RELATIONSHIPS OF LOIN EYE AREA AND OTHER BEEF CARCASS CHARACTERISTICS WITH TRIMMED WHOLESALE CUTS AND FAT TRIM

by

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INTRODUCTION

The longissimus dorsi muscle has been used in many ways in attempts to predict meatiness in beef, pork and lamb carcasses. McMeekan (1939) found combinations of length and depth measurements of lamb and pork loin eye areas were highly correlated with total carcass muscling. Boughton (1958) noted little association between longissimus dorsi muscle area of beef carcasses and percentage of total wholesale cuts. Cahill et al. (1959) observed a correlation of .68 between rib eye area and edible portion in beef carcasses. A correlation of .92 was found by Orme et al. (1959) between weight of the longissimus dorsi muscle and weight of separable beef carcass lean. Cole et al. (1960) noted a low correlation of .28 on a within year and breed basis, between loin eye area and total separable lean in work with steers, heifers and cows.

It can be noted from this brief review, that from very significant to non significant correlations have been obtained when comparing the longissimus dorsi with carcass meatiness.

This study was conducted to determine if loin eye area or loin eye area per 100 pounds of carcass weight could be used as a dependable indicator of the trimmed wholesale round, loin, rib and chuck of beef. One live animal and 29 carcass characteristics were considered in this study. If loin eye area was not a suitable indicator of trimmed wholesale cuts, possibly one of the other characteristics might prove valuable in predicting the amount of lean meat in a carcass.

The beef cattle industry is continually striving to find new methods of improving their product, increasing efficiency and lowering production costs. If some characteristic could be found to be highly associated with meatiness and if this characteristic could be measured objectively, the industry would have made a great step forward. Ultrasonics and X-rays in addition to live animal measurements and observations have been used in evaluating beef cattle in an attempt to identify the animal with the highest percentage of edible meat, but these measurements are still in the experimental stages.

Breeding cattle operations would greatly benefit from an objective measure that would aid them in selecting replacement stock and herd bulls which have indications of producing offspring with desirable carcass traits. The producer, feeder, processor and consumer would benefit from a program that would develop an animal with enough fat for optimum palatibility and quality and yield a large portion of lean meat.

REVIEW OF LITERATURE

Cole et al. (1960) working with 81 steers, 9 heifers and 9 cows which varied in grade from U.S. Standard to U.S. Choice and represented a variety of beef, cross bred and dairy type cattle, found that the total separable lean of the round is a much better indicator of total carcass lean than loin eye area. Of all the variables investigated, separable round lean gave the most precise estimate of total carcass muscling. With the effects of carcass weight and breed eliminated; 56 to 82 percent of the variations in carcass meatiness was accounted for by either the separable lean of the round, chuck or foreshank. Regression equations showed that the total carcass lean was found to increase by 2.94 pounds per pound increase in separable round and 20.43 pounds per pound increase in foreshank weight.

While area of loin eye had a highly significant correlation (.43) with total separable carcass lean, separable lean of the round was more highly correlated (.95) according to Cole et al. (1960). Simple correlations between separable carcass lean and separable lean of the following cuts were; chuck .93, sirloin .80, shortloin .75, rib .79, 9-10-11 rib cut .74 and foreshank .81. Separable lean of the carcass was correlated (.77) with total carcass weight. Carcass weight and separable lean from all the above mentioned cuts are better indicators of total carcass lean, than loin eye area. Area of loin eye was associated with only 18 percent of the variation in separable carcass lean. Loin eye area was correlated with separable carcass lean of the following; round .40, chuck .37, sirloin .22, shortloin .42, rib .44, 9-10-11 rib cut .55, carcass weight .52, and separable carcass fat .33. Although all the above relationships were found to be highly significant only 5 to 30 percent of the variation in separable lean of either the carcass or a particular wholesale cut was associated with loin eye area. Several breeds were represented in the study. When breed effects were eliminated, loin eye area was a poorer predictor of carcass leanness than when breed effects were ignored. The preceeding correlations from the study of Cole et al. (1960) ignored year and breed effects. When year and breed effects were considered, the loin eye area correlations with total separable lean and the lean of individual wholesale cuts were reduced from highly significant to significant or non significant in all cases except the separable lean of the round. On a within year and breed basis, the correlations between separable carcass lean with the separable lean of the individual cuts varied little from those noted when year and breed effects were ignored. When breed effects were not considered and correlations were on a within year basis, the loin eye area correlations with carcass separable lean and individual wholesale cut lean increased.

