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The Physical Composition of a Lean, a Half Fat, and a Fat Beef Carcass and the Relative Cost of the Nutrients Contained in Each

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The Physical Composition of a Lean, a Half Fat, and a Fat Beef Carcass and the Relative Cost of the Nutrients Contained in Each

A. T. EDINGER

Abstract.—Three steers varying in age and in degree of finish and weighing 945, 1070 and 1000 pounds, respectively, were slaughtered, and a physical analysis of the carcasses was made. The steer in high condition had the highest dressing percentage and produced a carcass with more external fat than the other steers. The half-fat steer ranked next in dressing percentage and amount of external fat on the carcass. The thin steer has the lowest dressing percentage and the least amount of external fat on the carcass. The weights of the empty internal organs of the various steers were about the same, while the amounts of internal fat varied with the degree of fatness and breeding of the animals. The thin and fat steers varied considerably in composition. The thin steer contained 24 per cent more lean, 20 per cent less fat and 5 per cent more bone than did the fat steer. The plates and the flanks in the three steers carried the largest percentage of fat, and the ribs, loins, rounds and chucks follow in the order named. The protein in a pound of lean was found to be greatest in amount when the flesh was taken from the half-fat animal. In the fatter animal the percentage of moisture and protein in the fatty tissue decreased with an increase in fat. The cuts from the fat steer produced about twice as many calories per pound as the same cuts from the thin steer. The food values of the meat did not correspond to the market prices of the different cuts. The most economical source of protein was the chuck, followed in order by the round, rib and loin. The cuts with the lower market value produced protein and calories at a lower cost than the more expensive cuts. In these animals of various degrees of fatness, the chuck was the most economical source of lean meat. The loin steak was the most expensive source of total boneless meat.

It was stated in 1910 that studies in American homes had shown that meat and poultry supply 16 per cent of the total food material, 30 per cent of the total protein and 59 per cent of the total fat in the average American dietary.^{1*} During the ten years following, however, the per capita consumption of meat gradually declined. The greatest portion of this decrease occurred in beef consumption. For the year ending December, 1920, the per capita meat consumption in the United States was 56.4 lbs. beef, 8.5 lbs. veal, 6.1 lbs. mutton and lamb, 0.1 lb. goat meat, 71 lbs. pork and 12.2 lbs. lard.² Since meat, especially beef, forms such an important part of the diet of the average person, a knowledge of the final market products into which beef cattle are converted may prove useful.

The majority of meat consumers have had very little training which aids in the economical purchase of meats. A knowledge of the amount of lean, fat and bone in the various cuts, and the nutritive values of these cuts should enable purchasers to buy on a more economical basis.

*Refers to list of references on page 87.

During periods of high prices and general prosperity the most choice of meats find a ready sale. Only limited consideration is given to the nutrients supplied at a given cost price, so long as the meat is thought to be the most edible of the carcass. This tendency coupled with the lack of knowledge as to the cuts which are most economical, has at times produced an over-supply of the cheaper cuts of meat and a shortage of the more choice portions. Consequently high prices may prevail for certain portions of the carcass, not because of their higher energy content, but because the buying public has cultivated a desire for these particular cuts. The following table³ indicates that the more valuable cuts as the loin and rib compose about one-fourth of the carcass and sell for one-half of its value.

Wholesale Prices and Proportion of Cuts From Half Carcass (250 Pounds) Year 1920

Cuts	Pounds	Percentage	Price per pound	Value
Loin	42.5	17	\$ 0.35	\$14.87
Rib	22.5	9	0.30	6.75
Round	60.0	24	0.14	8.40
Chuck	60.0	24	0.11	6.60
All others	65.0	26	0.10	6.50
Total	250.00	100	(av.) 17.25	43.12

A full appreciation by the buying public of the less expensive cuts of meat would effect: (1) a saving of money for the purchasers of meat; (2) more complete utilization of the carcass; and (3) a narrowing of the necessary margin of profit on the part of the retail butcher.

The variation in cattle coming on the market necessitates their classification into different grades. The same is true of the carcasses that they produce. Carcass classification depends upon the amount of lean, fat and bone along with other important characteristics which the carcasses possess.

The amount and distribution of fat throughout the carcass presents a problem that concerns the producer as well as the consumer. In order that beef production may be most profitable, the producer must not only take into consideration the breeding and feeding of an animal, but he must give some attention to the final marketable products. Thus the more efficient cattle feeders are making an effort to acquaint themselves as thoroughly with the finished commodities as they are with the living animals. As yet, however, a very small amount of data has been presented which gives an insight into the relation of the living animal to the various portions of the carcass. The result is that many producers continue their business operations without giving much thought as to how the ultimate product will be accepted by the consumer.

This study was undertaken in order to secure data concerning the composition and nutritive value of the various cuts of beef from carcasses of different degrees of fatness. Such knowledge is of value both to the producer and consumer.

REVIEW OF LITERATURE

The physical analysis of beef carcasses has been made only in a brief way, giving the total amount of hand separated fat in the different wholesale cuts, and not the amounts in each retail cut made from these wholesale cuts. No published data are available concerning the physical composition of both wholesale and retail cuts, produced from animals of different degrees of fatness.

At the Illinois Station,⁴ three animals grading good to prime steers were used to determine the relative percentages of the different cuts in the carcasses and their physical and chemical compositions. The percentages of the various wholesale cuts depend on the conformation of the animal, the fatness, and the manner of cutting. These steers being of the same quality produced similar carcasses, dressing 60 to 64 per cent, chilled weight. On the average these carcasses showed the following percentages in the various cuts: loin, 16.67 per cent; rib, 9.77 per cent; round, 21.78 per cent; chuck, 21.89 per cent; plate, 15.63 per cent; flank, 5.15 per cent; fore shank, 4.97 per cent; and the kidney suet, 4.06 per cent.

Dividing these cuts into the retail market cuts and then separating them into lean, fat and bone, it was found that the lean varied from one-third in the flank to two-thirds in the chuck. The extreme percentages of visible fat were 11 per cent in the shank and 63 per cent in the flank. The percentage of bone ranged from practically nothing in the flank to 40 per cent in the shank. In general those portions containing the largest percentages of lean had a small percentage of visible fat, and *vice versa*, while the relative weight of bone was more variable. The average composition was 57 per cent lean, 30 per cent visible fat and 13 per cent bone.

The retail cuts showed a wide variation in composition. The entire loin averaged 59 per cent lean, 32 per cent visible fat and 9 per cent bone, with the sirloin containing more lean and less fat than the porterhouse steaks. The round steaks contained more lean and less fat and bone than the loin steaks. The average composition of the round was 65 per cent lean, 18 per cent fat and 17 per cent bone. In the round the maximum amount of fat was in the rump, and the maximum amount of bone in the shank. The rib cuts compared very closely to the loin in physical composition with the greatest amount of lean in the sixth rib roast and the smallest amount in the 11th and 12th rib roasts. The

chuck showed a greater variation than the other cuts in composition, the lean varying from 62 to 82 per cent and the fat from 6 to 22 per cent. The flank steak carried the greatest amount of lean, amounting to 83 per cent while the flank stew was lower in lean, and carried 35 per cent of fat. The brisket and navel ends of the plate averaged about one-half fat and 8 per cent bone, these cuts being very similar in composition. The fore shank had very little visible fat and the different soup bones showed a variation of from 25 to 75 per cent bone and of 17 to 69 per cent lean.

This experiment indicates, when considering the relative economy of the different cuts from prime carcasses, that in the porterhouse steaks the edible meat costs the most while in the chuck it costs the least. Of the roasts the rump is the cheapest for edible meat while the first cut of the prime rib is the most expensive. The lowest priced cuts were the most economical sources of both lean and total edible meat, showing that the market value of the different cuts is determined by other considerations than their relative food values.

The chemical composition shows that the water content of edible meat varies from 32 per cent in the flank to 63 per cent in the clod, consequently the dry substance varied from 37 per cent in the clod to 68 per cent in the flank. The total fat varied from 18 per cent in the clod to 57 per cent in the flank. The protein, an essential food constituent of beef, varied in the different cuts inversely as the dry substance and fat. The maximum percentage of protein was 17 per cent in the shank and 9.44 per cent in the flank. When calculated on a fat-free basis, the percentage ranged from 20 to 22 per cent in the various wholesale cuts. There is no relation between market prices and the percentage of protein, fat and extractives. When not considering the tenderness and palatability as influenced by the degree of fatness, the neck, shank and clod are the most economical cuts, with the loin the most expensive. From the standpoint of fuel value, the flank, plate, neck, and shank are the cheapest, while the loin, rib and round are the most expensive.

At the Iowa Experiment Station⁵ steers in a finished condition, but of different breeds, were used in determining the relative values of the carcasses and the wholesale cuts produced from them. Eighteen steers were used in this experiment and the average dressing percentage, chilled weight, was 63.6 per cent with the highest as 66 per cent for a Hereford, a Shorthorn and an Angus, and the lowest 57.5 per cent for a Jersey and a Holstein. The eighteen carcasses were divided into the various wholesale cuts and the average percentage of each was: loin, 16.8 per cent; rib, 10.3 per cent; round, 23.1 per cent; suet, 4.1 per cent; flank 3.0 per cent; chuck, 21.6 per cent; plate, 14.9 per cent and shank

5.8 per cent. The loin ranged from 17.6 per cent to 15.7 per cent; the rib, 9.7 per cent to 11.4 per cent; round 21.7 per cent to 25 per cent; chuck 20.5 per cent to 22.8 per cent; plate 13.3 per cent to 16.2 per cent and flank, 2.5 per cent to 3.5 per cent.

The shrinkage of the meat in the cooler was 1 per cent while the average shrinkage is about 2 per cent. The meat was sold at the current market wholesale prices and 36.5 per cent of the entire value of the carcass came from the loin and 22.8 per cent from the ribs, or 60.9 per cent of the total value of the carcass came from the two cuts, the loin and the rib. In other words, 27 per cent of the carcass sold for 60.9 per cent of the total value.

Fat adds to the quality of beef and increases the percentage of the more valuable cuts. Animals of the dairy type, and scrub animals, have more internal fat and this decrease the dressing percentage.

At the Missouri Experiment Station,⁶ animals of different degrees of fatness were slaughtered and analyzed. The proportions of carcass and offal fat increased as the steers became fatter and heavier, while the proportion of hide and blood decreased. Most of the internal organs decreased slightly in proportionate weight while the stomachs and liver showed a percentage increase in weight as of the animal became fatter and heavier.

The carcasses were divided into the wholesale cuts, showing that the shin, shank and neck, the cheaper cuts of meat, decreased in percentage of total weight as the animal becomes fatter. The round, one of the better cuts, and the chuck, which varied somewhat, decreased in the fatter animals. The wholesale rib cut, the loin and the plate all increased in percentage weight of the total carcass as the animal fattened. The kidney, flank and plate serve for fat storage and increased in proportionate fat content as the animal fattened. The chuck forms the largest single cut or about one-fourth of the carcass, the plate ranged from 10 to 15 per cent; the rib from 9 to 12 per cent; the loin from 16 to 18.5 per cent and the round from 15 to 19 per cent.

The proportion of lean, fat and bone in carcasses of various degrees of fatness varied. The variation in the wholesale cuts follows: loin, lean 68 to 45 per cent; fat, 13 to 45 per cent; bone, 17 to 9 per cent; rib, lean, 65 to 41 per cent; fat, 7 to 46 per cent; bone, 25 to 12 per cent; chuck, lean 71 to 58 per cent; fat, 6 to 27 per cent; bone, 21 to 12 per cent; round, lean, 79 to 65 per cent; fat, 7 to 25 per cent; bone 13 to 8 per cent; rump, lean, 51 to 36 per cent; fat, 19 to 45 per cent; bone, 27 to 17 per cent; flank, lean, 57 to 26 per cent; fat, 40 to 73 per cent; bone, 1 to 0.3 per cent. The greatest increase in percentage of fatty tissues was found in those cuts which form a relatively larger part of the carcass as the

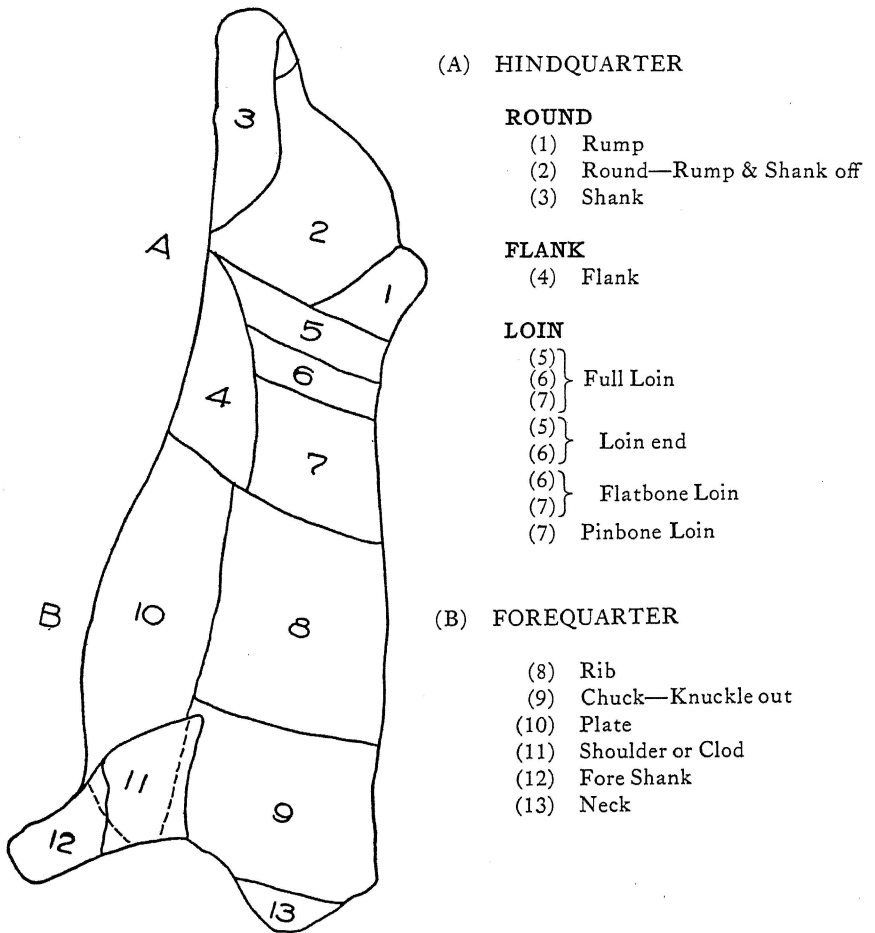


Figure 1.—Wholesale Cuts of Beef

(A) HINDQUARTER

- I RUMP
- II ROUND—R & S off
 - 1 First Cut
 - 2-13 Round Steaks
 - 14 Last Cut
 - 15 Pot Roast
- III HIND SHANK
 - 1 Hock soup bone
 - 2- 3 Soup bones
 - 4 Knuckle Bone
- IV LOIN
 - 1 Butt End Sirloin
 - 2- 3 Wedge Bone Sirloins
 - 4- 5 Round Bone Sirloins
 - 6-10 Double bone Sirloins
 - 11-12 Hip Bone Sirloins
 - 13-15 Hip Bone Porterhouse
 - 15-23 Porterhouse Steaks
 - 24-25 Club Steaks
- V FLANK
 - 1 Flank Steak
 - 2 Flank Stew

(B) FOREQUARTER

- I PLATE
 - 1 Rib Ends
 - 2 Navel End
 - 3 Brisket End.
- II SHOULDER
 - 1 Shoulder Joint
 - 2 Shoulder or Clod
 - 3 Elbow Joint
 - 4- 5 Soup Bones
- III RIBS
 - 1 6th 7th Ribs
 - 2 8th Rib
 - 3 9th 10th Ribs
 - 4 11th 12th Ribs

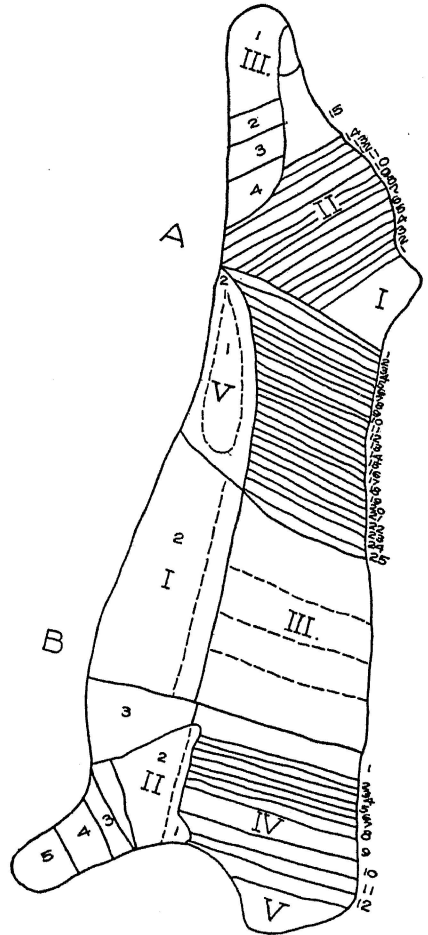


Figure 2.—Retail Cuts in a Beef Carcass

- IV CHUCK
 - 1 5th Rib
 - 2- 8 Chuck Steak
 - 9-12 Pot Roasts
- V NECK

animal fattens. This increase was consequently due largely to the deposit of fat. The weight of the lean flesh and the bone increased but not as rapidly as the weight of the fat. In the thin animals more than 21 per cent of the carcass was skeleton; the percentage decreased to less than 12 per cent in the fat animals. In the thin animal the lean was 65 per cent of the carcass while in the fat animal it amounted to 47 per cent. The fatty tissue increased from 12 to 40 per cent. The kidney fat forms about 10 per cent of the total fat in the thin animal and about 8 per cent in the fat animal.

OBJECT

The principal object of this project is: (1) to secure accurate data regarding the physical composition of beef animals of different degrees of fatness; (2) to show the relative amounts of lean, visible fat and bone in the retail and wholesale cuts; (3) to show the chemical composition and nutritive value of the boneless meat in the retail and wholesale cuts; (4) to show the relative economy and net cost to consumer of lean and total meat and the food nutrients in various cuts at current market prices and (5) to show the relative economy of beef of different degrees of fatness.

PLAN OF EXPERIMENT

The following plan is used in obtaining the data for the physical composition of a thin, a half fat and a fat steer carcass and the relative cost of the nutrients in each retail cut of meat:

The animals to be used are steers weighing 900 to 1000 pounds, one to be in a thin condition, one half-fat, and the third to be a well fattened animal. All should be in such a condition as to enable a butcher to sell all the cuts in a retail meat market.

Each animal is to be fasted for 24 hours, then weighed and slaughtered, using this weight to determine the dressing percentage. Weights of the offal and by-products are to be recorded and these are to compose part of the slaughter house data.

The carcasses are to be allowed to chill for 48 hours in the chill room at a temperature of 38°F. The weight after chilling is to be used as the final weight of the carcass. The right halves of the respective carcasses are to be divided into the regular wholesale cuts, namely: round, loin, flank, rib, chuck, plate, shank and neck, recording the weights of each to determine its percentage in the chilled carcass. The wholesale cuts are to be divided into the regular retail cuts as practiced in the retail meat markets. Each retail cut is then to be trimmed of excess fat, lean and bone as commonly practiced by the average meat cutter, from which will be determined the amount of lean, visible fat and bone remaining

in the cuts as purchased. This same procedure is to be carried out for each retail cut, and then the percentage of refuse and edible meat is calculated for the various wholesale cuts.

Using the data obtained from analytical work at this station, on carcasses of similar physical composition, the protein and total energy of each portion are to be determined.

Applying the current market prices to the retail cuts, the relative economy is to be shown from the standpoint of total protein and total energy content.

All of the data is to be secured by performing the work on the different animals under the same conditions and using as nearly as possible the same methods of cutting.

DESCRIPTION OF STEERS

Steer A.—Steer A (Fig. 3)* was a purebred Shorthorn steer, bred and raised by Mr. Fred C. Merry, Kansas City, Missouri. He was calved December 8, 1919, from which time he was cared for and fed in accordance with the practice of developing a steer for exhibition. He developed into an exceptionally good calf and was awarded fourth premium in the senior calf class at the Missouri State Fair. During the late fall he was allowed free run of bluegrass pasture and through the winter he was stall fed. This animal was purchased by the University of Missouri on March 31, 1921, and from this time to the date of slaughter, (May 10, 1921) he was allowed the following ration: corn chop, ground oats, bran, molasses and mixed hay.

He was purchased primarily for a show animal but soon after being placed on full feed digestive troubles arose with continuous bloating. From this time on he failed to make any gain in weight. At the time of slaughter this steer, weighing 945 pounds would have graded as choice on the market, sufficiently fat for this class but not carrying enough evenly distributed fat to be placed in the class of prime beef. He was well covered with external fat over the ribs and shoulder, smooth across the back, with an even but not thick enough covering over the loin, rather high in the flanks, shallow in the twist and light throughout the entire hind quarter. He produced a carcass that would grade as a choice yearling, or a baby beef carcass, which would only be found in the first class retail butcher shops.

