lean Cuts for Stewing and Grinding

The lean cuts classification includes the short ribs, lean trim and boneless foreshanks, hind shanks, brisket, flank, and neck. As shown by the grade averages in Table 6, Prime grade carcasses had the least amount of lean cuts (22.4% for steers and 22.6% for heifers). Only small differences existed among the averages for other grades. Within weight groups, no significant differences were found among grades or between heifers and steers. However, weight group averages showed that steers had a slightly higher percentage of lean cuts within weight groups. Slightly less than one-fourth of the carcass, on the average, was processed into lean cuts for stewing and grinding.

Percentage Waste, Bones, and Trimmed Fat

This portion of the carcass was composed of parts which had little value when compared to the steaks, roasts, and lean cuts previously discussed. Bones, exclusive of those left in retail cuts; trimmed fat, including kidney and pelvic fat, and fat removed from retail cuts; and inedible parts, including the backstrap, wooden skewers, bruises and peritoneum — all were combined in this classification.

Grade averages in Table 7 reveal a definite inverse relationship between grade and percentage waste, bones, and fat. Prime steer carcasses had an average of 24.6% of their weight in this category; Choice, 21.5%; Good, 19.4%; Standard, 17.8%; and Utility, 17.1%. Comparable values for heifer carcasses were 26.9%, 22.9%, 21.4%, 19.6%, and 19.3%, respectively. Thus, heifer carcasses had a higher percentage of waste, bones, and fat in every grade. Within the weight groups there were significant differences among grades in the 200-300 pound and 400-500 pound groups, and highly significant differences among grades in the 300-400 pound and 500+ pound groups. Although there were apparent differences between steers and heifers in the other two weight groups, these differences were not statistically significant.

Table 7. Average Percent of Carcass Weight Represented by Waste, Bones, and Trimmed Fat, by Grade, Weight, and Sex.

Grade	Weight groups (lb.)								Grade averages	
	200-300		300-400		400-500		500+			
	M	F	M	F	M	F	M	F	M	F
Prime	—	—	—	—	—	27.0	24.6	26.8	24.6	26.9
Choice	—	—	22.1	22.4	20.3	23.1	21.0	23.3	21.1	22.9
Good	19.1	22.3	19.8	20.4	19.0	23.4	19.8	19.6	19.4	21.4
Standard	17.1	19.5	19.0	18.5	17.6	20.4	17.7	19.7	17.8	19.6
Utility	17.6	18.4	16.6	20.1	—	—	—	—	17.1	19.3
Wt. group av.	17.9	20.1	19.4	20.4	19.0	23.5	20.8	22.4		

A low positive association existed between fat thickness over the rib-eye muscle and per cent of waste, bones, and fat within grades. The simple correlation coefficients ranged from 0.07 to 0.30. None of the coefficients was statistically significant. The pooled within breed coefficient was 0.08, which also was not significant. However, when the data from all carcasses were pooled with grade ignored, the association between fat thickness and per cent of waste, bones, and fat was highly significant ($r = 0.53$). Thus, as fat thickness increased there was a strong tendency for per cent of waste, bones, and fat to also increase, when grade effects were ignored.

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