King et al. (1959) noted that highly significant differences between beef carcasses were observed when the wholesale cuts were measured by the "retail trimmed" method; whereas by the standard cutting method, little or no significant difference was observed. One hundred twenty carcasses, ranging in weight from 204 to 745 pounds, and in grade from U.S. Standard to U.S. Choice were used in the study. The average percent of loin, rib, round and rump was 47.82 percent by the standard method of cutting, as compared to 37.25 percent by the "retail trimmed" method. The "retail trim" consisted of trimming all exterior fat on each standard wholesale cut to one-quarter inch depth. The flank side of the loin and the short ribs were removed. The shank was removed from the round and boned and the English cut and foreshank were removed from the chuck and boned. A uniform fat trim was made on the brisket, plate and short ribs.

Cahill et al. (1959) reported a correlation of .68 between rib eye area and edible portion in beef carcasses. Edible portion included muscle and a maximum of three-eights inch fat on any exposed surface.

Bray and Merkel (1957) found low correlations between 12th rib fat cover with rib eye area and marbling for U.S. Prime and Choice Hereford steers. Low correlations were also noted between marbling and rib eye area. 12th rib fat cover showed a low correlation with carcass grade (.07 and .19) in U.S. Prime and Choice steers. Marbling score however was highly correlated (.64 and .70) in U.S. Prime and Choice steers with carcass grade.

Orme (1959) found an average of the loin eye area taken at three locations, or the combination of average of areas of loin eye with carcass length, gave a better indication of actual muscling for a particular carcass than loin eye area at the 12th rib. The area of loin eye was taken at 3 locations; fifth rib, twelfth rib and the last lumbar vertebra. The three were used in an attempt to derive a better estimate of total carcass lean using area of loin eye. In work with 10 beef carcasses, a correlation coefficient of .35 was obtained between the area taken at the 12th rib and total separable lean of the carcass. Using the average of 3 areas of the loin eye, a correlation of .52 was obtained. When a product of the fifth and 12th rib and last lumbar loin areas were used, and carcass length was combined, a correlation coefficient of .61 was obtained with separable carcass lean.

The specific gravity of the longissimus dorsi muscle had a correlation of .67 with the total separable carcass lean in beef according to Orme (1959). This was significant at the .01 level. Orme et al. (1959a) stated that a simple correlation coefficient between weight of separable carcass lean and weight of the longissimus dorsi muscle was .917.

Woodward et al. (1954) stated that under conditions where more detailed study is not practical, determination of the area of the longissimus dorsi between the 12th and 13th ribs, has proven to be a very useful objective measurement of carcass value. They also found that area of eye muscle and thickness of fat over the eye muscle were not correlated. When final weight was held constant, there was a slight negative relationship between them. Selection for these 2 factors must be carried on independently.

The loin eye cross sectional area in hogs was highly correlated (.57) with the yield of the four lean cuts, according to Zobrisky et al. (1959). They also found the yield of the 5 primal cuts was negatively correlated with backfat thickness measurements.

Boughton (1958) found the area of longissimus dorsi muscle correlation with percent of wholesale cuts to be .11 for steers and .08 for heifers. He noted significant correlations of -.44 in steers, and -.28 in heifers, between percent of commercial round and fat thickness at the 12th rib. Area of longissimus dorsi was negatively correlated (-.07) with percent of commercial round in steers and positively (.17) in heifers. Percent of loin was significantly correlated (.45) with area of loin eye in steers and negatively (-.03) in heifers.

Branaman (1940) found that area of loin eye muscle is a fairly good index of lean meat content of lamb carcasses. Correlations were high between area of loin eye and weights of each of the following among Hampshire lambs and when Hampshire and Southdown data were combined: lean in half carcass and loin eye muscle. In Southdowns, the correlation of area of loin eye with lean in the carcass half, was slightly significant.