Steer B.—Steer B (Fig. 4) was an animal in half fat condition, and on the market was equal to the cattle that would grade as good butcher steers. He was a well bred, high grade Hereford, possessing many of the desired characteristics sought in a good beef animal. His

*Figs. 3 to 23 inclusive, will be found in the half-tone section, beginning on page 56.

teeth showed him to be a 2-year-old and after fasting for 24 hours he weighed 1070 pounds. This steer (in the opinion of the local shipper, from whom he was purchased) was much better than the average steer that is slaughtered at our packing centers for beef. Up to the time of killing, this animal had free range of a good bluegrass pasture, also receiving a small amount of grain daily. During the preceding winter he received very little grain.

He was an animal well fleshed, firm, solid and carrying a good covering of fat over the entire body. Possessing a heavier and coarser bone, and showing less refinement throughout the entire body, this steer was not quite equal to Steer A in quality. He was criticized for being entirely too heavy and coarse in the forequarters, especially over and just back of the shoulders. He was also light in the loin and slightly shallow through the twist, lacking the desired development down to the hocks.

Steer C.—Steer C (Fig. 5) was an animal of rather mediocre type, although carrying a considerable amount of Shorthorn blood. This animal was thin, lacking finish and the desired condition for good beef. He possessed considerable quality for an animal of his breeding, free from coarseness, showing a fine textured bone.

This animal, at the time of killing, after fasting 24 hours, weighed 1000 pounds. He carried a large well developed frame, was fairly well fleshed, smooth, of good quality and possessing the essential requirements for a good feeder steer, but lacking in condition and fatness for good beef; consequently he was used in this experiment as a steer in thin condition but fleshed enough for his carcass to be sold in second rate meat markets as fresh beef. He, as Steer B, was also purchased from a local shipper and feeder who purchased him in April, 1921, on the St. Louis feeder cattle market. At that time he was a two-year-old, coming from southeast Missouri, and sold as a native steer. Records are not to be had showing how this animal was reared up to the time of coming to market. From April up to the time of slaughtering (November 6) he had free range of a good bluegrass pasture; and, during the last thirty days on pasture, he was fed daily a small amount of corn.

SLAUGHTER TESTS

The cattle used in this experiment received the same treatment before slaughtering, i. e., they were weighed, fasted for 24 hours, though plenty of fresh water was always to be had, and slaughtered. Just before slaughtering, the live weight was taken and this weight was then used in all calculations. The larger shrinkage in the case of the steers B and C, 60 pounds for each, may be accounted for by the fact that both were on grass with a small grain ration while the smaller shrinkage, of 20 pounds for steer A, may be attributed to the fact that he was stall fed.

Such a shrinkage is expected by all stock buyers; consequently, a discount is always allowed on grass fed animals. Not only does the feeding affect the shrinkage on the hoof, but it also affects the loss while the carcass is in storage. Since grass fed animals and those in thin flesh have a watery and less firm flesh and the external fat is not as great, there is a greater evaporation giving a larger loss while in the cooler. As the animal grows fatter with an increase of external fat, the loss of moisture from the carcass becomes less, as shown in Table 1.

The temperature and the humidity of a cooler will greatly affect the shrinkage of the meat. The temperature of the cooler ranged from 35° to 37°F. while the humidity was high. In an experiment carried on by the United States Department of Agriculture, the shrinkage of beef

TABLE 1.—SLAUGHTER HOUSE DATA

Steer	Pounds			Per cent		
	A	B	C	A	B	C
Live weight	925	1070	1000			
Carcass—warm	575	627	528	62.16	58.60	52.80
Carcass—chilled	568	618	520	61.4	57.76	52.00
Shrinkage	7	9	8	1.21	1.43	1.51
Right half—warm	285	315	266	30.81	29.43	26.60
Left half—warm	290	312	262	31.35	29.16	26.20
Right half—chill	280	311	263	30.27	29.06	26.30
Left half—chill	288	307	257	31.13	28.69	25.70
Hide	74	81	71	8.0	7.57	7.1
Head	29.25	33.2	28.8	3.16	3.10	2.88
Tongue	4	4.5	4.7	0.44	0.40	0.47
Brain	0.5	0.5	0.7	0.05	0.04	0.07
Fore feet	8.5	8.3	10.4	0.92	0.77	1.04
Hind feet	8.0	8.2	9.5	0.86	0.77	0.95
Sweetbread	0.75	0.75	0.5	0.08	0.07	0.05
Heart	4.5	4.2	3.7	0.49	0.39	0.37
Lung	17.5	18.0	16.2	1.89	1.68	1.62
Liver	11.0	13.5	10.6	1.18	1.26	1.06
Spleen	1.5	1.8	1.6	0.16	0.16	0.16
Intestinal fat	22.0	20.0	9.5	2.38	1.87	0.95
Caul fat	12.0	12.0	6.2	1.29	1.12	0.62
Stomach and contents	75.5	120.75	164.0	8.16	11.29	16.40
Intestines	31.5	46.0	46.0	3.40	4.30	4.60
Bladder	0.5	0.75	0.4	0.05	0.07	0.04
Tail	1.75	2.0	1.5	0.19	0.18	0.15
Blood and loss	47.25	67.55	86.7	5.10	6.31	8.67

held in storage from 14 days to 177 days varied from 2.15 per cent to 10.0 per cent.⁷ In this experiment the humidity was low, causing more drying out, and the growth of mold was only slight, as mold does not grow readily when the moisture content is low. This hardening and drying of meat with the accompanying change in color lowers the market value when the meat is held in storage for a long time. The physical changes that took place when the meat was held in storage two to four weeks, periods corresponding to the length of time that beef is held in cold storage in commercial practice, were not marked and did not lower the value of the product. The principal effect of this cold storage was a marked increase in the tenderness, but the extent of this change does

not bear direct relation to the length of storage periods. Beef stored in the average packing house cooler will shrink about 2 per cent to 3 per cent, due to the high humidity and low temperature, and the maximum storage period is about 50 days, when the shrinkage will be a little over 3 per cent and a considerable growth of mold will be present.

The majority of country butchers, when slaughtering the average grade of animals, expect a dressing percentage of about 50 per cent. The packers who kill a much better grade of cattle along with some that are of an inferior grade receive a higher average, and a year's killing will give about 54 per cent as the dressing percentage. According to Ostertag,⁸ the difference between the live weight and the dressed weight varies according to the condition of the animal. For cattle, it ranges from 40 to 65 per cent.

Table 1 presents the slaughter house data for the three steers. The A steer in high condition, B steer in medium and C steer in thin condition dressed out 62.16 per cent, 58.6 per cent and 52.8 per cent warm weight, respectively. Considering the dressing percentages of the chilled weight to the live fasted weight, these figures would be somewhat reduced showing that a thin steer dresses considerably less than a well fattened animal. The shrinkage while in the cooler was much less than the average, as the coolers were not ventilated. Thus the atmosphere in the rooms was soon saturated, stopping evaporation of moisture from the carcasses. The layer of external fat over the carcasses of A and B greatly retarded the loss of moisture, which was less than in C. There was a considerable difference in the contents of the digestive tract of the animals but even when figured on the same fill the dressing percentages were in favor of the better conditioned animals. The dressing percentage is not only controlled by the degree of fatness but also by the conformation and quality. An animal of poor quality and conformation might have a coarse bone, as shown by the legs, and be of a rangy, upstanding type, thus increasing the weight of the waste products. Such a type is generally lacking in development of the body and in the high-price cuts, thus reducing the weight of the carcass. Such is the case of steer C, causing a reduction in his dressing percentage.

There was little difference in the weights of the various organs except the stomach and intestines, which varied because of the difference in fill. A considerable difference existed in the amounts of caul and intestinal fats as the animal increased in fatness. Steer A, a well bred animal, containing considerable internal fat, had a tendency to increase the external fat rather than to increase the amount of internal fat. The latter tendency is common in poorly bred and in dairy animals. Steer B carried about the same amount of internal fat as A, but when on foot he

was considered as a half fat animal. Steer C, classified as a thin animal, carried less than half the internal fat carried by the other two steers.

As an animal fattens, there is a gradual increase, in proportion to live fasted weight, of the carcass, hide lung, liver, heart and edible fats. Also there is a gradual decrease of wastes due to feet, fill and loss at killing time.

THE FORE AND HIND QUARTERS OF THE CARCASS

The carcasses were put in a refrigerating room, where the initial temperature was 34°F. They were held for 48 hours at a temperature below 38°. The shrinkage during this time may be found in Table 2.

TABLE 2.—LOSS OF MOISTURE WHILE CARCASSES ARE IN COOLER

	Steer A	Steer B	Steer C
Warm weight (lbs.).....	575	627	528
Chilled weight (lbs.).....	568	618	520
Shrinkage (lbs.).....	7	9	8
Percentage shrinkage.....	1.21	1.43	1.51

The right half of each carcass was then cut into two quarters. The division was made between the 12th and 13th ribs, allowing one rib to remain on the hindquarter. Since the cutting of the carcasses was done at different dates, great care was exercised to cut them in like manner having one person to do all the cutting. The weights and percentage of the total carcass for each of these main wholesale cuts appear in Table 3.

TABLE 3.—THE WEIGHTS AND PERCENTAGES OF FORE AND HIND QUARTERS

	Pounds			Percentage		
	A	B	C	A	B	C
Fore-left.....	148	157	140	26.06	25.40	26.92
Fore-right.....	143	162	142	25.18	26.21	27.31
Hind-left.....	140	150	117	24.64	24.27	22.50
Hind-right.....	137	149	121	24.12	24.11	23.27

The thinner animals show a greater percentage of forequarters in the carcass, which means a less amount of the more expensive meat and a greater amount of that which sells at a lower price. Forequarter varied from 51.24 per cent of the total carcass weight in steer A to 54.23 per cent of the total carcass weight in steer C and the variation depended upon the condition, conformation, quality and finish of the animal. The Illinois Experiment Station⁴ reports 52.70 per cent as the average percentage of forequarter in carcasses from animals in prime fat condition.

Investigations at this station indicate that for carcasses of this general class from 53 to 54 per cent of the weight is forequarter and from 46 to 47 per cent is hindquarter.⁶

WHOLESALE CUTS OF BEEF

The right half of each carcass is reduced to the smaller wholesale cuts as illustrated in Figure 1; namely: round, including rump and shank loin; flank; rib; clod; plate; chuck, excluding clod; fore shank, neck and kidney. The hindquarter is divided into the various cuts: first, remove the flank by starting at the cod and continuing down over the round following the white line that lies on the inside of the flank to the remaining rib at the end of the loin. The loin is separated from the round by commencing at the fourth vertebra in the rump, passing through the hip joint to a point just in front of the stifle joint. The rump, a triangular piece of meat, is removed from the round by cutting just back of the pelvic bone. The shank is not removed until the round has been cut down as steaks or roasts. In the forequarter the clod or shoulder is removed at the shoulder joint and the shank separated from the shoulder just above the elbow. Starting about 12 to 14 inches from the backbone on the 12th rib and continuing forward a little below the shoulder joint, the lower part of the forequarter or plate is removed. The prime rib is separated from the chuck between the 5th and 6th ribs, leaving 7 ribs in this cut. The chuck is now trimmed by cutting off the neck at a point where it tends to become shallow. The kidney, along with the kidney suet, is removed from the loin.

TABLE 4.—WEIGHTS AND PERCENTAGES OF WHOLESALE CUTS

	Pounds			Percentage		
	A	B	C	A	B	C
Round	64.5	82.0	67.5	23.05	26.37	25.66
Loin	54.2	53.5	42.5	19.35	17.20	16.15
Rib	27.2	28.4	20.4	9.72	9.13	7.76
Flank	11.0	8.5	6.9	3.93	2.73	2.63
Plate	35.75	45.0	32.0	12.77	14.47	12.17
Chuck, clod	61.35	67.7	63.4	21.91	21.77	24.11
Fore shank	10.0	10.3	11.0	3.57	3.31	4.18
Neck	8.7	10.6	14.8	3.10	3.40	5.63
Kidney and suet	7.3	5.0	4.5	2.60	1.61	1.71
Entire side	280.0	311.0	263.0	100.00	99.99	100.00

Table 4 gives the distribution of the various wholesale cuts of meat in the carcass. Since only the right half is used in order to determine the

actual amount of these cuts, the weights must be multiplied by two. This table also presents the percentage of the wholesale cuts in the carcass.

Perhaps due to the faulty conformation, the round of Steer A was not as large as is preferred, thus accounting for the lower percentage. In all the other cuts the animal in the highest condition showed the highest per cent of the more valuable cuts, and a smaller percentage of the cheaper or inferior cuts. The plate of Steer B was heavier, due to the longer and wider sternum and a longer and more paunchy side while the heavy plate of A was due to the great amount of fat deposited there. The small variation between A and C might have been caused by making a slight mistake in cutting the ribs of C a little short, thus increasing the amount in the plate. Even though this might be true, the total of the plate and rib shows a greater development in case of the A steer.

There is a tendency for the animal, as he becomes fatter and better conditioned, to increase in the more valuable cuts, as the loin, and decrease in the less expensive cuts, such as chuck. The rib remains about constant while the plate shows a slight increase. The deposit of external, internal, intermingling or marbling fat not only increases the weight of various portions, but it also improves the flavor and quality, rendering the meat more juicy and tender. The carcasses that possess these characteristics and that will cut to the best advantage must contain a large proportion of the rib and loin. Thus, the best conditioned animal excels in this respect as shown in Table 5.

TABLE 5.—RELATIVE PROPORTIONS OF THE MORE VALUABLE CUTS
(Percentage the Total Animal Contains)

	Loin	Rib	Loin and Rib
Steer A	19.35%	9.71%	29.06%
Steer B	17.20%	9.13%	26.33%
Steer C	16.16%	7.76%	23.92%

At the Illinois Experiment Station, in animals of good to prime condition, the percentages of the loin and rib were found to be 25.24 to 27.83 per cent.⁴

Composition of Wholesale Cuts.—The above mentioned wholesale cuts were divided into the retail cuts as practiced on the average market, and these retail cuts were again divided into lean, fat and bone. From these data the amounts of lean, fat and bone in each wholesale cut were calculated as shown in Table 6.

This table gives the actual weights of the amounts of lean, fat and bone in each cut for each steer. During the cutting a certain loss always

occurs, due to the loss of small pieces of bone and flesh and evaporation of moisture, along with any error in weighing. This loss of moisture gradually increases as the animal becomes thinner, since the flesh is more watery and consequently the evaporation of moisture from the carcass is greater.

TABLE 6.—LEAN, VISIBLE FAT AND BONE IN WHOLESALE CUTS

Wholesale cuts	Expressed in pounds				Expressed in percentage			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Loin.....	28.15	19.60	5.87	35.62	52.50	35.99	11.51	100.00
Rib.....	11.75	10.10	5.15	27.00	43.52	37.41	19.07	100.00
Round.....	37.87	12.66	13.85	64.38	58.83	19.66	21.51	100.00
Round—R and S off.....	27.32	6.71	2.70	36.73	74.40	18.26	7.34	100.00
Shank.....	4.05	1.15	7.05	12.25	33.07	9.38	57.55	100.00
Rump.....	6.50	4.80	4.10	15.40	42.21	31.16	26.62	100.00
Chuck.....	40.25	16.65	13.05	70.05	57.60	23.79	18.63	100.00
Chuck—Knuckle out.....	29.70	14.25	8.90	52.85	56.20	26.96	16.84	100.00
Shoulder—Knuckle.....	5.65	1.00	2.40	9.05	62.43	11.05	26.52	100.00
Neck.....	5.00	1.40	1.75	8.15	61.35	17.18	21.47	100.00
Plate.....	12.45	17.55	5.75	35.75	34.83	49.09	16.08	100.00
Flank.....	2.40	8.50	.10	11.00	21.82	77.27	.91	100.00
Fore Shank.....	4.85	1.25	3.85	9.95	48.74	12.56	38.70	100.00
Kidney and suet.....	1.10	6.20	-----	7.30	15.77	84.23	-----	100.00
Loss.....	-----	-----	-----	.95	-----	-----	-----	.35
Entire Side.....	138.92	92.51	47.62	279.05	49.61	32.93	17.11	99.65
Steer B								
Loin.....	31.15	14.85	7.15	53.15	58.61	27.94	13.45	100.00
Rib.....	15.90	5.70	6.70	28.30	56.18	20.14	23.68	100.00
Round.....	53.60	11.95	15.85	81.40	65.85	14.68	19.47	100.00
Round—R and S off.....	29.80	6.45	2.95	49.20	80.89	13.11	6.00	100.00
Shank.....	4.80	2.00	8.50	15.30	31.37	13.07	55.56	100.00
Rump.....	9.00	3.50	4.40	16.90	53.25	20.71	26.04	100.00
Chuck.....	52.65	9.60	16.05	78.30	67.24	12.26	20.50	100.00
Chuck—Knuckle out.....	35.55	7.20	10.65	53.40	66.58	13.48	19.93	100.00
Shoulder—Knuckle.....	9.80	1.20	3.40	14.40	68.06	8.33	23.61	100.00
Neck.....	7.70	1.20	2.00	10.50	69.52	11.43	19.05	100.00
Plate.....	26.10	11.50	7.40	45.00	58.00	25.56	16.44	100.00
Flank.....	3.00	5.50	-----	8.50	35.30	64.70	-----	100.00
Fore Shank.....	4.80	.80	4.70	10.30	46.60	7.77	45.63	100.00
Kidney and Suet.....	1.00	4.00	-----	5.00	20.00	80.00	-----	100.00
Loss.....	-----	-----	-----	1.05	-----	-----	-----	.33
Entire Side.....	188.20	63.90	57.85	309.95	60.54	20.54	18.60	99.68
Steer C								
Loin.....	29.35	5.15	7.50	42.00	69.88	12.74	17.38	100.00
Rib.....	12.50	1.90	5.40	19.80	65.15	9.60	25.25	100.00
Round.....	45.85	5.03	15.32	66.20	69.26	7.60	23.14	100.00
Round R and S off.....	34.05	2.03	1.92	38.00	89.61	5.34	5.00	100.00
Shank.....	4.40	1.10	9.20	14.70	29.93	7.48	62.59	100.00
Rump.....	7.40	1.90	4.20	13.50	54.81	14.07	31.12	100.00
Chuck.....	52.00	6.65	19.00	77.65	66.97	8.56	24.47	100.00
Chuck—Knuckle out.....	32.40	4.25	9.90	46.55	69.60	9.13	21.27	100.00
Shoulder—Knuckle.....	11.10	1.00	4.10	16.20	68.52	6.17	25.31	100.00
Neck.....	8.50	1.30	5.00	14.80	57.43	8.78	33.79	100.00
Plate.....	17.10	8.30	7.50	32.90	51.98	25.22	22.80	100.00
Flank.....	3.20	3.50	.20	6.90	46.38	50.72	2.90	100.00
Fore Shank.....	5.50	.40	5.10	11.00	50.00	3.64	46.36	100.00
Kidney and Suet.....	1.20	2.80	-----	4.00	30.00	70.00	-----	100.00
Loss.....	-----	-----	-----	2.55	-----	-----	-----	.97
Entire Side.....	166.70	33.73	60.02	260.45	63.54	12.90	22.59	100.00

It has been shown that as an animal fattens certain wholesale cuts increase in proportion to the carcass, and those that act as a depot for fat increase the most rapidly. With this increase in fat, there is a decrease in the percentage of lean and bone. This does not mean that as an animal becomes fatter only fat is deposited. There is also an increase in bone and lean but a less rapid increase than in the case of the fat, consequently

the proportion of lean and bone to the carcass becomes less. These facts are shown very clearly in the last four columns of Table 6 which give the percentage of each in the different steers.

The percentage of total bone decreases as the animal fattens, although the total weight is just about the same except in steer A, where the total weight is less. This animal was not nearly as old or matured as the others, although his live weight almost equalled that of either of the other two. This tends to prove that a young, well finished animal has a smaller percentage of bone as well as a smaller total amount.

The average percentages of the different portions from a carcass of prime beef were found to be, at the Illinois Experiment Station, 57 per cent lean, 30 per cent fat and 13 per cent bone.⁴ This compares very similarly to the data obtained for the fat steer used in this experiment: 49.61 per cent lean, 32.93 per cent fat and 17.11 per cent bone. Such a carcass would only be found in a shop that caters to such trade as first class hotels and dining cars. The average meat that is purchased at our retail markets would have a composition similar to that of Steer B, which is about 60.72 per cent lean, 20.62 per cent fat and 18.66 per cent bone. Animals having the composition of the C steer, as: lean, 63.54 per cent, fat, 12.90 per cent, and bone 22.57 per cent, would only be found in a very cheap market, and then the percentage of fat might be somewhat reduced and the percentage of bone and lean increased. Thus, between a fat animal and a thin animal, we have a difference of 14 per cent in the lean, 20 per cent in the fat and 4 per cent in the bone.