Kline and Hazel (1955) correlated loin eye tracings of swine carcasses taken at the 10th rib with tracings at the last rib and found a correlation coefficient of .88. High correlations of .96 and .92 were noted when left side loin eye areas at the 10th rib and last rib were correlated with similar areas from the right side. Similar correlations were obtained when percent lean cuts and percent loin were correlated with loin eye area at the 10th and last rib. Kline and Hazel (1955) found striking differences between pigs for all carcass traits studied, while differences between sides were negligible. They also found that due to the high correlation between loin areas on the same carcass, there is little increase in accuracy of predicting lean cuts from measuring the loin area in more than one place.

Pearson et al. (1956), when comparing the effectiveness of using the area of loin eye at the 10th and last ribs, found the area of lean at the 10th rib or last rib was only slightly less reliable than the ratio of fat to lean for estimating cut-out values. They found the correlation between area of lean at the last rib and percent of primal cuts to be .62 and .53 with percent of lean cuts. The area of lean refers to both the longissimus dorsi and multifidis dorsi muscle in this particular study. Very similar correlations were noted when the area of lean at the 10th rib and percent primal cuts (.59) and percent lean cuts (.52) were compared. Percent of fat trim was negatively correlated with area of lean at the 10th rib (-.38) and area at the last rib (-.41).

Pearson et al. (1959) studied the backfat thickness, carcass length, area of loin eye and percentage of various trimmed wholesale cuts from 7 breeds of hogs. Ranking of breeds on area of loin eye and on lean cuts showed marked inconsistencies, indicating the loin eye area does not closely reflect actual cut-outs. Backfat thickness or carcass length ranking by breeds, did not closely parallel similar rankings for lean or primal cut-out.

Negative correlations of carcass backfat with percentage lean cuts (-.66), percentage of primal cuts (-.58) and loin eye area (-.28) were noted by De Pape and Whatley (1956). They also noted that backfat on pigs at a live weight of about 210 pounds was more highly correlated with percent primal cuts than was the carcass backfat measurement. Similar results were obtained by Hazel and Kline (1952) working with 96 hogs. The average of 4 carcass backfat measurements was negatively correlated (-.45) with the percentage of primal cuts. The most accurate locations were just behind the shoulder and middle of the loin, about 1½ inches off the midline of the body. Hazel and Kline (1959) noted that mechanical probes of live hogs had a higher negative correlation (-.89) with percent of lean cuts, than carcass backfat thickness (-.84) on 56 pigs representing 5 breeds.

Mathews et al. (1959) found that cross-sectional measurements of the longissimus dorsi muscle were not as highly correlated as were fat measurements with either percentage wholesale cuts or separable lean in the rack of lambs. Palsson (1939) also working with lamb carcasses, reported the loin eye area to be a fairly good index of the total muscling of a particular carcass.

Orme et al. (1959) in work with 8 Angus and 23 Hereford long age yearling steers, dealt with relationship between carcass measurements and rib eye area. Correlation coefficients between rib eye area and width of shoulder (.54), width of rump (.46) and width of round (.48) were all significant at the .01 level. Depth of flank, depth at the fifth rib and width of the crops, were significantly related to area of rib eye. They concluded, that carcasses having the larger measurements tended to have the larger area of rib eye. Orme et al. (1959) also reported that percentage of primal cuts, sirloin plus round and fore shank, showed highly significant negative relationships to the area of rib eye muscle. This indicated that as the eye muscle increased in size, percentage of these various cuts tended to decrease. They found this to be true whether or not live weight was held constant.

Hirzel (1939) used the length, depth and "Shape Index" of the cross sectional area of the loin eye for determining body muscling. McMeekan (1939) correlated length plus depth and twice length plus depth of loin eye with the total weight of muscle in pork and lamb carcasses. All correlations were higher than .73. McMeekan (1941) found in pork carcasses that length of the cross section of the loin eye was correlated (.64) with total weight of muscle. Depth of cross section of loin eye was correlated (.50) with weight of muscle. Length plus depth and twice length plus depth were highly correlated .84 and .93 respectively with total weight of muscle in the carcass. McMeekan (1941) noted neither "length of eye" nor "depth of eye" alone gave satisfactory correlations, though values are significant and indicated quantitative relationship with total carcass muscle. Length of eye gives a higher correlation than depth of eye.

Palsson (1939) used combinations of length and depth measurements of the cross sectional area of the eye on lambs and hogs to determine total weight of muscle. Length plus depth and twice length plus depth, both were highly correlated (.77) with total weight of muscle. Length plus depth in swine was highly correlated (.81) with total weight of muscle, while twice length plus depth was correlated to a lesser degree (.73) with total weight of muscle. Palsson (1939) also found the muscle in one leg, or muscle in a leg plus that in the loin provides an excellent index of weight of muscle in the whole carcass.

Knapp and Clark (1950) working with 64 progeny groups of Hereford calves, estimated heritability of loin eye size to be .68 using half sib correlations. Their lower fiducial limits for heritability was .31. Knapp and Nordskog (1946) estimated heritability using paternal half sibs, to be .69 for area of eye muscle, .84 for carcass grade and .63 for slaughter grade. Knapp and Clark (1950) noted a lower heritability of .33 for carcass grade.

Hankins et al. (1943) found that there was a significant difference between sires within each type accounted for approximatly 22 percent of the total variance of the muscle bone ratio with percent of separable fat. Black and Knapp (1936) reported percentage of total edible portion produced by the progeny of one sire exceeded that of the progeny of another sire by 2.09$\pm$ .68 percent, which can be considered significant.

Shelby et al. (1955) observed a heritability of 72 percent for rib eye size, thus indicating that selection for variation in carcass composition should be effective. A heritability estimate of 38 percent for fat over the eye muscle was observed.

Lush (1925) concluded that wholesale rib cut rather adequatly represented the carcass regarding lean, fat and bone. Pierce (1957) found that higher finish grade and greater depth of fat were associated with higher wholesale yields of shortloin, rib, flank, brisket, plate and hindquarter, but with lower yields of round, loin end, chuck and foreshank. He reported the following variations in yields of major wholesale beef cuts; round 25 percent, loin end 22 percent, shortloin 33 percent, square chuck 13 percent and rib 22 percent. (Range among average yields for grade-weight groups was expressed as percent of the mean yield for all carcasses).

Willey et al. (1951) in a study of conventional and comprest type steers fed on the same ration and under the same conditions, found the percentage of most wholesale cuts were not significantly different. Only the shank was significantly different. The percentage of shank from the conventional calf was greater. The estimated percentages of separable fat, lean and bone were not significantly different in carcasses from the two types.

Butler et al. (1956b) found percentage yields of wholesale cuts varied little between Hereford and Hereford-Brahman crosses. The estimated percent of bone in both Hereford and Hereford-Brahman crosses was 15.4 percent. The loin, rib and round made up 48.8 percent of the Hereford carcass, and 49.9 percent of the Hereford-Brahman carcass. The round with rump on, made up 24.7 percent of the Hereford, and 25.1 percent of the Hereford-Brahman cross carcasses. The rib and chuck percentages were almost identical. Butler et al. (1956) stated that there is a strong tendency toward proportional development of bone and muscling among steers of about the same age. Fat is the greatest variable, and may have a marked influence on cutting yields of very fat cattle.

Cahill et al. (1956) working with 900 to 1000 pound steers reported that percentages of wholesale cuts of Stilbesterol implanted and non implanted steers varied little. "Edible portion" was obtained by weighing the wholesale cuts of the right side, and separating the entire side into bone, fat in excess of 3/8 inch thickness, and the remaining product was identified as "edible portion." Loins made up 15 percent of non implanted carcasses, and 15.4 of the implanted. Rounds of non implanted carcasses made up 23.7 percent of carcass and rounds from implanted steers 24 percent.

Black and Knapp (1936) obtained correlations of .82 and .81 when comparing carcass grade and slaughter grade respectively with the percent of edible portion in the beef carcass. Carcasses in this study were broken down into separable fat, lean, edible meat, bone and waste.