TABLE 7.—PER CENT OF LEAN, FAT AND BONE IN FORE AND HIND QUARTERS TOTAL CARCASS

	Forequarter			Hindquarter		
	Lean	Fat	Bone	Lean	Fat	Bone
Steer A.	49.96	49.40	58.02	50.04	50.60	41.98
Steer B.	52.90	43.20	60.25	47.10	56.80	39.75
Steer C.	52.37	50.84	61.60	47.63	39.16	38.40

In animals of various degrees of fatness, we find that the plate and the flank always carry the largest percentage of fat. The ribs and the loins follow next in order. The ribs of the A steer are high in fat because of the large, thick layer of external fat that is laid down as the fattening period progresses. The round follows next as a store for fat; but, as the animal becomes rather thin, the chuck contains more fat because the round is about the last place to receive external fat, along with the marbling which does not take place until the fattening process is well under

way. The fore shank seems to be free from a large amount of fat even in well conditioned animals, and in the thin animals only a small amount is present. Thus, this wholesale cut remains at the bottom in fat content. The amount of fat, lean and bone in the fore and hind quarters was calculated with the following results:

The spread between the fat content of the steers remains about the same in the various cuts. This also holds true in the case of the bone excepting for the bone in the round of the medium fat steer which drops below that of the fat steer, due to the heavy development of lean meat in Steer B and the light development of the hindquarters of Steer A. The difference in the percentage of lean varies in case of the plate where the medium steer runs a little higher than the thin steer because of the extraordinary development of the brisket. Because of the large amount of bone in the fore shank of Steer B, the percentage of lean is reduced and falls below that of Steer A.

The conformation of the animals plays a very important part in this comparison as is very noticeable in the diagram relating to the amount of lean. There the lines are more irregular, due to the heavy development of muscles in certain parts and light muscling in others. Where fat may be stored in large quantities, these parts will contain less lean as the animal fattens, consequently making the relative position of the lines showing the amount of lean more irregular.

The actual number of pounds of bones in the steers is just about the same, but the percentage is lowered as the animal fattens with about 7 per cent as the maximum difference. This uniformity does not continue in the case of the lean and fat as an animal fattens. The lean in the flank varies by 25 per cent; in the loin, by 17 per cent; and in the rib, by 22 per cent. The percentages of fat show a greater difference. In the flank the variation is 27 per cent; in the plate, 24 per cent; in the loin, 23 per cent, and in the rib 26 per cent. If the animals were fattened to the maximum, these differences would be still greater.

RETAIL CUTS

The wholesale cuts were divided into the various retail cuts that are common to the average retail market. The manner of locating and cutting these cuts is illustrated in figure 2. Each wholesale cut was weighed before being separated into the smaller divisions and this weight minus the sum total of the retail portions, equals the loss due to cutting and evaporation. The large loss in case of the fat steer was due to the fact that quite a large amount of fat was broken off in small pieces, while the loss in the thin steer was mostly due to evaporation. The weight of each retail cut was recorded in those tables headed by the name of the wholesale cut from which they were taken. As is a common practice in

the retail markets, the cuts were trimmed of the surplus lean, fat and bone and these weights were also recorded. By use of the boning knife the different constituents of the cuts were separated. This same separation was carried out with the trimmings. In making the retail cuts from the three different steers care was exercised to have each weight about the same and to take them from the same relative position as nearly as possible, but due to conformation of the animals and the difference in condition this was not always achieved. Even though the original retail cuts were very similar, there was a considerable difference after trimming; thus, this procedure will affect the relative economy of each cut. This phase of the work will be taken up under a different heading.

The Loin.—*Description of Loin.*—The loin consists of two main divisions commonly termed the sirloin, that portion joining the round, and the porterhouse, that portion between the sirloin and the last rib. These cuts are the most valuable and command the highest prices of any cut in the beef, and their relative market values are regulated by the tenderness and quality of lean. Such cuts are graded into three classes as determined by the marked excellence or deficiency in either thickness, covering or quality or by a uniform degree of development in all respects. A loin, to grade No. 1, must have a full, well rounded shape, a complete covering of white fat the thickness of which is in proper proportion to the lean, and bright firm, fine grained, well marbled flesh, weighing 50 to 85 pounds. No. 2's are less rounded in form, with insufficient, excessive or uneven covering and a slight deficiency in grain, marbling or color of flesh, and weighing from 40 to 60 pounds. No. 3's are more flat in shape, nearly lacking in covering of fat and very deficient in thickness and quality of flesh. but sufficiently developed to be cut in steaks for cheap trade, and weighing 25 to 40 pounds. Thus, with these qualifications to judge a loin, we may call the loin of the Steer A a No. 1, of Steer B a No. 2, and of Steer C a No. 3.

Comparison of Loins.—The distribution of fat, lean and bone for the three steers is shown in pounds and percentages in Table 8. It will be noticed that as an animal fattens the percentage of lean and bone decreases while the fat increases, although the actual weights of bone and lean remain about the same.

In general the sirloin steaks of any beef are leaner than the porterhouse and club steaks, with the percentage of bone varying but little but with the percentage of fat increasing considerably in the porterhouse, except when the animal becomes rather thin; then the variation is slight. In the fat beef the largest percentages of bone occur in the double-bone sirloin, hip bone sirloin and the club steaks. As a beef becomes thin the deposit of kidney fat is lowered, thus increasing the percentage of

(Page 24) TABLE 8.—LEAN, VISIBLE FAT AND BONE IN RETAIL CUTS OF LOIN EXPRESSED IN POUNDS

Retail loin cuts	Expressed in pounds				Expressed in percentage			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Sirloin steak—Butt end...	1.95	0.60	0.30	2.85	68.42	21.05	10.53	100.00
" " —Wedge bone...	1.65	0.65	0.20	2.50	66.00	26.00	8.00	100.00
" " —Wedge bone...	1.60	0.70	0.20	2.50	64.00	28.00	8.00	100.00
" " —Round bone...	1.40	0.65	0.15	2.20	63.64	29.55	6.81	100.00
" " —Round bone...	1.40	0.60	0.45	2.45	57.14	24.49	18.37	100.00
" " —Double bone...	1.10	0.50	0.20	1.80	61.11	27.77	11.11	100.00
" " —Double bone...	1.20	0.85	0.20	2.25	53.33	37.77	8.90	100.00
" " —Double bone...	1.25	0.95	0.30	2.50	50.00	38.00	12.00	100.00
" " —Double bone...	1.25	0.90	0.35	2.50	50.00	36.00	14.00	100.00
" " —Double bone...	1.20	0.95	0.25	2.40	50.00	39.58	10.42	100.00
" " —Hip bone...	1.50	0.75	0.35	2.60	57.69	28.85	13.46	100.00
" " —Hip bone...	1.35	0.80	0.35	2.50	54.00	32.00	14.00	100.00
" " —Hip bone...	1.20	1.00	0.40	2.60	46.15	38.46	15.39	100.00
" " —Hip bone...	0.80	0.85	0.20	1.85	43.24	45.95	10.81	100.00
Porterhouse steak	0.85	1.00	0.20	2.05	41.46	48.78	9.76	100.00
" " —	1.05	0.90	0.25	2.20	47.72	40.91	11.37	100.00
" " —	0.75	0.60	0.15	1.50	50.00	40.00	10.00	100.00
" " —	1.00	0.85	0.20	2.05	48.78	41.46	9.76	100.00
" " —	1.10	0.95	0.20	2.25	48.89	42.22	8.89	100.00
" " —	0.80	1.05	0.30	2.15	37.21	48.83	13.96	100.00
" " —	0.80	0.70	0.10	1.60	50.00	43.75	6.25	100.00
" " —	0.85	0.90	0.12	1.87	45.45	48.13	6.42	100.00
" " —	0.85	0.70	0.15	1.70	50.00	41.18	8.82	100.00
Club steak	0.45	0.60	0.15	1.20	37.50	50.00	12.50	100.00
Club steak	0.80	0.60	0.15	1.55	51.61	38.71	9.68	100.00
Entire loin	28.15	19.60	5.87	53.62	52.50	36.50	11.00	100.00
Steer B								
Sirloin steak—Butt end...	1.55	0.50	0.30	2.35	65.96	21.28	12.76	100.00
" " —Wedge bone...	1.40	0.60	0.20	2.20	63.64	27.27	9.09	100.00
" " —Wedge bone...	1.70	0.30	0.20	2.20	77.27	13.64	9.09	100.00
" " —Round bone...	1.30	0.50	0.20	2.00	65.00	25.00	10.00	100.00
" " —Double bone...	1.60	0.60	0.30	2.50	64.00	24.00	12.00	100.00
" " —Double bone...	1.50	0.55	0.55	2.60	57.70	21.15	21.15	100.00
" " —Double bone...	1.50	0.60	0.50	2.60	57.70	23.08	19.22	100.00
" " —Double bone...	1.40	0.65	0.35	2.40	58.33	27.08	14.59	100.00
" " —Double bone...	1.30	0.70	0.40	2.40	54.17	29.17	16.66	100.00
" " —Hip bone...	1.30	0.70	0.20	2.20	59.09	31.82	9.09	100.00
" " —Hip bone...	1.35	0.80	0.35	2.50	54.00	32.00	14.00	100.00
" " —Hip bone...	1.20	0.90	0.40	2.50	48.00	36.00	16.00	100.00
" " —Hip bone...	1.10	0.80	0.20	2.10	52.38	38.10	9.52	100.00
Porterhouse steak	1.60	0.80	0.20	2.60	61.54	30.77	7.69	100.00
" " —	1.20	0.60	0.20	2.00	60.00	25.00	15.00	100.00
" " —	1.60	0.60	0.20	2.40	54.54	31.87	13.64	100.00
" " —	1.20	0.50	0.30	2.00	60.00	25.00	15.00	100.00
" " —	1.20	0.70	0.30	2.20	54.55	31.82	13.63	100.00
" " —	1.20	0.50	0.30	2.00	60.00	25.00	15.00	100.00
" " —	1.10	0.70	0.30	2.10	52.38	33.33	14.29	100.00
" " —	1.00	0.75	0.20	1.95	51.28	38.46	10.26	100.00
" " —	1.60	0.70	0.40	2.70	59.26	28.93	14.81	100.00
Club steak	0.75	0.30	0.30	1.35	55.56	22.22	22.22	100.00
Club steak	0.50	0.50	0.30	1.30	38.46	38.46	23.08	100.00
Entire loin	31.15	14.85	7.15	53.15	58.61	27.94	13.45	100.00
Steer C								
Sirloin steak—Butt end...	1.55	0.30	0.40	2.25	68.69	13.33	17.78	100.00
" " —Wedge bone...	1.60	0.20	0.30	2.10	76.19	9.52	14.29	100.00
" " —Wedge bone...	1.50	0.30	0.30	2.10	71.42	14.29	14.29	100.00
" " —Round bone...	2.00	0.30	0.20	2.50	80.00	12.00	8.00	100.00
" " —Round bone...	1.90	0.30	0.30	2.50	76.00	12.00	12.00	100.00
" " —Double bone...	1.40	0.20	0.30	1.90	73.68	10.53	15.79	100.00
" " —Double bone...	1.30	0.30	0.20	1.80	72.22	16.67	11.11	100.00
" " —Double bone...	1.60	0.30	0.40	2.30	69.57	13.04	17.39	100.00
" " —Double bone...	1.50	0.30	0.40	2.20	68.18	13.64	18.18	100.00
" " —Double bone...	1.50	0.30	0.30	2.10	71.43	14.28	13.29	100.00
" " —Hip bone...	1.20	0.30	0.30	1.80	66.67	16.67	16.66	100.00
" " —Hip bone...	1.10	0.30	0.40	1.80	61.11	16.67	22.22	100.00
" " —Hip bone...	1.00	0.25	0.40	1.65	60.61	15.15	24.24	100.00
" " —Hip bone...	1.00	0.20	0.30	1.50	66.67	13.33	20.00	100.00
Porterhouse steak	1.20	0.20	0.40	1.80	66.67	11.11	22.22	100.00
" " —	1.00	0.10	0.40	1.50	66.67	6.67	26.66	100.00
" " —	1.00	0.10	0.30	1.40	71.43	7.14	21.43	100.00
" " —	1.00	0.15	0.25	1.40	71.43	10.71	17.86	100.00
" " —	1.10	0.20	0.25	1.55	70.97	12.90	16.13	100.00
" " —	0.70	0.15	0.25	1.10	63.64	13.64	22.72	100.00
" " —	0.80	0.10	0.20	1.10	72.73	9.09	18.18	100.00
" " —	0.60	0.10	0.20	0.90	66.67	11.11	22.22	100.00
" " —	0.40	0.10	0.30	0.80	50.00	12.50	37.50	100.00
Club steak	0.40	0.10	0.45	0.95	42.11	10.53	47.36	100.00
Club steak	0.40	0.10	0.50	1.00	40.00	10.00	50.00	100.00
Entire side	29.35	5.15	7.50	42.00	69.88	12.27	17.85	100.00

TABLE 9.—LEAN, VISIBLE FAT AND BONE IN THE TRIMMED RETAIL LOIN CUTS (Page 25)

Retail cuts in loin	Expressed in pounds				Expressed in percentages			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Sirloin steak—Butt end.	1.95	0.50	0.20	2.65	73.58	18.87	7.55	100.00
" " —Wedge bone.	1.65	0.45	0.10	2.20	75.00	20.45	4.55	100.00
" " —Wedge bone.	1.55	0.60	0.05	2.20	70.45	27.27	2.28	100.00
" " —Round bone.	1.40	0.55	0.05	2.00	70.00	27.50	2.50	100.00
" " —Round bone.	1.40	0.50	0.35	2.25	62.22	22.22	15.56	100.00
" " —Double bone	1.10	0.45	0.10	1.65	66.67	27.27	6.06	100.00
" " —Double bone	1.20	0.65	0.10	1.95	61.54	33.33	5.13	100.00
" " —Double bone	1.40	0.70	0.10	2.20	63.64	31.82	4.54	100.00
" " —Double bone	1.25	0.65	0.15	2.05	60.98	31.71	7.31	100.00
" " —Double bone	1.20	0.55	0.20	1.95	61.54	28.21	10.25	100.00
" " —Hip bone.	1.45	0.70	0.20	2.35	61.70	29.79	8.51	100.00
" " —Hip bone.	1.35	0.50	0.25	2.10	64.29	23.81	11.90	100.00
" " —Hip bone.	1.20	0.70	0.30	2.20	54.55	31.82	13.63	100.00
" " —Hip bone.	0.80	0.55	0.15	1.50	53.33	36.67	10.00	100.00
Porterhouse steak.	0.80	0.60	0.10	1.50	53.33	40.00	6.67	100.00
" " -----	1.00	0.70	0.15	1.85	54.05	37.84	8.11	100.00
" " -----	0.60	0.40	0.10	1.10	54.55	36.36	9.09	100.00
" " -----	1.00	0.65	0.10	1.75	57.14	37.14	5.72	100.00
" " -----	0.90	0.70	0.20	1.80	50.00	38.89	11.11	100.00
" " -----	0.80	0.55	0.10	1.45	55.17	37.93	6.90	100.00
" " -----	0.60	0.50	0.10	1.20	50.00	41.67	8.33	100.00
" " -----	0.60	0.60	0.10	1.30	46.15	46.15	7.70	100.00
" " -----	0.65	0.50	0.15	1.30	50.00	38.46	11.54	100.00
Club steak.	0.45	0.50	0.10	1.05	42.85	47.62	9.53	100.00
Club steak.	0.80	0.40	0.10	1.30	61.54	30.77	7.69	100.00
Entire loin.	27.10	14.15	3.60	44.85	60.42	31.55	8.03	100.00
Steer B								
Sirloin steak—Butt end.	1.55	0.20	0.20	1.95	79.49	10.26	10.25	100.00
" " —Wedge bone.	1.30	0.40	0.10	1.80	72.22	22.22	5.56	100.00
" " —Round bone.	1.70	0.30	0.10	2.10	80.95	14.29	4.76	100.00
" " —Round bone.	1.30	0.40	0.10	1.80	72.22	22.22	5.56	100.00
" " —Double bone	1.60	0.50	0.10	2.20	72.73	22.73	4.54	100.00
" " —Double bone	1.50	0.35	0.25	2.10	71.43	16.67	11.90	100.00
" " —Double bone	1.50	0.30	0.20	2.00	75.00	15.00	10.00	100.00
" " —Double bone	1.30	0.25	0.15	1.70	76.47	14.71	8.82	100.00
" " —Double bone	1.20	0.50	0.20	1.90	63.16	26.32	10.52	100.00
" " —Hip bone.	1.20	0.30	0.20	1.70	70.59	17.64	11.76	100.00
" " —Hip bone.	1.30	0.50	0.35	2.15	60.47	23.26	16.27	100.00
" " —Hip bone.	1.10	0.50	0.40	2.00	55.00	25.00	20.00	100.00
" " —Hip bone.	1.10	0.50	0.20	1.80	61.11	27.78	11.11	100.00
Porterhouse steak.	1.30	0.50	0.20	2.00	65.00	25.00	10.00	100.00
" " -----	0.90	0.40	0.20	1.50	60.00	26.67	13.33	100.00
" " -----	1.30	0.50	0.20	2.00	65.00	25.00	10.00	100.00
" " -----	0.90	0.40	0.20	1.50	60.00	26.67	13.33	100.00
" " -----	1.20	0.50	0.20	1.90	63.16	26.32	10.52	100.00
" " -----	0.90	0.40	0.20	1.50	60.00	26.67	13.33	100.00
" " -----	0.80	0.40	0.20	1.40	57.14	28.57	14.29	100.00
" " -----	0.80	0.50	0.10	1.40	57.14	35.72	7.14	100.00
" " -----	1.30	0.50	0.20	2.00	65.00	25.00	10.00	100.00
Club steak.	0.70	0.20	0.20	1.10	63.64	18.18	18.18	100.00
Club steak.	0.50	0.40	0.20	1.10	45.45	36.37	18.18	100.00
Entire loin.	28.25	9.70	4.65	42.60	66.31	22.77	10.92	100.00
Steer C								
Sirloin steak—Butt end.	1.55	0.20	0.30	2.05	75.61	9.76	14.63	100.00
" " —Wedge bone.	1.60	0.10	0.30	2.00	80.00	5.00	15.00	100.00
" " —Wedge bone.	1.50	0.20	0.30	2.00	75.00	10.00	15.00	100.00
" " —Round bone.	2.00	0.20	0.20	2.40	83.33	8.33	8.34	100.00
" " —Round bone.	1.90	0.30	0.20	2.40	79.17	12.50	8.33	100.00
" " —Double bone	1.40	0.10	0.10	1.60	87.50	6.25	6.25	100.00
" " —Double bone	1.30	0.30	0.10	1.70	76.47	17.65	5.88	100.00
" " —Double bone	1.60	0.30	0.10	2.00	80.00	15.00	5.00	100.00
" " —Double bone	1.50	0.30	0.20	2.00	75.00	15.00	10.00	100.00
" " —Double bone	1.50	0.30	0.10	1.90	78.95	15.79	5.26	100.00
" " —Hip bone.	1.20	0.10	0.20	1.50	80.00	6.67	13.33	100.00
" " —Hip bone.	1.10	0.20	0.30	1.60	68.75	12.50	18.75	100.00
" " —Hip bone.	1.00	0.15	0.30	1.45	68.97	10.34	20.69	100.00
" " —Hip bone.	0.90	0.10	0.20	1.20	75.00	8.33	16.67	100.00
Porterhouse steak.	1.20	0.20	0.20	1.60	75.00	12.50	12.50	100.00
" " -----	1.00	0.10	0.20	1.30	76.92	7.69	5.39	100.00
" " -----	1.00	0.10	0.20	1.30	76.92	7.69	5.39	100.00
" " -----	1.00	0.15	0.15	1.30	76.97	11.54	11.54	100.00
" " -----	1.10	0.20	0.15	1.45	75.86	13.79	10.35	100.00
" " -----	0.70	0.15	0.15	1.00	70.00	15.00	15.00	100.00
" " -----	0.60	0.10	0.10	0.80	75.00	12.50	12.50	100.00
" " -----	0.60	0.10	0.10	0.80	75.00	12.50	12.50	100.00
" " -----	0.40	0.10	0.10	0.60	66.66	16.67	16.67	100.00
Club steak.	0.40	0.10	0.35	0.85	47.06	11.76	41.18	100.00
Club steak.	0.40	0.10	0.30	0.80	50.00	12.50	37.50	100.00
Entire loin.	28.45	4.25	4.90	37.60	75.66	11.30	13.04	100.00

bone at this portion of the carcass from which the porterhouse steaks are derived; consequently in thin animals the percentage of bone is more uniform throughout the various steaks of the loin. From this table it is evident that the porterhouse steaks from an animal of good condition or from one of the average butcher animal contains less lean and bone and more fat than the sirloin.

In a fat steer the sirloin contains more lean and less fat than the porterhouse. The percentage of fat in the porterhouse could have been increased a marked degree if in removing the kidney the one-half of the kidney fat next to the carcass had been allowed to remain. But since the left side or the open side of the carcass does not have this particular characteristic, the entire amount of fat surrounding the kidney of the right half was removed, thus making it possible to apply these figures to either half of the carcass. The amount of bone is decreased in the club steaks because of the external layer of fat, which thus brings up the percentage of fat. The percentage of lean is also increased because of the large amount of fat deposited amongst the muscles, which could not be separated by hand.

In the sirloin of the half fat steer there was only a slight reduction in the percentage of fat due to the large amount of bed fat that was present. The sirloin of this steer carried more lean and bone and less fat than the porterhouse. The difference in the amount of lean in the various cuts of the loin in Steer B was not so great as in Steer A, because of the large amount of bed fat and the smaller amount of kidney fat. Due to the falling off of the amount of external fat, the percentage of bone in the club steak was increased.

In the thin steer there is an increase in the percentage of lean in both the sirloin and porterhouse steaks with the amounts being almost equal. The distribution of fat and bone throughout the loin is very similar, with the exception of the club steaks where the percentage of fat is reduced and the percentage of bone increased. As the marbling of fat can not be hand separated, such deposit will add greatly to the amount of lean and since very little such fat was present in Steer C the percentage of lean in the club steaks was reduced considerably. The layer of external fat is also lacking, thus tending to lower the percentage of fat and increasing the percentage of bone and lean.

In Table 10 the pounds and percentages of the trimmings from the steaks, consisting of lean, fat and bone, are recorded. The trimmings from the two fat animals are very similar but as an animal becomes thinner in condition the percentage of lean and fat is reduced and the percentage of bone increased. As the Steer B possessed a deep body and a long flank, giving rise to a long tail to the various steaks, it was neces-

TABLE 10.—LEAN, VISIBLE FAT AND BONE IN TRIMMINGS FROM LOIN CUTS (Page 27)

Retail loin cuts	Expressed in pounds				Expressed in percentages			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Sirloin steak—Butt end...	-----	0.10	0.10	0.20	-----	50.00	50.00	100.00
" " —Wedge bone...	-----	0.20	0.10	0.30	-----	66.67	33.33	100.00
" " —Wedge bone...	-----	0.15	0.15	0.30	-----	50.00	50.00	100.00
" " —Round bone...	-----	0.10	0.10	0.20	-----	50.00	50.00	100.00
" " —Round bone...	-----	0.10	0.10	0.20	-----	50.00	50.00	100.00
" " —Double bone...	-----	0.05	0.10	0.15	-----	33.33	66.67	100.00
" " —Double bone...	-----	0.20	0.10	0.30	-----	66.67	33.33	100.00
" " —Double bone...	-----	0.10	0.20	0.30	-----	33.33	66.67	100.00
" " —Double bone...	-----	0.25	0.20	0.45	-----	55.56	44.44	100.00
" " —Double bone...	0.05	0.35	0.05	0.45	11.11	77.78	11.11	100.00
" " —Hip bone...	0.05	0.05	0.15	0.25	20.00	60.00	20.00	100.00
" " —Hip bone...	-----	0.30	0.10	0.40	-----	75.00	25.00	100.00
" " —Hip bone...	-----	0.30	0.10	0.40	-----	75.00	25.00	100.00
" " —Hip bone...	-----	0.30	0.05	0.35	-----	85.71	14.29	100.00
Porterhouse steak...	0.05	0.40	0.10	0.55	9.09	72.73	18.18	100.00
" " -----	0.05	0.20	0.10	0.35	14.29	57.14	28.57	100.00
" " -----	0.15	0.20	0.05	0.40	37.50	50.00	12.50	100.00
" " -----	-----	0.20	0.10	0.30	-----	66.67	33.33	100.00
" " -----	0.20	0.25	-----	0.45	44.44	55.56	-----	100.00
" " -----	-----	0.20	0.50	0.70	-----	28.57	71.43	100.00
" " -----	0.20	0.20	-----	0.40	50.00	50.00	-----	100.00
" " -----	0.25	0.30	0.02	0.57	43.86	52.63	3.51	100.00
" " -----	0.20	0.20	-----	0.40	50.00	50.00	-----	100.00
Club steak	-----	0.10	0.05	0.15	-----	66.67	33.33	100.00
Club steak	-----	0.20	0.05	0.25	-----	80.00	20.00	100.00
Entire loin	1.20	5.00	2.57	8.77	13.68	57.01	29.31	100.00
Steer B								
Sirloin steak—Butt end...	-----	0.30	0.10	0.40	-----	75.00	25.00	100.00
" " —Wedge bone...	0.10	0.20	0.10	0.40	25.00	50.00	25.00	100.00
" " —Wedge bone...	-----	-----	-----	-----	-----	-----	100.00	100.00
" " —Round bone...	-----	0.10	0.10	0.20	-----	50.00	50.00	100.00
" " —Round bone...	-----	0.10	0.20	0.30	-----	33.33	66.67	100.00
" " —Double bone...	-----	0.20	0.30	0.50	-----	40.00	60.00	100.00
" " —Double bone...	-----	0.30	0.30	0.60	-----	50.00	50.00	100.00
" " —Double bone...	0.10	0.40	0.20	0.70	14.29	57.14	28.57	100.00
" " —Double bone...	0.10	0.20	0.20	0.50	20.00	40.00	40.00	100.00
" " —Hip bone...	0.10	0.40	-----	0.50	20.00	80.00	-----	100.00
" " —Hip bone...	0.05	0.30	-----	0.35	14.29	85.71	-----	100.00
" " —Hip bone...	0.10	0.40	-----	0.50	20.00	80.00	-----	100.00
" " —Hip bone...	-----	0.30	-----	0.30	-----	100.00	-----	100.00
Porterhouse steak	0.30	0.30	0.60	1.20	50.00	50.00	-----	100.00
" " -----	0.30	0.20	-----	0.50	60.00	40.00	-----	100.00
" " -----	0.30	0.10	-----	0.40	75.00	25.00	-----	100.00
" " -----	0.30	0.10	0.10	0.50	60.00	20.00	20.00	100.00
" " -----	-----	0.20	0.10	0.30	-----	66.67	33.33	100.00
" " -----	0.30	0.10	0.10	0.50	60.00	20.00	20.00	100.00
" " -----	0.30	0.30	0.10	0.70	42.86	42.86	14.28	100.00
" " -----	0.20	0.25	0.10	0.55	36.36	45.46	18.18	100.00
" " -----	0.30	0.20	0.20	0.70	42.86	28.57	28.57	100.00
Club steak	0.05	0.10	0.10	0.25	20.00	40.00	40.00	100.00
Club steak	-----	0.10	0.10	0.20	-----	50.00	50.00	100.00
Entire loin	2.90	5.15	2.50	10.55	27.49	48.82	23.69	100.00
Steer C								
Sirloin steak—Butt end...	-----	0.10	0.10	0.20	-----	50.00	50.00	100.00
" " —Wedge bone...	-----	0.10	-----	0.10	-----	100.00	-----	100.00
" " —Wedge bone...	-----	0.10	-----	0.10	-----	100.00	-----	100.00
" " —Round bone...	-----	0.10	-----	0.10	-----	100.00	-----	100.00
" " —Round bone...	-----	-----	0.10	0.10	-----	-----	100.00	100.00
" " —Double bone...	-----	0.10	0.20	0.30	-----	33.33	66.67	100.00
" " —Double bone...	-----	-----	0.10	0.10	-----	-----	100.00	100.00
" " —Double bone...	-----	-----	0.30	0.30	-----	-----	100.00	100.00
" " —Double bone...	-----	-----	0.20	0.20	-----	-----	100.00	100.00
" " —Double bone...	-----	0.20	-----	0.20	-----	100.00	-----	100.00
" " —Hip bone...	-----	0.20	0.10	0.30	-----	66.67	33.33	100.00
" " —Hip bone...	-----	0.10	0.10	0.20	-----	50.00	50.00	100.00
" " —Hip bone...	-----	0.10	0.10	0.20	-----	50.00	50.00	100.00
" " —Hip bone...	0.10	0.10	0.10	0.30	33.33	33.33	33.34	100.00
Porterhouse steak	-----	-----	0.20	0.20	-----	-----	100.00	100.00
" " -----	-----	-----	0.20	0.20	-----	-----	100.00	100.00
" " -----	-----	-----	0.10	0.10	-----	-----	100.00	100.00
" " -----	-----	-----	0.10	0.10	-----	-----	100.00	100.00
" " -----	-----	-----	0.10	0.10	-----	-----	100.00	100.00
" " -----	0.20	-----	0.10	0.30	66.67	-----	33.33	100.00
" " -----	-----	-----	0.10	0.10	-----	-----	100.00	100.00
" " -----	-----	-----	0.20	0.20	-----	-----	100.00	100.00
Club steak	-----	-----	0.15	0.15	-----	-----	100.00	100.00
Club steak	-----	-----	0.15	0.15	-----	-----	100.00	100.00
Entire loin	0.30	1.20	2.90	4.40	6.82	27.27	65.91	100.00

sary to trim off a considerable amount of lean. The fat that was removed consisted primarily of internal and kidney fat, while in the fat animal some external fat was also removed from the porterhouse steaks. Practically the same amount of bone, which consisted of the lower part, was removed from every steak. There was a slight increase in the amount of bone trimmings in the double bone sirloin. The total amount of trimmings varied from 10 to 19 per cent with the least amount in case of the thin steer and the largest for the half fat steer, due to the extra long flank. Any animal that is extra fat, or possesses a conformation that produces an extra long tail to the steaks, requires the greatest amount of trimming. The distribution of lean, fat and bone in the various steaks after trimming is such that the thin animal gives a cut with a larger percentage of lean and bone and a smaller percentage of fat. See Table 9.

The Prime Rib.—*Description of Beef Ribs.*—The prime rib consists of the 6th to 12th ribs inclusive, thus allowing one rib on the hind-quarter and five in the chuck. This entire cut was made into roasts allowing the ribs to remain long instead of cutting them off and making the short rib roasts. This wholesale cut then consists of that portion between the chuck and the loin and forms the best roasts in a beef carcass. This cut and the loin form what are known as the valuable cuts of a carcass. The rib is valued at 10 to 20 per cent less than the loin of the same grade, due to the difference in the quality of lean and the large percentage of bone.¹⁰ The various grades of beef differ in thickness, covering and quality to the same relative extent as the corresponding grades of loins. The "eye" or heart of beef should be of finest quality, well covered with an external layer of fat about half an inch deep. The ribs are graded into three classes according to weight, quality and covering of lean. No. 1's weigh 35 to 50 pounds and carry a large, well developed, fine grained, well marbled, muscular tissue with an even covering of solid, firm, even and white external fat. No. 2's weigh 25 to 35 pounds, possessing less quality, are more irregular in form, lack development of lean and are insufficiently supplied with external and marbling fat. No. 3's weighing 20 to 25 pounds, are from thinner animals; they lack quality, form, development and deposit of external and marbling fat. Noting the photographs of these cuts, figures 12, 13 and 14, and applying the above qualifications, we may grade the ribs of Steers A, B, C, as No. 1, No. 2 and No. 3, respectively.

Discussion and Comparison of Beef Ribs.—Table 11 gives the pounds and percentages of lean, fat and bone in the total ribs. In the fatter steers the percentage of lean in the first cut or the 11th and 12th ribs of the prime rib was the smallest with gradual increase until the

maximum was reached in the 6th rib roast. Just the reverse was true of the thin steer, due to the larger percentage of bone, thus decreasing the percentage of lean. The largest total amount of edible material, i. e. fat and lean combined, occurs in the first cuts. This statement applies only when an animal is fat, as in a thin steer the greatest percentage of lean is to be found in the first cut and also the total amount of edible material is the largest in this cut.

TABLE 11.—LEAN, VISIBLE FAT AND BONE IN RETAIL CUTS OF RIB

Retail cuts in rib	Expressed in pounds				Expressed in percentage			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Roast—11th-12th ribs	2.80	2.85	1.55	7.20	38.89	39.58	21.53	100.00
Roast—9th-10th ribs	3.75	3.40	1.30	8.45	44.38	40.24	15.38	100.00
Roast—8th rib	1.80	1.40	0.85	4.05	44.44	34.57	20.99	100.00
Roast—6th-7th ribs	2.90	2.15	1.45	6.50	44.62	33.08	22.30	100.00
Skirt	0.50	0.30		0.80	62.50	37.50		100.00
Entire rib	11.75	10.10	5.15	27.00	43.52	37.41	19.07	100.00
Loss				.20				
Steer B								
Roast—11th-12th ribs	4.80	1.90	2.00	8.70	55.17	21.84	22.99	100.00
Roast—9th-10th ribs	3.90	1.80	1.70	7.40	52.70	24.32	22.98	100.00
Roast—8th rib	2.20	0.70	1.00	3.90	56.41	17.95	25.64	100.00
Roast—6th-7th ribs	4.80	1.20	2.00	8.00	60.00	15.00	25.00	100.00
Skirt	0.20	0.10		0.30	66.67	33.33		100.00
Entire rib	15.90	5.70	6.70	28.30	56.18	20.14	23.68	100.00
Loss				0.10				
Steer C								
Roast—11th-12th ribs	3.60	0.40	1.50	5.50	65.45	7.27	27.28	100.00
Roast—9th-10th ribs	3.50	0.50	1.50	5.50	63.64	9.09	27.27	100.00
Roast—8th rib	3.50	0.70	1.40	5.60	62.50	12.50	25.00	100.00
Roast—6th-7th ribs	1.90	0.30	1.00	3.20	59.38	9.37	31.25	100.00
Skirt								
Entire rib	12.50	1.90	5.40	19.80	62.12	9.60	28.28	100.00
Loss				0.60				

The thinner the animal becomes the greater is the percentage of bone. Thus, the fat steer had 19.07 per cent bone, the half fat steer had 23.68 per cent, and the thin steer had 28.28 per cent. With this increase in bone there was also a like increase in the lean as the fat animal had 43.52 per cent lean and the thin animal, 62.12 per cent. The percentage of fat shows a greater variation, depending on the condition of the animal, as the thin animal had 9.6 per cent of fat while the fat steer had 37.41 per cent.

The distribution of fat throughout the various cuts of the rib was of such nature that there was a gradual decrease from the first cut to the last, when the animals were in good condition, while the reverse was true in the thin animals.

We might say that with a slight irregularity there is a gradual increase of bone from the first cut to the last. This variation will depend considerably upon the distribution of fat. There was a tendency for the second and third cuts to carry less bone than the other two.

The trimmings consisted almost entirely of bone and fat with lean in two cases only. Tables 12 and 13 give the pounds and percentages in the trimmed retail cuts and the trimmings. In all the ribs the greatest amount of trimming was required in the first cuts for both the fat and bone, consequently this lowers the percentage of fat and bone and increases the percentage of lean when such cuts are purchased. The amount of fat that is removed depends on the condition of the animal

TABLE 12.—LEAN, VISIBLE FAT AND BONE IN TRIMMED RIB CUTS

Retail cuts in rib	Expressed in pounds				Expressed in percentages			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Roast—11th-12th ribs	2.80	2.70	1.20	6.70	41.79	40.30	17.91	100.00
Roast—9th-10th ribs	3.75	3.20	1.00	7.95	47.17	40.25	12.58	100.00
Roast—8th rib	1.80	1.35	0.65	3.80	47.37	35.53	17.10	100.00
Roast—6th-7th ribs	2.90	2.10	1.10	6.10	47.54	34.43	18.03	100.00
Skirt	0.50	0.30		0.80	62.50	37.50		100.00
Entire rib	11.75	9.65	3.95	25.35	46.35	38.07	15.58	100.00
Steer B								
Roast—11th-12th ribs	4.20	1.20	1.10	6.50	64.62	18.46	16.92	100.00
Roast—9th-10th ribs	3.90	1.80	0.90	6.60	59.09	27.27	13.64	100.00
Roast—8th rib	2.20	0.60	0.60	3.40	64.71	17.65	17.64	100.00
Roast—6th-7th ribs	4.80	1.00	1.50	7.30	65.75	13.70	20.55	100.00
Skirt	0.20	0.10		0.30	66.67	33.33		100.00
Entire rib	15.30	4.70	4.10	24.10	63.49	19.50	17.01	100.00
Steer C								
Roast—11th-12th ribs	3.60	0.30	1.10	5.00	72.00	6.00	22.00	100.00
Roast—9th-10th ribs	3.50	0.50	1.00	5.00	70.00	10.00	20.00	100.00
Roast—8th rib	3.50	0.70	1.00	5.20	67.31	13.46	19.23	100.00
Roast—6th-7th ribs	1.90	0.30	0.80	3.00	63.34	10.00	26.66	100.00
Skirt								100.00
Entire rib	12.50	1.80	3.90	18.20	68.68	9.89	21.43	100.00

TABLE 13.—LEAN, VISIBLE FAT AND BONE IN TRIMMINGS FROM RETAIL RIB CUTS

Retail cuts in rib	Expressed in pounds				Expressed in percentages			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Roast—11th-12th ribs	-----	0.15	0.35	0.50	-----	30.00	70.00	100.00
Roast—9th-10th ribs	-----	0.20	0.30	0.50	-----	40.00	60.00	100.00
Roast—8th rib	-----	0.05	0.20	0.25	-----	20.00	80.00	100.00
Roast—6th-7th ribs	-----	0.05	0.35	0.40	-----	12.50	87.50	100.00
Entire rib	-----	0.45	1.20	1.65	-----	27.27	72.73	100.00
Steer B								
Roast—11th-12th ribs	0.60	0.70	0.90	2.20	27.27	31.82	40.91	100.00
Roast—9th-10th ribs	-----	-----	0.80	0.80	-----	-----	100.00	100.00
Roast—8th rib	-----	0.10	0.40	0.50	-----	20.00	80.00	100.00
Roast—6th-7th ribs	-----	0.20	0.50	0.70	-----	28.57	71.43	100.00
Entire rib	0.60	1.00	2.60	4.20	14.29	23.81	61.90	100.00
Steer C								
Roast—11th-12th ribs	-----	0.10	0.40	0.50	-----	20.00	80.00	100.00
Roast—9th-10th ribs	-----	-----	0.50	0.50	-----	-----	100.00	100.00
Roast—8th rib	-----	-----	0.40	0.40	-----	-----	100.00	100.00
Roast—6th-7th ribs	-----	-----	0.20	0.20	-----	6.25	100.00	100.00
Entire rib	-----	0.10	1.50	1.60	-----	-----	93.75	-----

while the bones that are removed are the same ones and the amounts depend on their density. Improper splitting will also alter the amounts that are removed. Thus, due to improper splitting of Steer A a greater amount of bone was left on the right side thus increasing the percentage. The character of the bone in the medium steer was such that there was a great development of backbone and rib, increasing the amount to be

trimmed off. The amount of bone trimmed off varied from 6 per cent in the fat steer to 14 in the half fat steer and an average of 8 per cent in the thin steer.

The Round.—*Description of Round.*—The round, the third most valuable cut, consists of three main divisions, the rump, the buttock and the shank. On the average about 60 per cent of the full weight of the round is buttock, about 20 per cent rump and about 20 per cent shank. The cut surface of the full round being identical with the butt end of the corresponding loin, the condition as to grain, marbling, covering and color at that point determines the grade in each case alike. The shape plays a very important part in determining the value of the round as the size and number of steaks that are received are so governed. Because of the shape, quality, covering, grain and marbling of meat the rounds produced from the steers used in this experiment graded Steer A, No. 1; Steer B, No. 2; and Steer C, No. 3.

The distribution of lean, fat and bone in the rounds from the three steers is shown in Table 14. It will be noted that the actual weight of bone in the three rounds is very similar, while the fat varies because of the condition. The lean shows quite a contrast. The faulty conformation of the round in Steer A causes an irregular difference in the amount of lean. This difference is also influenced to quite an extent because of the heavy and well developed round of the Steer B. This table indicates that as an animal fattens the percentage of lean is decreased and the percentage of fat increases. There is a slight tendency for the bone to decrease as the animal fattens. Thus, with the amount of bone about constant, the percentages of lean and fat are changed according to the addition of fat during the fattening period. This variation amounted to about 10 per cent for the lean and about 12 per cent for the fat.

Comparison of the Rounds.—The fat is not so evenly distributed throughout the entire round for in Steer A the rump contained 38 per cent fat and the buttock 50 per cent. In Steer B the rump contained 30 per cent and the buttock 54 per cent, while in Steer C the rump contained 37 per cent and the buttock 40 per cent. As an animal becomes fatter the difference between the fat content of the rump and buttock becomes larger. The faulty conformation of the round of Steer A may account for the fact that the fat content of the buttock was lower than that of Steer B. In comparing the rump cuts of the steers it is found that as an animal fattens the percentage of bone decreases as Steer A had 26 per cent and Steer C 31 per cent. With this decrease in bone content we have an increase of fat content from 14 per cent to 31 per cent and also a reduction in the lean from 54 per cent to 42 per cent. The Illinois Experiment Station gives the composition of the rump as one-half lean

and one third fat, the buttock 73 to 85 per cent lean and 9 to 22 per cent fat.⁴ In the buttock of the fat steer the percentage of lean ranged from 60 to 85 per cent; fat, 7 to 28 per cent and bone 2½ to 14½ per cent.