Boughton (1958) reported that carcass grade was not significantly correlated with fat thickness in steers, but was significantly correlated (.32) in heifers. He also determined that fat thickness was significantly correlated with percent round in steers (.48), but was not as highly correlated (.14) in heifers. In similar work by Clifton (1952) the depth of fat on the eye was highly correlated with U.S. Grade. Loin eye area showed a low correlation of .10 when compared with U.S. Grade.

Green (1955) obtained a significant correlation of .30 when comparing slaughter grade with weight of round, trimmed loin and rib of 50 steers. A significant correlation (.29) was also obtained when slaughter grade was compared with round, trimmed loin, rib and cross cut. Trimmed loin referred to loins with kidney fat removed and the cross cut included the chuck with brisket and shank on.

Hankins and Burk (1938) reported a very high correlation of .95 between beef carcass grade and thickness of flesh which includes thickness of both fat and lean. An identical correlation (.95) was observed when correlating thickness of external fat of the carcass with carcass grade. In the same work, marbling of lean was highly correlated with carcass grade (.90), thickness of external fat (.88) and thickness of flesh (.85). Kidwell et al. (1951) found a low but significant relationship exists between slaughter grade and percent wholesale cuts.

Wheat and Holland (1959) obtained information on 688 Hereford steers and heifers in 15 groups concerning the relationship between slaughter and carcass grade. Their average correlation between slaughter grade and after ribbing carcass grade ranged from .07 to .39. All except 2 were highly significant and only .07 was not significant. Average correlations between carcass conformation and before ribbing carcass grade was .42, after ribbing carcass grade .25 and with degree of marbling .25. The average correlation for before ribbing carcass grade with after ribbing carcass grade was .53. Degree of marbling was correlated (.45) with before ribbing carcass grade and (.89) with after ribbing carcass grade.

Studying the relationship of inheritance and ration to carcass characteristics of yearling steers, Cartwright et al. (1958) found daily gain to be the main influence in increasing lean meat in beef.

Dahl (1958) found a low correlation (-.04) between marbling score and loin eye area using either simple or partial correlations. Marbling score was highly significantly correlated with fat cover using simple (.23) and partial (.25) correlations. Area of loin eye showed a slightly negative partial or simple correlation with fat cover at the 12th rib.

Woodward et al. (1954) obtained a correlation of .08 between carcass grade and cross sectional area of eye muscle. In the same study, they noted a highly significant correlation .43 between carcass grade and thickness of fat cover over the loin eye muscle.

Tallis et al. (1959) established an edible portion to bone ratio. They termed edible meat as meat where no more than a 3/8 inch layer of fat remains on any surface. The edible portion to bone ratio was significantly correlated (.63) with fat trim for steers and not significantly (.13) in heifers. They found that percent of edible portion is highly influenced by amount of fat trim on the carcass.

Butler et al. (1956a) used 77 cattle to determine if left and right side measurements would yield approximatly the same results. Except for a slightly heavier mean weight of the left hindquarter and left kidney knob caused by leaving the hanging tender on the left side, little difference in mean cut weights was found. Cutting data obtained from either side of the carcass apparently is sufficiently accurate for most purposes. Correlations for mean of the left side to mean of both sides were all over .94 for weights of cuts. The eye muscle fat from the left side was highly correlated (.96) with the mean of both sides. The area of loin eye from the left side was also highly correlated (.98) with the mean of both sides.

Hegarty (1960) noted a highly significant correlation of .98 between average loin eye area (measured at the 10th rib) of the right and left sides with loin eye area of a single side in swine carcasses. This was true when using either the right or left side.

Callow (1948) reported that during growth and fattening, percentages of fatty tissue and musclar tissue vary considerably. His work showed that at birth, a pig contained 7 percent fatty tissue, 25 percent bone and 60 percent muscle. At 16 weeks the fatty tissue has increased to 9 percent, the bone decreased to 18 percent and the muscle increased to 70 percent. A very fat hog contains 59 percent fatty tissue, 6 percent bone and 34 percent muscle. The fattest wether and steer in his studies contained 42.6 percent and 39 percent fat respectively. Carcasses from cattle and sheep in the fattening stage of growth may be considered to contain over 18 percent fatty tissue.

Hankins et al. (1943) noted non significant correlations of .19 and .17 when correlating a muscle bone ratio with percent separable fat and thickness of fat over the loin eye in beef and dual purpose cattle. The fat over the loin eye was an average of 3 measurements.

In work with U.S. Choice and Good grade market steers, Kidwell et al. (1951) determined percentage ranges within the grades for wholesale cuts and bone weight. Rounds of Choice grade cattle made up 24.8 to 26.4 percent of carcass weight and in Good grade 25.3 to 26.4 percent. Choice ribs ranged from 9.7 to 10 percent and Good grade ribs from 9.6 to 10 percent. The wholesale loins of Choice grade cattle varied from 22.4 to 23.4 percent, while

Good grade loins ranged from 22 to 23.1 percent. The chuck percentages varied little with the Choice going from 34.3 to 35 percent and Good from 34.4 to 35.5 percent. The bone percentages were 13.9 to 15.6 percent in Choice grade and 13.8 to 16.9 in the Good grade. An increase in round is associated with an increase in bone and muscle and a decrease in fat. An increase in loin is associated with a decrease in bone and an increase in muscle and fat.

Kidwell et al. (1951) noted that carcass score and percentage fat increased with longer feeding. Percentages of muscle, round, chuck and bone decreased with longer feeding. Higher grading slaughter steers yield relatively less round, bone and muscle, but a higher proportion of loin, rib and fat.

McMeekan (1941) found that muscle of the loin was highly correlated (.87) with total weight of muscle in hogs. The muscle of the leg and leg muscle plus loin muscle were both highly correlated (.97) with total weight of muscle in the carcass. The total fat of loin, leg and leg plus loin were highly correlated .86, .88 and .93 respectively, with the total weight of fat in the carcasses.

Stonaker et al. (1952) compared Hereford steers of conventional type with those of comprest type, and found virtually no differences in percentages of high price cuts in the carcasses. Physical separation of the 9-10-11 rib cuts into bone, lean and fat showed almost identical composition for the 2 types. Cahill et al. (1959) studied carcasses sired by long and short bodied bulls and found significant differences between weight of edible portion and bone of the right side and separable muscle of the 9-10-11 rib cut.

The proportion of ham, lamb leg and beef round in a carcass decreases as proportion of fat deposition on the body increases according to Hankins and Ellis (1939). This indicates the relatively light fat deposition in the thigh region.

Woodward et al. (1954) found highly significant correlations between final weight and slaughter grade (.40), carcass grade (.34), area of eye (.43) and thickness of fat (.49). Total gain on test was highly significantly correlated with thickness of fat (.57), area of eye (.29) and carcass grade (.35).

Crown and Damon (1960) reported that the 12th rib cut can be used to predict carcass yield and meat quality of beef cattle. The separable lean (.825), fat (.965) and bone (.85) of the 12th rib cut was highly correlated with the 9-10-11th rib lean, fat and bone and separable lean, fat and bone of the 12th rib was correlated with total carcass lean (.818), fat (.962) and bone (.750).

Green et al. (1955) found that many of the intercorrelations of wholesale cuts of beef carcasses were highly significant. Fifty-three steers ranging in live weight from 800 to 1445 pounds and in grade from U.S. Good to U.S. Choice were used in the test. The round was highly significantly correlated with trimmed full loin (.43) and with arm chuck (.69). The full trimmed loin was highly significantly correlated with round (.43), rib (.47) and with arm chuck (.34). The rear quarter was highly significantly correlated with round (.69) and loin (.73), while the fore quarter was highly significantly correlated with the rib (.39) and arm chuck (.84). A correlation of .79 was noted by Hegarty (1960) between trimmed ham and percent lean cuts of pork carcasses.

Stouffer et al. (1959) reported that results to date with ultrasonic equipment indicate that fat thickness and rib eye area can be accuratly measured with a close relationship of a plotted outline made ultrasonically from the live animal, with a tracing from between the 12th and 13th rib of the carcass. Similar results were obtained when comparing back fat thickness and loin eye area at the 12th rib in live hogs with tracings from the cross section of the rough loin at the same location on the carcass.