TABLE 14.—LEAN, VISIBLE FAT AND BONE IN RETAIL ROUND CUTS

Retail cuts in round	Expressed in pounds				Expressed in percentages			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Rump roast	6.50	4.80	4.10	15.40	42.21	31.17	26.62	100.00
Round steak—first cut	0.95	0.45	0.20	1.60	59.38	28.13	12.50	100.00
" "	1.40	0.35	0.25	2.00	70.00	17.50	12.50	100.00
" "	1.20	0.40	0.20	1.80	66.67	22.22	11.11	100.00
" "	1.35	0.30	0.15	1.80	75.00	16.67	8.33	100.00
" "	1.70	0.15	0.25	2.10	80.95	7.14	11.91	100.00
" "	1.60	0.15	0.25	2.00	80.00	7.50	12.50	100.00
" "	1.75	0.28	0.05	2.08	84.13	13.46	2.41	100.00
" "	1.80	0.20	0.10	2.10	85.71	9.52	4.77	100.00
" "	1.82	0.38	0.10	2.30	79.13	16.52	4.35	100.00
" "	1.80	0.55	0.05	2.40	75.00	22.92	2.08	100.00
" "	2.05	0.70	0.10	2.85	71.93	24.56	3.51	100.00
" "	1.85	0.65	0.10	2.60	71.15	25.00	3.85	100.00
" "	1.95	0.40	0.40	2.75	70.90	14.55	14.55	100.00
" "	1.40	0.55	0.50	2.45	57.14	22.45	20.41	100.00
Pot roast—heel of round	4.70	1.20	---	5.90	79.66	20.34	---	100.00
Knuckle soup bone	1.10	0.55	3.10	4.75	23.16	11.58	65.26	100.00
Soup bone	1.20	0.15	0.45	1.80	66.67	8.33	25.00	100.00
Soup bone	1.30	0.20	0.40	1.90	68.42	10.53	21.05	100.00
Soup bone	0.45	0.25	3.10	3.80	11.84	6.58	81.58	100.00
Entire round	37.87	12.66	13.85	64.38	58.82	19.66	21.52	100.00
Loss	---	---	---	0.12	---	---	---	---
Steer B								
Rump roast	9.00	3.50	4.40	16.90	53.25	20.71	26.04	100.00
Round steak—first cut	1.50	0.25	0.25	2.00	75.00	12.50	12.50	100.00
" "	1.90	0.30	0.30	2.50	76.00	12.00	12.00	100.00
" "	1.90	0.30	0.20	2.40	79.17	12.50	8.33	100.00
" "	1.90	0.20	0.30	2.40	79.17	8.33	12.50	100.00
" "	2.70	0.20	0.30	3.20	84.38	6.25	9.37	100.00
" "	2.50	0.20	0.15	2.85	87.72	7.02	5.26	100.00
" "	3.20	0.35	0.20	3.75	85.33	9.33	5.34	100.00
" "	3.00	0.25	0.10	3.35	89.55	7.46	2.99	100.00
" "	2.80	0.30	0.20	3.30	84.85	9.09	6.06	100.00
" "	2.50	0.30	0.15	2.95	84.75	10.17	5.08	100.00
" "	2.50	0.35	0.15	3.00	83.33	11.67	5.00	100.00
" "	1.80	0.60	0.25	2.65	67.92	22.64	9.44	100.00
" "	2.20	0.60	0.20	3.00	73.33	20.00	6.67	100.00
" "	2.00	0.40	0.20	2.60	76.92	15.38	7.70	100.00
Pot roast—heel of round	7.40	1.85	---	9.25	80.00	20.00	---	100.00
Knuckle soup bone	0.70	1.40	4.20	6.30	11.11	27.22	66.67	100.00
Soup bone	1.50	0.20	0.60	2.30	65.22	8.70	26.08	100.00
Soup bone	1.60	0.10	0.50	2.20	72.73	4.55	22.72	100.00
Soup bone	1.00	0.30	3.20	4.50	22.22	6.67	71.11	100.00
Entire round	53.60	11.95	15.85	81.40	65.85	14.68	19.47	100.00
Loss	---	---	---	0.60	---	---	---	---
Steer C								
Rump roast	7.40	1.90	4.20	13.50	54.81	14.08	31.11	100.00
Round steak—first cut	1.50	0.10	0.20	1.80	83.33	5.56	11.11	100.00
" "	1.30	0.20	0.15	1.65	78.79	12.12	9.09	100.00
" "	1.70	0.10	0.10	1.90	89.48	5.26	5.26	100.00
" "	2.00	0.10	0.10	2.20	90.90	4.55	4.55	100.00
" "	2.30	0.10	0.10	2.50	92.00	4.00	4.00	100.00
" "	2.60	0.10	0.15	2.85	91.23	3.51	5.26	100.00
" "	2.40	0.08	0.12	2.60	92.31	3.08	4.61	100.00
" "	2.30	0.10	0.10	2.50	92.00	4.00	4.00	100.00
" "	2.00	0.15	0.05	2.20	90.91	6.82	2.27	100.00
" "	2.20	0.20	0.10	2.50	88.00	8.00	4.00	100.00
" "	1.70	0.20	0.10	2.00	85.00	10.00	5.00	100.00
" "	2.00	0.20	0.10	2.30	86.96	8.70	4.34	100.00
" "	1.70	0.10	0.20	2.00	85.00	10.00	5.00	100.00
" "	1.75	0.10	0.35	2.20	79.55	4.55	15.90	100.00
Pot roast	6.60	0.20	---	6.80	97.06	2.94	---	100.00
Knucklesoup bone	0.80	0.50	4.80	6.10	13.11	8.20	78.69	100.00
Soup bone	1.40	0.10	0.80	2.30	60.87	4.35	34.78	100.00
Soup bone	1.70	0.10	0.50	2.30	73.91	4.35	21.74	100.00
Soup bone	0.50	0.40	3.10	4.00	12.50	10.00	77.50	100.00
Entire round	45.85	5.03	15.32	66.20	69.26	7.60	23.14	100.00
Loss	---	---	---	1.30	---	---	---	---

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As the steers decreased in amount of fat, or condition, these percentages were changed, i. e.: Steer B, lean, 67 to 90 per cent, fat, 6 to 22 per cent and bone 3 to 13 per cent; Steer C, lean, 78 to 92 per cent, fat, 3 to 12 per cent, and bone 2 to 16 per cent.

TABLE 15.—LEAN, VISIBLE FAT AND BONE IN TRIMMED RETAIL ROUND CUTS

Retail cuts in round	Expressed in pounds				Expressed in percentages			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Rump roast	6.50	3.90	4.10	14.50	44.83	26.90	28.27	100.00
Round steak—first cut	1.15	0.20	0.15	1.50	76.67	13.33	10.00	100.00
" "	1.40	0.25	0.20	1.85	75.68	13.51	10.81	100.00
" "	1.20	0.30	0.20	1.70	70.59	17.65	11.76	100.00
" "	1.35	0.20	0.15	1.70	79.41	11.76	8.83	100.00
" "	1.70	0.10	0.25	2.05	82.93	4.87	12.20	100.00
" "	1.60	0.10	0.25	1.95	82.05	5.13	12.82	100.00
" "	1.75	0.23	0.05	2.03	86.21	11.33	2.46	100.00
" "	1.80	0.20	0.10	2.10	85.71	9.52	4.77	100.00
" "	1.82	0.28	0.10	2.20	82.73	12.73	4.54	100.00
" "	1.80	0.45	0.05	2.30	78.26	19.57	2.17	100.00
" "	2.05	0.55	0.10	2.70	75.93	20.37	3.70	100.00
" "	1.85	0.65	0.10	2.60	71.15	25.00	3.84	100.00
" "	1.95	0.40	0.35	2.70	72.22	14.81	12.97	100.00
" "	1.40	0.45	0.10	1.95	71.79	23.08	5.13	100.00
Pot roast—heel of round	4.70	1.20	---	5.90	79.66	20.24	---	100.00
Knuckle soup bone	1.10	0.55	3.10	4.75	23.16	11.58	65.26	100.00
Soup bone	1.20	0.15	0.45	1.80	66.67	8.33	25.00	100.00
Soup bone	1.30	0.20	0.40	1.90	68.42	10.53	21.05	100.00
Soup bone	0.45	0.25	3.10	3.80	11.84	6.58	81.58	100.00
Entire round	38.07	10.61	13.30	61.98	61.42	17.12	21.46	100.00
Steer B								
Rump roast	9.00	3.00	4.40	16.40	54.88	18.29	26.83	100.00
Round steak—first cut	1.50	0.25	0.05	1.80	83.33	13.89	2.78	100.00
" "	1.90	0.30	0.30	2.50	76.00	12.00	12.00	100.00
" "	1.90	0.30	0.20	2.40	79.17	12.50	8.33	100.00
" "	1.90	0.20	0.50	2.60	73.07	7.69	19.24	100.00
" "	2.70	0.20	0.10	3.00	90.00	6.67	3.33	100.00
" "	2.50	0.20	0.15	2.85	87.72	7.02	5.26	100.00
" "	3.20	0.25	0.20	3.65	87.67	6.85	4.48	100.00
" "	3.00	0.25	0.10	3.35	89.55	7.46	2.99	100.00
" "	2.80	0.30	0.20	3.30	84.85	9.09	6.06	100.00
" "	2.50	0.30	0.15	2.95	84.75	10.17	5.08	100.00
" "	2.50	0.35	0.15	3.00	83.33	11.67	5.00	100.00
" "	1.80	0.60	0.10	2.50	72.00	24.00	4.00	100.00
" "	2.20	0.40	0.20	2.80	78.57	14.29	7.14	100.00
" "	2.00	0.40	0.20	2.60	76.92	15.38	7.70	100.00
Pot roast—heel of round	7.40	1.85	---	9.25	80.00	20.00	---	100.00
Knuckle soup bone	0.70	1.40	4.20	6.30	11.11	22.22	66.67	100.00
Soup bone	1.50	0.20	0.60	2.30	65.22	8.70	26.08	100.00
Soup bone	1.60	0.10	0.50	2.20	72.73	4.55	22.72	100.00
Soup bone	1.00	0.30	3.20	4.50	22.22	6.67	71.11	100.00
Entire round	53.60	11.15	15.50	80.25	66.79	13.89	19.32	100.00
Steer C								
Rump roast	7.40	1.20	4.20	12.80	57.81	9.38	32.81	100.00
Round steak—first cut	1.50	0.10	0.10	1.70	88.24	5.88	5.88	100.00
" "	1.30	0.20	0.15	1.65	78.79	12.12	9.09	100.00
" "	1.70	0.10	0.10	1.90	89.47	5.26	5.26	100.00
" "	2.00	0.10	0.10	2.20	90.90	4.55	4.55	100.00
" "	2.30	0.10	0.10	2.50	92.00	4.00	4.00	100.00
" "	2.60	0.10	0.15	2.85	91.22	3.51	5.27	100.00
" "	2.40	0.08	0.12	2.60	92.31	3.08	4.61	100.00
" "	2.30	0.10	0.10	2.50	92.00	4.00	4.00	100.00
" "	2.00	0.15	0.05	2.20	90.90	6.82	2.28	100.00
" "	2.20	0.20	0.10	2.50	88.00	8.00	4.00	100.00
" "	1.70	0.20	0.10	2.00	85.00	10.00	5.00	100.00
" "	2.00	0.20	0.10	2.30	86.96	8.70	4.34	100.00
" "	1.70	0.10	0.20	2.00	85.00	5.00	10.00	100.00
" "	1.75	0.10	0.10	1.95	89.74	5.13	5.13	100.00
Pot roast—heel of round	6.60	0.20	---	6.80	97.06	2.94	---	100.00
Knuckle soup bone	0.80	0.50	4.80	6.10	13.11	8.20	78.69	100.00
Soup bone	1.40	0.10	0.80	2.30	60.87	4.35	34.78	100.00
Soup bone	1.70	0.10	0.50	2.30	73.91	4.35	21.74	100.00
Soup bone	0.50	0.40	3.10	4.00	12.50	10.00	77.50	100.00
Entire round	45.85	4.33	14.97	65.15	70.38	6.65	22.97	100.00

The pot roast, or what is commonly termed the "heel of the round," is free from bone and is the leanest piece of meat in the round. As the animal becomes fatter the percentage of lean is decreased from 97 per cent in the thin steer to 80 per cent in the fat steer. Accompanying this reduction of lean there was an increase of fat from 3 to 20 per cent.

TABLE 16.—LEAN, VISIBLE FAT AND BONE IN TRIMMINGS FROM RETAIL CUTS OF ROUND

Retail cuts in round	Expressed in pounds				Expressed in percentages			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Rump roast		0.90		0.90		100.00		100.00
Round steak—first cut		0.10		0.10		100.00		100.00
" "		0.10	0.05	0.15		66.67	33.33	100.00
" "		0.10		0.10		100.00		100.00
" "		0.10		0.10		100.00		100.00
" "		0.05		0.05		100.00		100.00
" "		0.05		0.05		100.00		100.00
" "		0.05		0.05		100.00		100.00
" "		0.10		0.10		100.00		100.00
" "		0.10		0.10		100.00		100.00
" "		0.15		0.15		100.00		100.00
" "			0.05	0.05			100.00	100.00
" "		0.10	0.40	0.50		20.00	80.00	100.00
Pot roast—heel of round								
Knuckle soup bone								
Soup bone								
Soup bone								
Soup bone								
Entire round		1.90	0.50	2.40		79.17	20.83	100.00
Steer B								
Rump roast		0.50		0.50		100.00		100.00
Round steak—first cut			0.20	0.20			100.00	100.00
" "								
" "								
" "								
" "		0.10		0.10		100.00		100.00
" "								
" "								
" "			0.15	0.15			100.00	100.00
" "		0.20		0.20		100.00		100.00
" "								
" "								
Pot roast—heel of round								
Knuckle soup bone								
Soup bone								
Soup bone								
Soup bone								
Entire round		0.80	0.35	1.15		69.67	30.43	100.00
Steer C								
Rump roast		0.70		0.70		100.00		100.00
Round steak—first cut			0.10	0.10			100.00	100.00
" "								
" "								
" "								
" "								
" "								
" "								
" "								
" "								
" "								
" "								
" "								
" "								
" "			0.25	0.25			100.00	100.00
Pot roast—heel of round								
Knuckle soup bone								
Soup bone								
Soup bone								
Soup bone								
Entire round		0.70	0.35	1.05		66.67	33.33	100.00

The shank, a cut that is of little importance, is composed of a cheap grade of meat and a considerable amount of bone with little fat. The variation in the composition of the shank was not so marked; e. g.: the lean ran to 29 to 23 per cent, fat, 7 to 13 per cent and bone, 57 to 63 per cent. The knuckle and hock bones consisted largely of bone, while the two middle cuts were mostly of lean. The largest percentage of fat was present in the knuckle bone.

The percentage and pounds of lean, fat and bone in the trimmed retail cuts is indicated in Table 15 while the trimmings as expressed in pounds and percentages are to be found in Table 16. These trimmed cuts differ very little from the untrimmed ones as only small amounts of external fat are removed and some bone in the first cuts of round steaks. As the animal becomes fatter, more trimming is required to remove this excessive external fat. The trimmings amount to about 1 to 4 per cent of the total rounds. In trimming the rump only the excess fat was removed allowing the pelvic bone to remain. This bone weighs nearly two pounds and might be classed as bone trimmings for it is generally removed before the cut is used by the consumer.

The Chuck.—*Description of Chuck.*—The chuck consists of that portion of the carcass forward of the 6th rib, thus including the first five ribs of the beef. The chucks used in this experiment were of the kind that are commonly known as the “knuckle out”, that is, the shank was removed at the second joint. In such a chuck the arm steak would not be found as the shoulder and knuckle are removed as one cut.

The following description from the Illinois Experiment Station gives the difference in grades. Thickness, shape and color are the most important points considered in grading the chucks and the covering of fat is of much less consequence than in the ribs and loins. The general quality of chucks is indicated by the chine and brisket bones, color and grain of flesh. No. 1 chucks have a complete covering of fat, which is thickest along the rib end of the cut. No. 2's have a little covering and No. 3's none. The proportions of the chuck which are suitable for roast steaks and boiling meat vary greatly according to shape and thickness; and in view of the wide difference in market value of these cuts, the importance of a compact shape and full, thick development of lean meat is apparent.

Comparison of Chucks.—The distribution of lean, fat and bone used in this experiment expressed in pounds and percentages is recorded in Table 17. The total weight of the different chucks varied only a little with the lightest one coming from the fattest steer. The percentage of chuck to total weight of carcass is indicated in Table 4 and it is apparent that as an animal becomes fatter this percentage tends to decrease.

The distribution of lean, fat and bone varies with the condition of the animal. As an animal fattens the percentage of fat increases and the percentages of lean and bone decrease. Even though the chucks weighed the same, the actual amount of bone increased as the animal becomes thinner. The variation in the constituents of the chuck were: lean 57 to 67 per cent, fat, 8 to 23 per cent and bone, 18 to 24 per cent.

TABLE 17.—LEAN, VISIBLE FAT AND BONE IN RETAIL CUTS OF CHUCK

Retail cuts in chuck	Expressed in pounds				Expressed in percentages			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Roast—5th rib-----	3.10	1.90	1.25	6.25	49.60	30.40	20.00	100.00
Chuck steak-----	1.80	1.10	0.80	3.70	48.65	29.73	21.62	100.00
Chuck steak-----	2.60	1.15	0.85	4.60	56.52	25.00	18.48	100.00
" "-----	2.95	0.95	0.85	4.75	62.11	20.00	17.89	100.00
" "-----	1.25	0.60	0.35	2.20	56.82	27.27	15.91	100.00
" "-----	2.40	0.80	0.75	3.95	60.76	20.25	18.99	100.00
" "-----	2.20	1.10	0.50	3.80	57.89	28.95	13.16	100.00
" "-----	1.65	1.05	0.70	3.40	48.53	30.88	20.59	100.00
Pot roast-----	2.55	1.35	0.65	4.55	56.04	29.67	14.29	100.00
" "-----	4.20	1.40	1.50	7.10	59.15	19.72	21.13	100.00
" "-----	3.20	1.50	0.45	5.15	62.14	29.13	8.73	100.00
" "-----	1.80	1.35	0.25	3.40	52.94	39.71	7.35	100.00
Shoulder or clod-----	4.55	0.70	0.55	5.80	78.45	12.07	9.48	100.00
Knuckle bone-----	1.10	0.30	1.85	3.25	33.85	9.23	56.92	100.00
Neck-----	5.00	1.40	1.75	8.15	61.35	17.17	21.43	100.00
Entire chuck-----	40.35	16.65	13.05	70.05	57.60	23.77	18.63	100.00
Steer B								
Roast—5th rib-----	3.50	1.10	1.30	5.90	59.32	18.64	22.04	100.00
Chuck steak-----	1.90	0.50	0.50	2.90	65.52	17.24	17.24	100.00
" "-----	2.20	0.60	1.00	3.80	57.89	15.79	26.32	100.00
" "-----	2.05	0.50	0.60	3.15	65.08	15.87	19.05	100.00
" "-----	2.30	0.40	0.60	3.30	69.70	12.12	18.18	100.00
" "-----	2.10	0.20	0.70	3.00	70.00	6.67	23.33	100.00
" "-----	2.10	0.30	0.70	3.10	67.75	9.67	22.58	100.00
" "-----	4.00	0.60	1.50	6.10	65.57	9.83	24.60	100.00
Pot roast-----	3.80	0.60	0.80	5.20	73.08	11.54	15.38	100.00
" "-----	3.40	0.70	0.95	5.05	67.33	13.86	18.81	100.00
" "-----	3.50	0.60	0.80	4.90	71.43	12.24	16.33	100.00
" "-----	4.70	1.10	1.20	7.00	67.14	15.71	17.15	100.00
Shoulder or clod-----	8.50	1.00	1.20	10.70	79.44	9.35	11.21	100.00
Knuckle bone-----	1.30	0.20	2.20	3.70	35.14	5.41	59.45	100.00
Neck-----	7.30	1.20	2.00	10.50	69.53	11.43	19.05	100.00
Entire chuck-----	52.65	9.60	16.05	78.30	67.24	12.26	20.50	100.00
Steer C								
Roast—5th rib-----	3.00	0.20	0.90	4.10	73.17	4.88	21.95	100.00
Chuck steak-----	2.50	0.30	0.80	3.60	69.44	8.33	22.23	100.00
" "-----	1.50	0.30	0.40	2.20	68.18	13.64	18.18	100.00
" "-----	2.90	0.25	0.80	3.95	73.42	6.33	20.20	100.00
" "-----	2.90	0.20	0.80	3.90	74.36	5.13	20.51	100.00
" "-----	1.40	0.20	0.40	2.00	70.00	10.00	20.00	100.00
" "-----	1.50	0.10	0.30	1.90	78.95	5.26	15.79	100.00
" "-----	2.30	0.20	0.80	3.30	69.70	6.06	24.24	100.00
Pot roast-----	4.60	0.30	1.60	6.50	70.77	4.62	24.61	100.00
" "-----	4.20	0.70	1.20	6.10	68.85	11.48	19.67	100.00
" "-----	3.40	0.70	1.10	5.20	65.38	13.46	21.16	100.00
" "-----	2.20	0.90	0.80	3.90	56.40	23.08	20.52	100.00
Shoulder or clod-----	9.70	0.80	1.50	12.00	80.83	6.67	12.50	100.00
Knuckle bone-----	1.40	0.20	2.60	4.20	33.33	4.77	61.90	100.00
Neck-----	8.50	1.30	5.00	14.80	57.43	8.78	33.79	100.00
Entire chuck-----	52.00	6.65	19.00	77.65	66.97	8.56	24.47	100.00

The first cut made in the chuck consisted of the 5th rib used as a roast. This cut resembles very closely its adjacent cut, the 6th rib, in that it contains a large per cent of lean. There was present a greater amount of lean in the 5th rib in all the chucks than in the 6th rib of the corresponding prime rib of beef. The percentage of bone in this cut is

slightly less than in the sixth rib and also there is a tendency toward reduction of fat with an increase in lean. Thus, the percentage of lean in this cut is controlled almost entirely by the deposit of fat.

The next cuts of the chuck are those commonly termed "chuck steak," which increase in lean and decrease in the amount of fat and bone. The percentage of lean in the chuck steaks of the same animal showed a great variation, as did also the steaks of the different chucks. The percentage of lean in Steer A was 48 to 60 per cent, Steer B, 67 to 70 per cent and Steer C, 68 to 73 per cent, the difference being from 48 to 73 per cent. The percentage of bone in the chuck steaks remains fairly constant while the percentages of lean and fat fluctuate.

The remaining parts of the chuck were made into roasts, which resembled very closely the chuck steaks in the distribution of lean, fat and bone. It will be noted that there was a gradual increase in the percentage of fat and the maximum amount was found in the last pot roast. This roast contained a considerable amount of fat as it was just over the brisket and contained part of that fat that is deposited as brisket fat.

It is a well known fact that an animal being fattened puts on fat over the shoulders during the latter part of the fattening period, and, consequently, unless the animal is extremely fat, the percentage of fat will not be very great. This is verified in this experiment as the fat steer possessed 12 per cent fat in the shoulder cut and the thin steer, 7 per cent. The percentages of lean in this cut were very similar as the fat animal had 78 per cent, medium fat, 79 per cent and the thin animal, 80 per cent. The bone showed some difference since Steer A had 9 per cent, Steer B 11 per cent, and Steer C 12 per cent. This cut, with its large content of lean, muscular tissue, never carries an excessive amount of fat, more than is wanted by the average consumer.

A large bone commonly known as the knuckle is taken from the shoulder. This cut is mostly bone with an external covering of fat and lean. The percentage of lean varied from 33 to 53 per cent while the fat varied from 9 to 4 per cent. The bone comprises the largest part of this cut, 56 to 62 per cent.

The neck a very cheap cut, possesses meat of rather poor quality and its composition is greatly affected by the conformation of the animal. The fat content decreased from 17 per cent in the fat steer to 8 per cent in the lean one. The decrease in the amount of lean in the neck from the fat steer to the thin one was rather irregular due to the heavy development in the case of the medium fat steer. The change in the amounts of the various constituents in the neck is controlled more by the con-

formation than by the degree of fatness. The percentage of bone was the largest in the thin steer and very likely this was due to the conformation which was rather long and rangy.

The trimmed retail cuts as recorded in Table 18 appear very much like the untrimmed ones for only small amounts of bone and fat were removed. The thinner animals required more trimming of bone as shown in Table 19. These trimmings, in per cent of the total weight of the chuck, were: Steer A, 2.45 per cent; Steer B, 6.13 per cent; and Steer C, 4.05 per cent. About 82 to 90 per cent of these trimmings consisted of bone.

TABLE 18.—LEAN, VISIBLE FAT AND BONE IN TRIMMED RETAIL CUTS OF CHUCK

Retail cuts in chuck	Expressed in pounds				Expressed in percentages			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Roast—5th rib	3.10	1.85	1.05	6.00	51.67	30.83	17.50	100.00
Chuck steak	1.80	1.10	0.70	3.60	50.00	30.55	19.45	100.00
" "	2.50	1.15	0.70	4.35	57.47	26.44	16.09	100.00
" "	2.95	0.95	0.75	4.65	63.44	20.43	16.13	100.00
" "	1.25	0.60	0.35	2.20	56.82	27.27	15.91	100.00
" "	2.40	0.80	0.50	3.70	64.86	21.62	13.52	100.00
" "	2.20	1.10	0.30	3.60	61.11	30.56	8.33	100.00
" "	1.65	1.05	0.70	3.40	48.53	30.88	20.59	100.00
Pot roast	2.55	1.35	0.65	4.55	56.04	29.67	14.29	100.00
" "	4.20	1.40	1.20	6.80	61.76	20.59	17.65	100.00
" "	3.20	1.50	0.35	5.05	63.37	29.70	6.93	100.00
" "	1.80	1.20	0.20	3.20	56.25	37.50	6.25	100.00
Shoulder or clod	4.55	0.70	0.85	5.80	78.45	12.07	9.48	100.00
Knuckle bone	1.10	0.30	1.85	3.25	33.85	9.23	56.92	100.00
Neck	5.00	1.40	1.75	8.15	61.35	17.17	21.43	100.00
Entire chuck	40.25	16.45	11.60	68.30	58.93	24.09	16.98	100.00
Steer B								
Roast—5th rib	3.50	1.10	0.80	5.40	64.81	20.37	14.82	100.00
Chuck steak	1.90	0.50	0.30	2.70	70.37	18.52	11.11	100.00
" "	2.20	0.60	0.30	3.50	62.86	17.14	20.00	100.00
" "	2.00	0.50	0.30	2.80	71.43	17.86	10.71	100.00
" "	2.30	0.40	0.50	3.20	71.88	12.50	15.62	100.00
" "	2.10	0.20	0.40	2.70	77.78	7.40	14.82	100.00
" "	2.10	0.30	0.30	2.70	77.78	11.11	11.11	100.00
" "	4.00	0.60	0.70	5.30	75.47	11.32	13.21	100.00
Pot roast	3.80	0.60	0.50	4.90	77.55	12.24	10.21	100.00
" "	3.40	0.70	0.70	4.80	70.84	14.58	14.58	100.00
" "	3.50	0.60	0.40	4.50	77.78	13.33	8.89	100.00
" "	4.50	1.10	0.50	6.10	73.77	18.03	8.20	100.00
Shoulder or clod	8.50	1.00	1.20	10.70	79.44	9.35	11.21	100.00
Knuckle	1.30	0.20	2.20	3.70	35.14	5.41	59.45	100.00
Neck	7.30	1.20	2.00	10.50	69.52	11.43	19.05	100.00
Entire chuck	52.40	9.60	11.50	73.50	71.29	15.06	15.65	100.00
Steer C								
Roast—5th rib	3.00	0.20	0.60	3.80	78.95	5.26	15.79	100.00
Chuck steak	2.50	0.30	0.60	3.40	73.53	8.82	17.65	100.00
" "	1.50	0.30	0.20	2.00	75.00	15.00	10.00	100.00
" "	2.90	0.20	0.50	3.60	80.56	5.56	13.88	100.00
" "	2.90	0.10	0.50	3.50	82.86	2.86	14.29	100.00
" "	1.40	0.20	0.30	1.90	73.68	10.53	15.79	100.00
" "	1.50	0.10	0.20	1.80	83.33	5.56	11.11	100.00
" "	2.30	0.20	0.60	3.10	74.19	6.45	19.36	100.00
Pot roast	4.60	0.30	1.30	6.20	74.19	4.84	20.97	100.00
" "	4.20	0.70	0.90	5.80	72.41	12.07	15.52	100.00
" "	3.40	0.70	0.70	4.80	70.84	14.58	14.58	100.00
" "	2.20	0.90	0.50	3.60	61.11	25.00	13.89	100.00
Shoulder or clod	9.70	0.80	1.50	12.00	80.83	6.67	12.50	100.00
Knuckle	1.40	0.20	2.60	4.20	33.33	4.76	61.91	100.00
Neck	8.50	1.30	5.00	14.80	57.43	8.78	33.79	100.00
Entire chuck	25.00	6.50	16.00	47.50	69.80	8.72	21.48	100.00

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TABLE 19.—LEAN, VISIBLE FAT AND BONE IN TRIMMINGS FROM RETAIL CUTS OF CHUCK

Retail cuts in chuck	Expressed in pounds				Expressed in percentages			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Roast—5th rib	-----	0.05	0.20	0.25	-----	20.00	80.00	100.00
Chuck steak	-----	-----	0.10	0.10	-----	-----	100.00	100.00
" "	0.10	-----	0.15	0.25	40.00	-----	60.00	100.00
" "	-----	-----	0.10	0.10	-----	-----	100.00	100.00
" "	-----	-----	-----	0.25	-----	-----	100.00	100.00
" "	-----	-----	0.20	0.20	-----	-----	100.00	100.00
" "	-----	-----	-----	-----	-----	-----	-----	-----
Pot roast	-----	-----	-----	0.30	-----	-----	100.00	100.00
" "	-----	-----	-----	0.10	-----	-----	100.00	100.00
" "	-----	0.15	0.05	0.20	-----	75.00	25.00	100.00
Shoulder or clod	-----	-----	-----	-----	-----	-----	-----	-----
Knuckle	-----	-----	-----	-----	-----	-----	-----	-----
Neck	-----	-----	-----	-----	-----	-----	-----	-----
Entire chuck	0.10	0.20	1.45	1.75	5.71	11.43	82.86	100.00
Steer B								
Roast—5th rib	-----	-----	0.50	0.50	-----	-----	100.00	100.00
Chuck steak	-----	-----	0.20	0.20	-----	-----	100.00	100.00
" "	-----	-----	0.30	0.30	-----	-----	100.00	100.00
" "	0.05	-----	0.30	0.35	14.29	-----	85.71	100.00
" "	-----	-----	0.10	0.10	-----	-----	100.00	100.00
" "	-----	-----	0.30	0.30	-----	-----	100.00	100.00
" "	-----	-----	0.40	0.40	-----	-----	100.00	100.00
" "	-----	-----	0.80	0.80	-----	-----	100.00	100.00
Pot roast	-----	-----	0.30	0.30	-----	-----	100.00	100.00
" "	-----	-----	0.25	0.25	-----	-----	100.00	100.00
" "	-----	-----	0.40	0.40	-----	-----	100.00	100.00
" "	0.20	-----	0.70	0.90	22.22	-----	77.78	100.00
Shoulder or clod	-----	-----	-----	-----	-----	-----	-----	-----
Knuckle	-----	-----	-----	-----	-----	-----	-----	-----
Neck	-----	-----	-----	-----	-----	-----	-----	-----
Entire chuck	0.25	-----	4.55	4.80	5.21	-----	94.79	100.00
Steer C								
Roast—5th rib	-----	-----	0.30	0.30	-----	-----	100.00	100.00
Chuck steak	-----	-----	0.20	0.20	-----	-----	100.00	100.00
" "	-----	-----	0.20	0.20	-----	-----	100.00	100.00
" "	-----	0.05	0.30	0.35	-----	14.29	85.71	100.00
" "	-----	0.10	0.30	0.40	-----	25.00	75.00	100.00
" "	-----	-----	0.10	0.10	-----	-----	100.00	100.00
" "	-----	-----	0.10	0.10	-----	-----	100.00	100.00
" "	-----	-----	0.20	0.20	-----	-----	100.00	100.00
Pot roast	-----	-----	0.30	0.30	-----	-----	100.00	100.00
" "	-----	-----	0.30	0.30	-----	-----	100.00	100.00
" "	-----	-----	0.40	0.40	-----	-----	100.00	100.00
" "	-----	-----	0.30	0.30	-----	-----	100.00	100.00
Shoulder or clod	-----	-----	-----	-----	-----	-----	-----	-----
Knuckle	-----	-----	-----	-----	-----	-----	-----	-----
Neck	-----	-----	-----	-----	-----	-----	-----	-----
Entire Chuck	-----	0.15	3.00	3.15	-----	4.76	95.24	100.00

The Plate.—*Description of Plate.*—The plate, the lower half of the fore quarter, consists of two main divisions, the brisket and the navel end. Thickness of the cut, proper proportions of lean and fat, and quality of bone, determines the grade of a plate. Color, grain and firmness are less important factors than in the case of the more valuable cuts. The following description of the plate will determine into which grades the plate should be placed. No. 1's, weighing 40 to 80 pounds, are entirely covered with a thick layer of fat, which is most abundant over the brisket and have a corresponding depth of lean. No. 2's, weighing from 35 to 50 pounds, are of a poorer quality with less fat covering. No. 3's weighing 20 to 35 pounds, lack covering of fat and thickness.

Comparison of Plates.—The distribution of lean, fat and bone in the plates is indicated in Table 20. The plates were divided between the sixth and seventh ribs forming the brisket, or fore end, and the navel, or rear end. The rib ends were the small pieces taken from the upper side of the navel. This latter cut contained a larger per cent of bone and less fat and lean than the other cuts. The brisket and navel ends from the same plate show very little difference in composition when taken as a whole, but certain individual cuts from each of these portions show a considerable difference.

TABLE 20.—LEAN, VISIBLE FAT AND BONE IN PLATE

Retail cuts in plate	Expressed in pounds				Expressed in percentages			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Brisket end.....	6.35	9.55	3.45	19.35	32.81	49.35	17.84	100.00
Navel end.....	4.90	6.60	1.80	13.30	36.84	49.62	13.54	100.00
Rib ends.....	1.20	1.40	0.50	3.10	38.71	45.16	16.13	100.00
Entire plate.....	12.45	17.55	5.75	35.75	34.83	49.09	16.08	100.00
Steer B								
Brisket end.....	13.50	6.30	4.10	23.90	56.49	26.36	17.15	100.00
Navel end.....	10.00	4.00	2.40	16.40	61.32	25.47	13.21	100.00
Rib ends.....	2.60	1.20	0.90	4.70	60.34	22.41	17.25	100.00
Entire plate.....	26.10	11.50	7.40	45.00	58.00	25.56	16.44	100.00
Steer C								
Brisket end.....	7.00	4.50	4.60	16.10	43.47	27.95	28.58	100.00
Navel end.....	8.90	3.00	1.90	13.80	43.47	27.95	13.76	100.00
Rib ends.....	1.20	0.80	1.00	3.00	64.49	21.75	33.33	100.00
Entire plate.....	17.10	8.30	7.50	32.90	51.98	25.23	22.80	100.00

The degree of fatness and the conformation affect greatly the composition of the plate. Steer B was an animal carrying a brisket that was well developed and carried forward, thus producing considerable lean in this part. As an animal fattens the percentage of lean and bone decreases with an increase in the percentage of fat. Steer A had 35 per cent lean, 49 per cent fat and 16 per cent bone, while Steer C had 51 per cent lean, 25 per cent fat and 22 per cent bone. The medium fat steer had about the same content of fat as the thin animal and more lean and less bone.

The navel end in each case carried the largest percentage of lean, the brisket end possessed the most fat, while the brisket and rib ends contained the bone. These wholesale cuts were not trimmed and if such had been practiced only the excess fat on the lower edge would have been removed.

The Shank.—The shank was separated from the clod or shoulder just above the elbow joint. Such a cut is not graded on the market as they are most generally trimmed out and used in sausages, etc.

The shank carried very little covering of external fat or marbling but is well supplied with bone. The fatter an animal is the greater the percentage of fat in the shanks. The fat steer, A, had 12 per cent and the thin steer, C, 3 per cent. The amount of lean in the various shanks re-

mained about the same as the animal fattened but the fat content increased while the bone decreased, showing a reduction of 12 per cent.

TABLE 21.—LEAN, VISIBLE FAT AND BONE IN SHANK

Retail cuts in shank	Expressed in pounds				Expressed in percentages			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Elbow soup bone.....	1.90	0.75	1.75	4.40	43.18	17.05	39.77	100.00
Shank bone.....	2.95	0.50	2.10	5.55	53.15	9.01	37.84	100.00
Entire shank.....	4.85	1.25	3.85	9.95	48.74	12.56	38.70	100.00
Steer B								
Elbow soup bone.....	3.30	0.50	2.50	6.30	52.38	7.94	39.68	100.00
Shank bone.....	1.50	0.30	2.20	4.00	37.50	7.50	55.00	100.00
Entire shank.....	4.80	0.80	4.70	10.30	46.60	7.77	45.63	100.00
Steer C								
Elbow soup bone.....	2.50	0.20	2.40	5.10	49.02	3.92	47.06	100.00
Shank bone.....	3.00	0.20	2.70	5.90	50.85	3.39	45.76	100.00
Entire shank.....	5.50	0.40	5.10	11.00	50.00	3.64	46.36	100.00

The shank was divided into two separate divisions just below the elbow joint. The elbow contained the largest part of total fat and bone, except in the case of Steer B where the percentage of bone showed a decrease. The greatest amount of lean appears in the lower part of the shank with the exception of Steer B. On the average this part of the shank consists of about 50 per cent lean, 5 per cent fat and the rest bone.

The Flank.—*Description of the Flank.*—The flank is the one cheap cut from the hindquarter. It is free from bone in most cases and thus the grading depends entirely upon the thickness and quality of the lean and fat. Because the grain and color of the flank are less variable, the grades are determined by the weights of these cuts. No. 1's weigh 15 to 20 pounds, are thickly fleshed and the covering consists of solid white fat. No. 2's are lighter, carry less fat and weigh 10 to 15 pounds. No. 3's are thin, soft and in many cases dark colored and weigh 5 to 10 pounds.

TABLE 22.—LEAN, VISIBLE FAT AND BONE IN FLANK

Retail cuts in flank	Expressed in pounds				Expressed in percentages			
	Lean	Fat	Bone	Total	Lean	Fat	Bone	Total
Steer A								
Stew meat.....	0.60	0.55	0.10	1.25	48.00	44.00	8.00	100.00
Flank steak.....	1.20	0.50	-----	1.70	70.59	29.41	-----	100.00
Trimnings.....	0.60	7.45	-----	8.05	7.45	92.55	-----	100.00
Entire flank.....	2.40	8.50	0.10	11.00	21.82	77.27	0.91	100.00
Steer B								
Stew meat.....	0.80	0.60	-----	1.40	57.14	42.86	-----	100.00
Flank steak.....	2.00	0.30	-----	2.30	86.96	13.04	-----	100.00
Trimnings.....	0.20	4.60	-----	4.80	4.17	95.83	-----	100.00
Entire flank.....	3.00	5.50	-----	8.50	35.29	64.71	-----	100.00
Steer C								
Stew meat.....	1.50	0.30	0.20	2.00	75.00	15.00	10.00	100.00
Flank steak.....	1.60	0.10	-----	1.70	94.12	5.88	-----	100.00
Trimnings.....	0.10	3.10	-----	3.20	3.13	96.87	-----	100.00
Entire flank.....	3.20	3.50	0.20	6.90	46.38	50.72	2.90	100.00

Comparison of Flanks.—The actual weights of the flanks used in this experiment are a little low because in cutting them they were made short thus leaving a little more tail on the loin. The flanks were

divided into three portions, namely; the stew meat, flank steak and fat trimmings. The fatter an animal becomes the greater will be the amount of fat trimmed off. A comparison of the fat trimmed off with the total weight of the flank shows: A, 67.7 per cent, Steer B, 54.1 per cent and Steer C, 45 per cent. With this increase in the fat content as the animals fatten there is a corresponding decrease in lean. Steer A had 22 per cent, Steer B, 35 per cent and Steer C, 46 per cent. The total per cent of fat in the flank increases as the animal fattens, since Steer A had 77 per cent, Steer B, 64 per cent and Steer C, 51 per cent.

The stew meat is that portion of lean on the outside and it consists of one-half to three-fourths lean depending on the condition of the animal. The flank steak, the most valuable part, consists almost entirely of lean in the thin steer and decreases to 70 per cent in the fat steer.

CHEMICAL COMPOSITION

A considerable amount of analytical work has been performed at this station on beef carcasses of various ages and in different degrees of fatness. With such data available it was not deemed advisable to run a chemical analysis on these carcasses. Consequently, there are substituted the chemical data derived from three steers of former experiments, that corresponded very closely in physical composition to the ones used in this project.

In preparing the samples from the steers analyzed, the wholesale cuts were boned and separated into lean and visible fat. Those cuts classified as the cheaper ones were analyzed as a composite while in the case of the more valuable ones a separate analysis was made both for the lean and fat. The data from these analyses are shown in Tables 23 to 25. Table 23 gives the percentage composition of the various wholesale cuts of a beef carcass resembling very closely in physical composition the one produced by Steer A. The carcasses are very similar in their content of visible fat, and differ only slightly as regards lean or bone. The analysis as recorded in Table 24 was from a steer carcass that checked up very closely with that produced by the half fat animal or steer B. The steer C produced a carcass carrying slightly more fat than the carcass from which the data in Table 25 were derived, but the differences in lean and bone were slight.

These tables present the amount of total fat as hand separated and ether-soluble fat. The percentage of crude protein was calculated by multiplying the percentage of nitrogen by 6.25, this being the value assigned in calculating the amount of protein.

Fuel Value.—Fat, one of the chief nutrients of meat, is either deposited as such in the body or else yields energy by producing heat,

and thus has fuel value. Protein, the other nutrient of meat, is used for the formation of muscular tissue or for producing energy. Meats with a different physical composition will vary in fuel value because of this difference and also because of the variation in chemical composition of both the lean and fat. It has been found experimentally that a gram of fat when burned will yield 9.45 calories of heat and that a gram of protein when oxidized in the body will produce 4.35 calories.⁴ The amounts of energy from these nutrients that are available to man are 95 per cent of the fat and 92 per cent of the protein. Hence the approximate fuel values for fat and protein are: $9.45 \times .95 = 9$; $4.35 \times .92 = 4$ calories per gram respectively.

TABLE 23.—CHEMICAL COMPOSITION OF FAT STEER
(Expressed in percentages)

	Moisture %	Crude Fat %	Protein (N x 6.25)	Ash %	Phosphorus %
Shin and Shank, lean and fat	55.759	27.65	14.431	.697	.118
Flank and plate, lean and fat	29.221	62.259	7.762	.385	.065
Rump, lean and fat	31.575	58.755	8.612	.438	.080
Chuck and neck, lean and fat	47.879	37.191	13.450	.629	.116
Round—lean	65.159	14.337	18.131	.911	.173
Round—fat	17.763	76.089	5.756	.199	.024
Loin—lean	59.396	21.597	17.356	.826	.163
Loin—fat	8.901	88.492	2.287	.115	.018
Rib—lean	55.589	27.713	16.043	.757	.142
Rib—fat	17.797	75.455	2.550	.138	.021
Kidney fat	3.912	94.928	0.975	.074	.010

TABLE 24.—CHEMICAL COMPOSITION OF HALF FAT STEER
(Expressed in percentages)

	Moisture %	Crude Fat %	Protein (N x 6.25)	Ash %	Phosphorus %
Shin and shank, lean and fat	67.536	10.749	19.75	.933	.167
Flank and plate, lean and fat	43.753	41.749	13.981	.655	.116
Rump, lean and fat	45.528	35.883	14.656	.716	.133
Chuck and neck, lean and fat	61.792	18.520	18.187	.899	.156
Round—lean	71.904	5.223	20.65	1.065	.200
Round—fat	21.714	70.321	6.956	.295	.042
Loin—lean	68.406	9.593	20.325	1.004	.184
Loin—fat	12.520	83.405	4.212	.191	.033
Rib—lean	67.280	11.483	19.725	.979	.176
Rib—fat	15.622	78.878	5.325	.268	.040
Kidney fat	3.271	95.229	.937	.085	.022

TABLE 25.—CHEMICAL COMPOSITION OF THIN STEER
(Expressed in percentages)

	Moisture %	Crude Fat %	Protein (N x 6.25)	Ash %	Phosphorus %
Shin and shank, lean and fat	69.88	7.86	20.875	.93	.167
Flank and plate, lean and fat	51.93	32.36	15.625	.69	.124
Rump, lean and fat	50.80	31.64	14.1875	.72	.139
Chuck and neck, lean and fat	65.56	15.16	18.0687	.086	.156
Round—lean	72.72	5.77	20.1875	.981	.192
Round—fat	24.4	68.67	6.8125	.276	.039
Loin—lean	70.69	8.09	19.55	.972	.185
Loin—fat	17.82	76.68	5.1625	.223	.039
Rib—lean	67.43	12.33	18.7437	.937	.174
Rib—fat	17.55	76.43	5.9187	.253	.042
Kidney fat	6.78	91.3	1.775	.147	.025

Multiplying the percentage of fat by 9 and the percentage of protein by 4, and adding the results, will give the number of calories in 100 grams of a particular cut.

Table 26 shows the total per cent of fat and protein in each wholesale cut of the three different steers. These percentages were obtained by multiplying the percentage of fat and protein determined in the chemical analysis Tables 23 to 25, by the percentage of lean and fat of each wholesale cut as expressed in Table 6. Then using factors 9 and 4 as the amount of available energy for fat and protein in one gram respectively, we may calculate the energy supplied by each of the total energy in 100 grams of boneless meat. These amounts are recorded in columns 3-4-5 of Table 26. To determine the number of calories in one pound of boneless meat from the various cuts, the total amount of energy is multiplied by 4.5359 (1 pound = 453.59 grams).

As an animal fattens there is a tendency for the total protein to decrease and the percentage of total fat to increase in the wholesale cuts. The development or conformation will influence this considerably as in the chuck of the half fat steer the percentage of protein was greater than in the thin steer because of the heavy development in the fore quarters. In the round the thin steer was lacking development and this lowered the percentage of lean. With a decrease in lean as an animal fattens it follows that the lean in 100 grams of boneless meat from a thin animal will produce more calories than the lean from a fat steer. The reverse is true of the number of calories produced by the fat, as this amount is greatly increased as the animal fattens. As the fat also contains some protein which has fuel value, the sum of the two proteins equals the total protein in the boneless meat. This amount when reduced to calories shows that the fatter an animal is the less will be the number of calories produced by the protein in a given amount of boneless meat. This does not hold true in every case because the adipose tissue of the half fat animal which is high in protein is present in larger amounts than in the thin animal.

The total calorific value of each wholesale cut considering both protein and fat, is the greatest in the fat steer and the least in the thin animal. The total number of calories produced by the lean meat of the three wholesale cuts, loin, rib, and round is the greatest in the fat animal and the least in the half fat animal. This is due to the fact that the lean in Steer C carried more protein and practically the same amount of fat. The fat was easier to separate from the lean of the half fat steer than from the others because the external layer could be removed easily and the marbling fat was not greatly developed. In the thin steer the external fat was hard to remove while in the fat steer it was impossible to remove the marbling fat with the knife. In calculating the number of calories furnished by one pound of boneless meat it was found that the largest number was produced in the fat steer and the least in the thin steer. In

TABLE 26.—FUEL VALUE OF THE VARIOUS WHOLESALE CUTS
(Steers A, B and C)

Wholesale cuts	Composition		Calories per 100 grams of boneless meat			Calories per lb. boneless meat
	Fat %	Protein %	Fat x 9	Protein x 4	Total	
Steer A						
Loin Lean.....	11.338	9.1119	102.042	36.4474	138.4894	628.174
Fat.....	31.848	.8232	286.632	3.2928	289.9248	1315.069
Total.....	43.186	9.9351	388.674	39.7402	428.4142	1943.243
Round Lean.....	10.667	13.4896	96.005	53.9584	149.9632	680.218
Fat.....	13.894	1.0510	125.044	4.2040	129.2482	586.257
Total.....	24.561	14.5406	221.049	58.1624	279.2114	1266.475
Rib Lean.....	12.061	6.9822	108.545	27.9288	136.4742	619.033
Fat.....	28.228	.9539	254.049	3.8156	257.8649	1169.649
Total.....	40.288	7.9361	362.595	31.7444	394.3391	1788.683
Chuck and Neck Lean & Fat.....	30.262	10.9440	272.358	43.7760	316.1340	1433.952
Steer B						
Loin Lean.....	5.621	11.910	50.593	47.642	98.234	445.581
Fat.....	23.303	1.177	209.730	4.708	214.437	792.666
Total.....	28.925	12.087	260.322	52.349	312.672	1418.247
Round Lean.....	3.439	13.598	30.954	54.392	85.346	387.120
Fat.....	10.323	1.021	92.908	4.084	96.992	439.947
Total.....	13.762	14.619	123.862	58.476	182.338	827.067
Rib Lean.....	6.541	11.082	58.060	44.326	102.386	464.412
Fat.....	23.774	1.065	213.964	6.420	220.384	999.639
Total.....	30.225	12.686	272.024	50.746	322.770	1364.051
Chuck & Neck Lean & Fat.....	14.723	14.459	130.507	57.836	188.343	854.305
Steer C						
Loin Lean.....	5.657	13.662	50.916	54.646	105.562	478.818
Fat.....	9.769	.658	87.921	2.636	90.557	410.733
Total.....	15.426	14.319	138.837	57.277	196.114	889.553
Round Lean.....	3.998	13.982	35.978	55.927	91.906	416.874
Fat.....	5.219	.518	46.970	2.071	49.041	222.444
Total.....	9.217	14.500	82.949	57.998	140.947	639.318
Rib Lean.....	8.038	12.212	72.342	48.846	121.188	549.697
Fat.....	7.338	.568	66.040	2.272	68.213	309.856
Total.....	15.376	12.780	138.382	51.118	189.500	659.553
Chuck & Neck Lean & Fat.....	11.450	13.647	103.053	54.589	157.642	715.046

all the wholesale cuts practically twice as many calories per pound of boneless meat were produced by the fat steer as were produced by the thin steer.

Relative Economy of Meat From Straight Wholesale Cuts.—The relative economy of the wholesale cuts of the different carcasses is expressed in terms of cost per pound of lean and total boneless meat. Grading the cuts as No. 1, No. 2, and No. 3, and using the prices for these cuts as quoted by the packers at time of writing (1921) the values of each can be calculated. Table 27 shows the relative value of lean and total meat. The better the quality of beef the higher the wholesale market price. The No. 1, grade carries a less percentage of lean consequently the difference in the price per pound of lean will be greater than the difference in the market wholesale prices. The price per pound of total meat shows about the same differences as between the market quotations of the wholesale cuts. In the cheaper cuts as the plate, brisket, and shank the difference is less than the difference of the wholesale prices. In the shank the total meat of the fat steer was valued at less than that from the thin steer, which is just the reverse of all the other cuts.

TABLE 27.—COST OF LEAN AND TOTAL MEAT IN WHOLESALE CUTS OF CARCASSES OF VARIOUS CONDITIONS

Cuts	Steers	Weight (lbs.)	Cost per pound (cents)	Total cost	Cost per pound of lean (cents)	Cost per pound of boneless meat (cents)
Loin -----	A	53.62	33 ½	17.96	63.80	37.8
	B	53.15	28 ½	15.15	48.63	32.93
	C	42.	19 ½	8.19	27.90	23.74
Rib -----	A	27.	26 ½	7.15	60.85	32.72
	B	28.3	25 ½	7.22	45.40	33.42
	C	19.8	17 ½	3.47	27.76	24.09
Round -----	A	64.38	16	10.30	27.20	20.38
	B	81.40	15 ½	12.62	23.54	19.25
	C	66.2	14 ½	9.59	20.91	18.84
Chuck -----	A	70.05	10	7.00	17.34	12.28
	B	73.8	9 ½	7.01	13.31	11.26
	C	77.65	9	6.99	13.44	11.91
Plate -----	A	35.75	11	3.93	31.56	13.10
	B	45.00	10 ½	4.72	18.08	12.55
	C	32.7	8	2.62	15.40	10.40
Shank -----	A	9.95		.75	15.40	12.29
	B	10.3	7 ½	.77	16.04	13.75
	C	11.0		.83	15.09	14.06

The figures of this table indicate that food values of the beef cuts do not correspond to their wholesale market price and that the cheaper cuts are by far the more economical sources of lean and total meat. In all of the cuts the cost of the food ingredients varies more widely than the market price per pound of gross meat. A pound of boneless meat from the loin of a fat steer costs about 50 per cent more than a similar purchase from a thin animal, and one pound of lean costs about 150 per cent more. The ratio is about the same for the rib, but the round and chuck do not show as much difference in cost of boneless meat, although the

lean from these cuts from a fat steer costs about one-fourth more. The cost of the lean in the plate of the fat animal is about twice as much as in the half fat and thin animal, but the cost of total boneless meat is about the same. The shank does not follow the general rule as the cost of the lean in this cut from all animals is about the same while the cost of the total meat is less for the fat animal.

Primarily meat is purchased for the protein it contains and secondarily for the fat, thus a comparison is made of the costs of a given amount of protein from each cut and the cost of meat from the different cuts to supply the same number of calories. Some of the cheaper cuts carry about the same amount of protein and the main differences are in the amounts of fat and quality of meat. The quality as indicated by color, fineness of grain, marbling, tenderness and amount of bone plays an important part in determining the market value.

TABLE 28.—COST OF MEAT, OF ONE POUND PROTEIN AND OF 1000 CALORIES

Cut and Steer	Wholesale price (cents)	Cost per 1 pound of boneless meat (cents)	Cost per 1 pound protein in wholesale cuts (cents)	Cost of 1000 calories in boneless meat (cents)
Loin	A	33.5	37.8	19.4
	B	28.5	32.93	23.2
	C	19.5	23.74	26.7
Rib	A	26.5	32.72	18.2
	B	25.5	33.43	22.8
	C	17.5	24.09	28.0
Round	A	16.	20.38	16.00
	B	15.5	19.25	23.20
	C	14.5	18.84	29.40
Chuck	A	10.	12.28	8.5
	B	9.5	11.26	13.1
	C	9.	11.91	16.6

Having the wholesale prices (Table 27) and the total protein in the cuts, the price per pound of protein was calculated. Table 28 shows the price per pound of protein from the main wholesale cuts of the different steers. The amount of protein in the plate was not calculated because the chemical analysis was made in combination with the flank. The most expensive sources of protein are the more valuable market cuts. These cuts not only contain a smaller percentage of protein but their market values are greater and consequently the cost of the protein is increased. This difference in market value is caused by the greater demand, as these cuts are more tender, better flavored, and the muscular structure is such that a better appearing dish can be prepared. The cost of a pound of protein either from the loin or rib from the same beef is about the same. As an animal becomes thinner this cost is reduced until the protein from the fat animal costs about 2.5 times as much as that from a thin animal. In the cheaper cuts as the round and the chuck the cost of protein from the

fat animal is somewhat higher than from the thin animal, but the margin is much reduced. Thus the most economical source of protein is the chuck, followed in order by the round, rib and loin.

From the cost per pound of boneless meat and the number of calories in a pound of boneless meat, it is possible to determine the cost of the meat necessary to furnish 1000 calories. These results are indicated in the last column of Table 28. If all the cuts were valued at the same price, the cost of producing a given number of calories would be much less in the loin and rib because of the presence of large amounts of fat. Because of this large amount of fat the loin can sell at a price higher than that of the chuck and still supply 1000 calories almost as cheaply as the chuck. The price per pound of loin is normally twice that of the round, but the cost per calorie is only slightly higher. Because of the large amount of external fat on the ribs, this cut supplies 1000 calories at a lower cost than does the loin. As the animal becomes thinner this difference is reduced and in a thin animal where the external fat over the ribs is lacking, the loin will produce a given number of calories cheaper than the rib. In all the cuts the fat animal produces 1000 calories at a much less cost than the thin animal, the differences being about the same in all of the cuts.

In each cut the fatter the animal the greater the cost of the protein and the less the cost of 1000 calories. Those cuts that sell for the least money on the market produce protein and calories at a cost much less than do the other cuts, this is especially true of the chuck. In case of the round this is not so evident as this particular cut is low in fat and high in protein thus making the protein cheap but the price of total calories rather high. From the standpoint of most economical buying of protein and total fuel value, the chuck and round will head the list. Since the fat in the loin and rib is in excess and a lot of it is wasted, this will then increase the cost of the total fuel value of the meat consumed. If the quality of the meat, tenderness, flavor and convenience in serving are not taken into consideration then those cuts classified as the less valuable cuts will be the most economical ones to use as the source of protein and total energy.

Relative Economy of Various Retail Cuts.—Knowing the proportions of lean, fat and bone in the various retail cuts *after being trimmed*, and the market values, the price per pound of lean and of total meat may be calculated. The wholesale and retail prices were taken from quotations as given on the Chicago markets. The net cost of the lean meat is an approximate index of the relative economy of the various steaks and roasts, as they are purchased primarily for the lean they contain. Such is not the case of the boiling and stewing meat as the total meat,

THE COST AND PHYSICAL COMPOSITION OF BEEF CARCASSES 49

TABLE 29.—COST OF LEAN AND OF TOTAL MEAT IN VARIOUS RETAIL CUTS AT MARKET PRICES (1921)

Retail cuts	Retail Market price (cents)	Cost of 1 pound lean (cents)	Cost of 1 pound edible meat (cents)
Steer A			
Steaks			
Sirloin—Butt end.....	42.	57.0	45.4
" —Wedge bone.....	42.	57.5	43.3
" —Round bone.....	42.	63.6	43.0
" —Double bone.....	42.	66.6	45.1
" —Hip bone.....	42.	73.7	47.2
Porterhouse.....	50.	80.7	54.4
Club steak.....	40.	80.0	43.7
Round steak 1st cut.....	30.	40.0	33.3
Round steak middle cut.....	30.	35.3	31.4
Round steak last cut.....	30.	41.7	33.0
Chuck steak.....	20.	35.0	23.8
Flank steak.....	30.	42.8	30.0
Roasts			
Rump.....	25.	55.0	34.7
11th-12th ribs.....	32.	76.1	39.0
8th rib.....	30.	63.8	36.1
6th rib.....	30.	63.1	36.5
5th rib.....	20.	38.4	24.2
Chuck.....	20.	33.9	23.1
Clod.....	20.	25.49	22.09
Stews			
Brisket.....	15.	45.4	20.9
Navel ends.....	12.5	34.0	14.4
Short ribs.....	12.5	32.3	18.7
Steer B			
Steaks			
Sirloin—Butt end.....	35.	44.03	38.99
" —Wedge bone.....	35.	48.4	37.03
" —Round bone.....	35.	46.05	36.84
" —Double bone.....	35.	48.61	38.46
" —Hip bone.....	35.	56.91	41.08
Porterhouse.....	42.	68.62	47.35
Club steak.....	30.	55.04	36.67
Round—first cut.....	25.	30.00	26.31
" —middle cut.....	25.	28.73	25.00
" —last cut.....	25.	32.50	27.09
Chuck steak.....	15.	20.04	17.44
Flank steak.....	25.	28.74	25.00
Roasts			
Rump.....	20.	36.44	27.33
11th-12th ribs.....	28.	43.34	33.69
8th rib.....	25.	38.63	30.34
6th-7th ribs.....	25.	38.02	31.46
5th rib.....	15.	23.14	17.61
Chuck.....	15.	19.86	16.75
Clod.....	15.	18.88	16.88
Stews			
Brisket.....	12.5	22.12	15.08
Navel.....	11	17.91	12.60
Rib ends.....	11	18.20	13.10
Steer C			
Steaks			
Sirloin—Butt end.....	25.	33.06	29.28
" —Wedge bone.....	25.	32.22	29.41
" —Round bone.....	25.	31.25	27.27
" —Double bone.....	25.	31.88	26.70
" —Hip bone.....	25.	34.24	30.30
Porterhouse.....	28.	37.33	33.93
Club steak.....	22.	45.36	56.12
Round—first cut.....	20.	22.66	21.24
Round—middle cut.....	20.	22.22	21.00
Round—last cut.....	20.	22.28	21.08
Chuck steak.....	12.5	16.12	14.63
Flank steak.....	13.	13.81	13.00
Roasts			
Rump.....	18.	31.13	26.78
11th-12th ribs.....	19.	26.38	24.35
8th rib.....	17.	25.25	21.04
6th rib.....	17.	26.83	23.1
5th rib.....	12.5	15.83	14.84
Chuck.....	12.5	17.85	14.88
Clod.....	12.5	15.46	14.28
Stews			
Brisket.....	10.	23.00	14.00
Navel.....	8.	12.40	9.27
Rib ends.....	8.	20.00	11.99

lean and fat, is more largely considered, since the fat is more completely utilized.

The retail prices of beef cuts vary greatly, depending on the market price of the live animals, and also upon the methods of cutting and trimming and upon local conditions. Consequently, the relative economy of the different cuts varies accordingly and therefore cannot be expressed in fixed terms.

The prices that are paid for the various retail cuts indicate that the margin between the wholesale and retail prices is the greatest in case of those cuts termed the most valuable. These cuts are sold at a great profit because of the large demand. This excessive profit then tends to balance what is lost on the cheaper cuts where the demand is lacking. It will be noted that the spread between the wholesale and retail prices of the various cuts from steers of different degrees of fatness is the greatest where the largest amount of fat is present. Because of this extra fat, a greater amount of trimming is required, consequently this means a loss to the retailer and necessitates a wider margin of profit on these cuts.

Table 29 gives the retail market price of the various cuts from carcasses of different grades. The net cost of one pound of lean meat and total boneless meat is also given.

In comparing the relative economy of different cuts from the same animal it was found that the porterhouse steak was the most expensive source of a pound of lean when taken from a fat animal, while the club steak was the most expensive when taken from a thin animal. In this latter case the porterhouse steak supplied a pound of lean at a price only slightly less than that of the club steak. Due to the heavy layer of external fat over the ribs of the fat animal, the first cut of the prime rib was the next most expensive source of lean meat. In the thinner animals the hip bone and sirloin steaks followed the porterhouse steak. The lean in the ribs followed closely that of the loin in cost per pound with a smaller difference as the animal became fatter.

In the fat steer the lean of the clod could be purchased most economically, but as the animals lost their fat the navel produced a pound of lean at the smallest cost. With a change in the market values this index would be altered. In animals of various degrees of finish the chuck always proved to be a very economical source of lean meat. Of the more valuable cuts the round produced a pound of lean very economically at a cost just about half that of the porterhouse steak. Because of the increase in the amount of bone in the last cut of the round this proved to be a little more expensive source of lean meat than the other steaks derived from the round.

The loin furnishes the best quality of steaks and the ones that command the highest prices on the market. Because of the large deposits of

fat the percentage of lean is reduced materially and thus the fatter an animal gets, the greater the difference between the cost of a pound of lean and the retail market price. Animals with a considerable amount of fat produce a porterhouse steak that sells at a price per pound, equal to about two-fifths of the cost of a pound of lean from these steaks. As the animal becomes thinner the margin is reduced and the value of one pound of lean is only one third more than that of the original steak.

Of the steaks from carcasses of various conditions the most expensive source of lean meat is the porterhouse and club steaks, followed in order by the sirloin, round, flank, and chuck. In the fat animal the flank rates above the round. Of the different roasts the first cut, or the 11th and 12th ribs, is the most expensive source of lean meat, while in the thinner animals the rump holds first place. With the fifth rib selling at a price much lower than the adjoining rib, which is part of the prime rib, it proves to be a more economical source of lean meat than the other rib roasts. The clod, although not a choice roast, produced lean more cheaply than any other roast. The chuck roast consisting of those cuts nearer the neck and used primarily for pot roasts, supplies lean meat that is just about as cheap as that from the clod; although in a fat animal because of the larger amount of fat deposited here, thus reducing the percentage of lean, the cost of lean flesh is increased.

The market price of the stewing and boiling pieces as the brisket navel end, and rib ends, is rather low because these cuts are rather low in percentage of lean and possess a considerable amount of bone. On account of these facts the demand is slight. The navel end produces the lean at a more economical rate than the other cuts but with only a slight difference from that of the rib ends. As the beef becomes fatter the price of lean in all of the cuts increases. The lean of the brisket costs the most because of the large amount of fat that is present in a well conditioned animal. With only a slight difference in the wholesale prices of the briskets of the various conditions, there exists a difference of two to one in the cost of the lean meat from a fat and a thin animal. Since these cuts are not primarily purchased for the lean, the price does not have the same effect when considered from an economic point of view.

In comparing the retail price of meat and the price of total meat it is found that the difference is not so great as when the price of lean is compared to the retail market price. This difference is about the same whether from a fat or a thin animal. As stated previously the percentage of bone is more constant in the different animals when the same cuts are compared. The most costly total meat occurs in those cuts which are quoted the highest on the markets. The various steaks and roasts rank in substantially the same order as to relative economy on this basis

as on the basis of lean meat. The loin still continues to be the most expensive meat, while the rib which was nearly as expensive as the loin in producing lean is much more economical in producing total meat.

In considering the total meat, the most economical steaks from carcasses of various degrees of fatness ranked, as chuck, flank, round, sirloin, club and porterhouse. In the thin animal the club steak is the most expensive because it lacks development in both lean and fatty tissue. Of the roasts the clod and chuck are the most economical in supplying total edible meat, with the 11th and 12th ribs the most expensive. In the thin animal lacking in the deposit of fat, the rump is the most expensive. The stewing pieces as the brisket, navel end and rib end supply total meat at a much lower price than any other cut when figured on the present day quotations. Today the chuck is selling at a very low price and it is supplying total meat at a price just about as cheap as the plate. The navel end which contains a smaller amount of bone is the cheapest source of total meat in the plate.

Data from these tables indicate that the cuts selling for the least money on the market of today supply both lean and total edible meat at a much more economical price than the other cuts. Since the market price and the amount of extractives contained in the various cuts do not show any correlation, and the cooking tests⁴ indicate that the proportion of waste and shrinkage is not necessarily greater in the cheaper than in the more expensive cuts, it is evident therefore, that retail prices of beef are determined chiefly by considerations other than food value, such as tenderness, grain, color, general appearance and convenience of cooking.

GENERAL SUMMARY

The steer in thin condition dressed out a lower percentage and produced a carcass with less external fat than the better conditioned animals. The carcasses showed a shrinkage while in the cooler of 1.2 per cent for the fat carcass, and 1.5 per cent for the thin carcass.

The weights of the empty internal organs of the various steers were about the same, while the amount of internal fat varied with the degree of fatness and the breeding of the animals. In the fat animal there was shown a gradual increase in proportion to fasted live weight, of the carcass, hide, lung, liver, heart, and edible fats, with a gradual decrease of waste which consists of the feet, fill, and the loss at killing time.

In the thin animal there was a greater percentage of fore quarter to the carcass. The variation was from 51.24 per cent in the fat steer to 64.23 per cent in the thin steer. The percentage of the different cuts in the carcasses showed only a slight variation in the animals of different degrees of fatness. There was an increase of the loin and decrease of the chuck in the fatter animals. The rib remained about constant and the plate increased slightly. As the animal became fatter certain wholesale cuts increased in proportion to the carcass and those that acted as a fat depot increased the most rapidly. The thin and fat steers varied considerably in composition. The thin steer contained 24 per cent more lean, 20 per cent less fat, and 5 per cent more bone than did the fat steer of the same weight.

The plates and the flanks in the three steers carried the largest percentage of fat, and the ribs, loins, rounds and chucks follow in the order named. In the very thin animal the chucks carried more fat than the rounds. The shank carried the least amount of fat on all animals.

The sirloin steaks in the various beeves were leaner than the porterhouse steaks, with the percentage of bone varying but little. As the animals became thinner the composition of these steaks were more alike, until in the very thin animal it was almost the same. The steaks from the fatter animal required more trimming of fat, while the amount of bone removed was about the same. The total amount of trimmings varied from 10 per cent to 19 per cent.

The 11th and 12th rib roasts from the fat carcass contained the smallest amount of lean, while the 6th rib roast contained the maximum amount. In the fat carcass the largest amount of total meat was found in the first cut of the prime rib; also the greatest amount of fat was found in this cut with a gradual decrease to the last cut. Just the reverse was true when considering the carcass from the thin steer. The percentage of bone showed only a small difference in the various roasts. The trimmings consisted of bone and fat and the amount of the latter de-

pended entirely upon the condition of the animal. The percentage of trimmings ranged from 6 per cent in the fat steer to 14 per cent in the medium steer.

In the fatter animals the percentage of lean in the round decreased and the percentage of fat increased, with the percentage of bone having a tendency to decrease. The difference in percentage of lean in the rounds of the different steers was 10 per cent while the difference in percentage of fat was 12 per cent. The heels of the rounds varied in lean from 80 to 97 per cent. The steaks from the round required very little trimming and only in the first and last cuts was any bone removed. The amount of fat in the trimmings was the greatest when taken from the fat steer. The total trimmings varied from 1 to 4 per cent.

In the fatter animal the percentage of chuck in the carcass showed a decrease. In the fattest carcass there was less percentage of bone and lean in this cut and a greater percentage of fat. The constituents of the chucks varied as follows: Lean 57 to 60 per cent, fat 8 to 32 per cent and bone 18 to 24 per cent. The trimmings in the chuck ranged from 2 to 6 per cent. About 90 per cent of this was bone.

The plates were divided into brisket and navel ends. Each had about the same composition in the fat steer. The lean in the plates varied from 35 to 50 per cent, the bone varied from 16 to 22 per cent and the fat varied from 49 to 25 per cent.

The flank consisted of 51 to 77 per cent fat. The amount of fat trimmed off varied from 45 to 67 per cent. In the fattest animal the percentage of lean decreased from 46 to 22 per cent. The flank steak, the most valuable part of the flank, consisted almost entirely of lean in the thin animal, while in the fat animal this steak contained 70 per cent lean meat.

The shanks carried very little fat. In the fat animal the fat of this cut amounted to 12 per cent, while in the thin animal it composed only 2 per cent. The percentage of lean varied with the different cuts of the shank, with an average of 50 per cent lean for the whole shank.

The protein in a pound of lean was found to be the greatest in amount when the flesh was taken from the half fat animal. In the lean of the thin steer more water was present than was the case in the half fat animal, while in the fat steer more fat was present. In the fatter animal the percentage of moisture and protein in the fatty tissue decreased with an increase in fat. The total number of calories produced by the lean in a given weight of boneless meat was the least in the fat animal, while the total number of calories produced by the boneless meat was the greatest

in the fat animal. The cuts from the fat steer produced just about twice as many calories per pound as the same cuts from the thin steer.

The food values of meat did not correspond to the market prices of the different cuts. The cost of a pound of boneless meat from the loin and rib of the fat steer was about 50 per cent more than that from the thin steer, while a pound of lean from the fat animal cost about 150 per cent more than the lean from the thin steer. The lean from the round and chuck of the fat steer cost about one-fourth more than that from the thin steer. The cost of total meat from the plates of these animals of different degrees of fatness was about the same.

The most economical source of protein was the chuck, followed in order by the round, rib, and loin. The cost of protein from the loin and rib was about the same when taken from the same animal, but in the fat animal the protein from these cuts cost about 2.5 times more than from the thin animal. In every cut of the fatter animal the cost of a given amount of protein was greater and the cost of 1000 calories was less than that from the thin steer. The cuts with the lower market value produce protein and calories at a lower cost than the more valuable cuts.

The porterhouse steak, when compared with other cuts of the fat carcass, was found to be the most expensive source of lean meat, while in the thin animal the club steak was the most expensive source of lean meat. In the fat animal the clod produced the lean most economically while in the thin animal the plate was first. In these animals of various degrees of fatness the chuck was the most economical source of lean meat. A pound of lean meat in a porterhouse steak from the fat steer cost twice as much as that from the round. Of the roasts in the fat steer the 11th and 12th rib roast was the most expensive source of lean, while in the thin animal the rump roast was the most expensive. The clod produced lean meat at less cost than the other roasts in all three steers.

The loin steak was the most expensive source of total boneless meat. The rib produced total meat at a more economical price than did the loin. The most economical source of total meat from the various steaks was the chuck, followed in order by flank, round, sirloin, club and porterhouse. The clod and chuck produced the total boneless meat at a lower cost than any other roasts. The plate in all cases supplied the total boneless meat at lower cost than any other cut.

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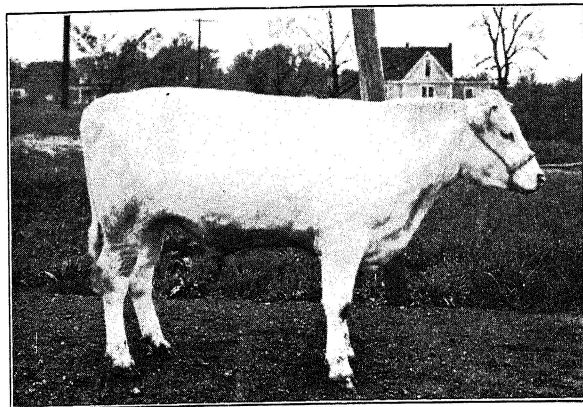


Fig. 3.—Steer A; Side View

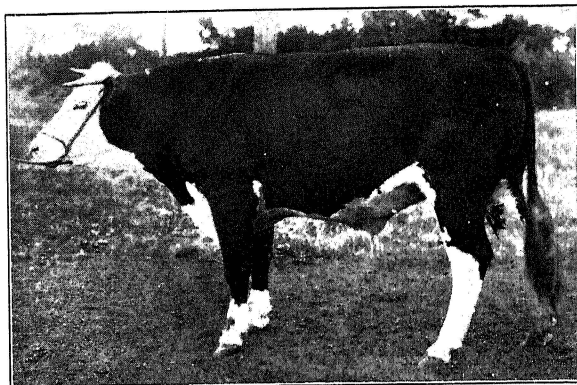


Fig. 4.—Steer B; Side View.

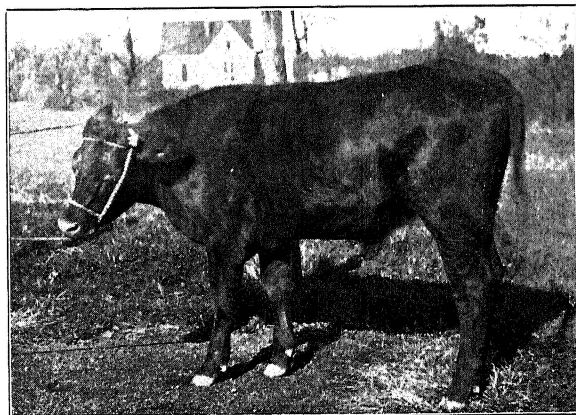


Fig. 5.—Steer C; Side View.



Fig. 6.—Steer A; Carcass, Outside View

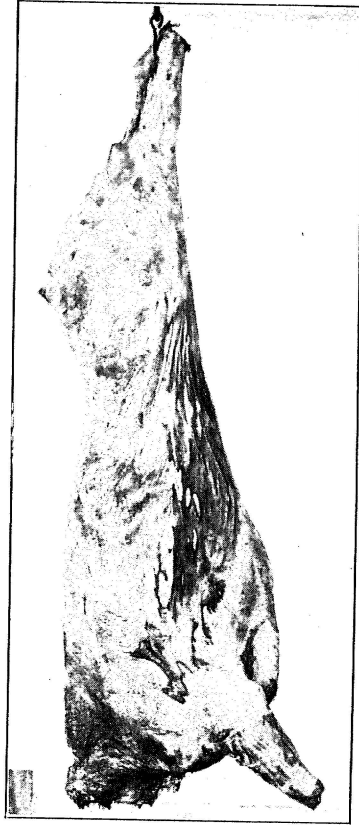


Fig. 7.—Steer B; Carcass, Outside View



Fig. 8.—Steer C; Carcass, Outside View



Fig. 9.—Steer A; Carcass, Inside View



Fig. 10.—Steer B; Carcass, Inside View



Fig. 11.—Steer C; Carcass, Inside View

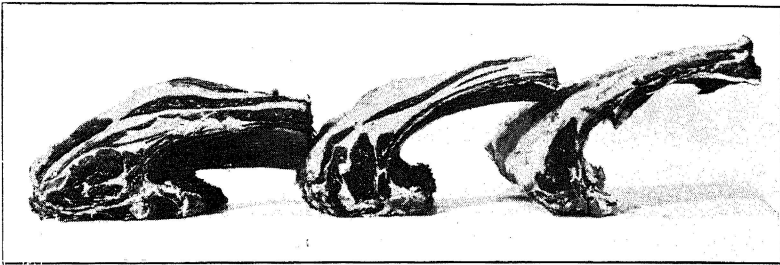


Fig. 12.—Steer A; Prime Rib

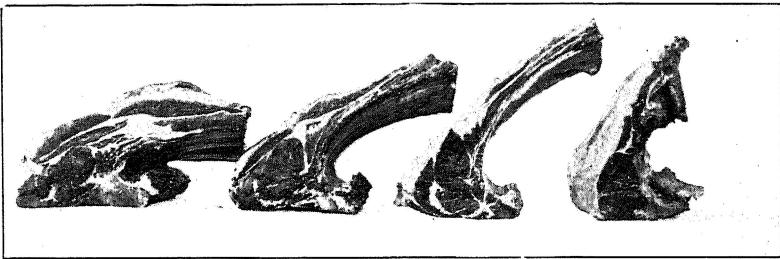


Fig. 13.—Steer B; Prime Rib



Fig. 14.—Steer C; Prime Rib

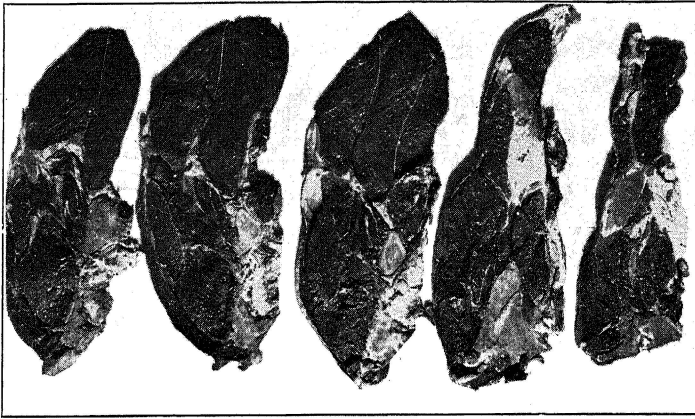


Fig. 17.—Steer C; Sirloin Steaks

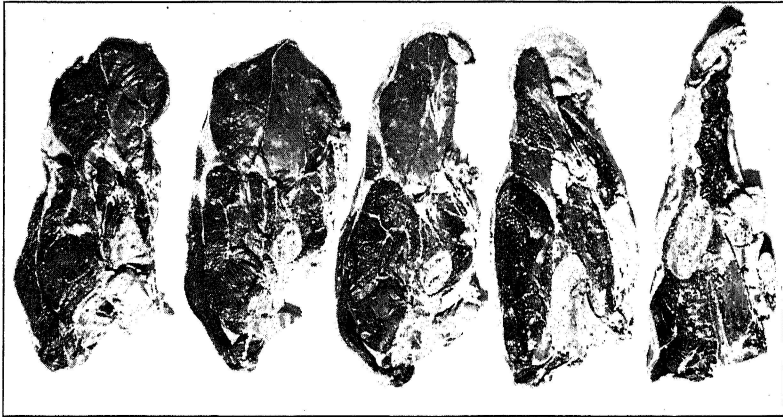


Fig. 16.—Steer B; Sirloin Steaks



Fig. 15.—Steer A; Sirloin Steaks



Fig. 18.—Steer A; Porterhouse and Club Steaks

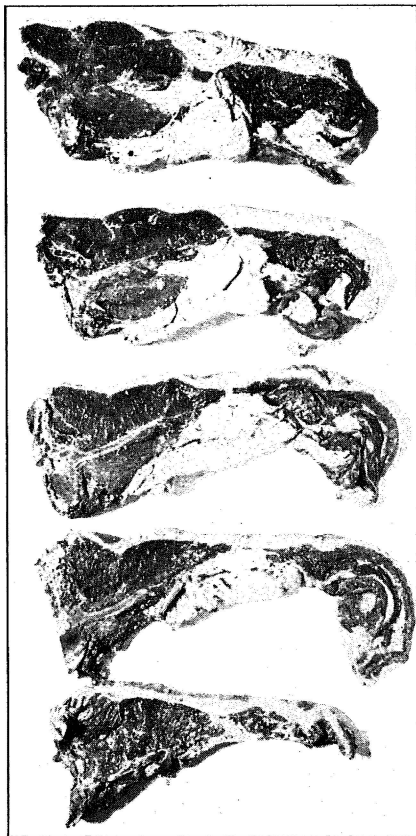


Fig. 19.—Steer B; Porterhouse and Club Steaks



Fig. 20.—Steer C; Porterhouse and Club Steaks

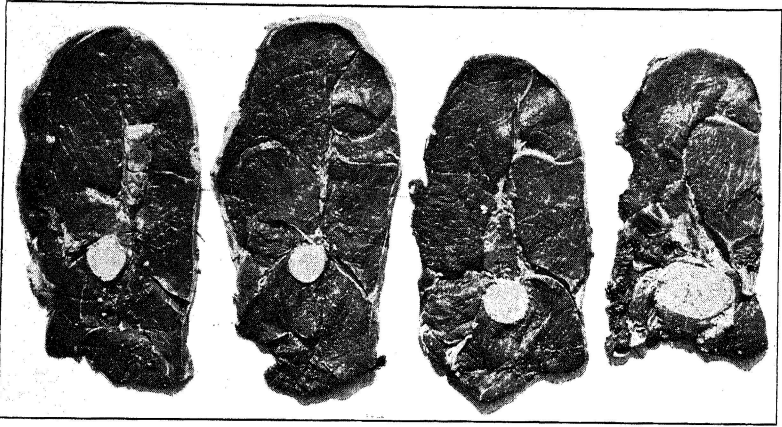


Fig. 23.—Steer C; Round Steaks

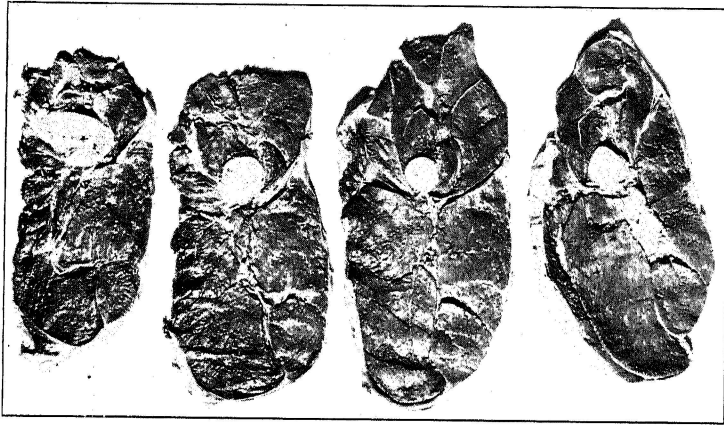


Fig. 22.—Steer B; Round Steaks



Fig. 21.—Steer A; Round Steaks