Campbell et al. (1959) found somascope readings of rib eye depth correlated with the corresponding value for the tracing depth, to be (.68 and .49, respectively) highly significant for 2 groups of lambs. The sum of somascope measurements and rib eye area was correlated. Significant values of .62 and .44 were noted for the two groups. Rib eye are and total tracing depth were significantly correlated with values of .76 and .79 for the 2 groups. An average ultrasonic probe reading of backfat in swine was found to be negatively correlated (-.90) with percent lean cuts by Hazel and Kline (1959). Price et al. (1958) felt that ultrasonic devices could accurately measure fatness and depth of lean in hogs.

MATERIALS AND METHODS

Forty-eight Hereford steers from the Fort Hays Branch, Kansas Agricultural Experiment Station were the animals used in this study. The 48 were selected by means of a "random digit table" from 143 on feeding trials from November 1958 to March 19, 1960 at Hays, Kansas. The mean weight of the steers was 1298 pounds with a range from 1100 to 1390 pounds. The steers were two year olds and were on basically the same type of ration. They were carried on a high roughage low grain ration the first winter, pastured with light supplementation during the spring and summer and placed on a heavy grain and silage ration October 1, 1959.

Live weights were obtained at the Fort Hays Station on March 18 and 19 and the average weight of the two days was used. They were hauled to Armour and Company packing plant in Kansas City on March 20 and slaughtered according to approved packing house procedure on March 21. Hide brands on the animals were used to identify cattle at the plant and the carcasses were tagged with numbers. The carcasses were allowed to hang in the cooler for 48 hours prior to ribbing. Kansas State University and Armour and Company personnel collected the data.

Carcass data were obtained from the 48 cattle on March 23, 24 and 25. A conformation grade was given each carcass prior to ribbing. According to the standards set by the United States Department of Agriculture. A numerical score was assigned to each grade with higher numbers for higher grades and lower numbers corresponding to lower grades. The carcasses were graded to one-third of a grade. The right side of each carcass was ribbed between the 12th and 13th rib. A United States Government grader assigned each carcass a marbling score and carcass grade after ribbing. The carcasses were graded to the nearest one-third of a grade and numerical scores assigned each grade with larger numbers being assigned to the higher grading carcasses. The U.S.D.A marbling scores range from 1 to 10; loin eyes with the most marbling receiving the highest scores and smaller numbers being assigned to loin eyes with less marbling.

Tracings of the cross sectional area of the longissimus dorsi and fat cover at the 12th rib were made on acetate paper. Area of the loin eye muscle was determined with a compensating polar planimeter. Loin eye area was converted to a loin eye area ratio by dividing loin eye area by carcass weight and multiplying by 100. Fat depth over the 12th rib was measured at three sites, averaged and recorded to the nearest tenth of an inch. These measurements were obtained as described by Naumann (1952) at the Fifth Annual Reciprocal Meat Conference.

The loin, rib, round and chuck were tagged for accurate identification in the cutting room. Cold carcass weight to the nearest pound was obtained at this time. The right side of each carcass was weighed and recorded prior to quartering between the 12th and 13th ribs. Fore and rear quarter weights were recorded. The quarters were then taken to the cutting room where they were cut into standard wholesale cuts as described by Wellington (1953) at the Sixth Annual Reciprocal Meat Conference. Weights were recorded to the nearest quarter pound for untrimmed loin, round, chuck and rib. Wholesale cuts in this study will refer to round, loin, rib and arm chuck. Bone was not removed in this study. Total fat trim will refer to the total fat trimmed from the round, loin, rib and chuck.

Five fat probe measurements were made as described by Bray and Merkel (1957) and recorded to the nearest tenth of an inch. They were recorded as round, sirloin, shortloin, rib and chuck fat depth probes. Exterior fat on the wholesale loin, round, rib and chuck was trimmed to one-fourth inch. Frequent probes were made while trimming to insure as uniform and accurate a trim as possible. The weight of the trimmed cuts and trim from the cuts were recorded to the nearest quarter pound. Inside and outside loin trim were recorded separatly and combined prior to calculating correlation coefficients.

All correlation coefficients in this study are simple correlation coefficients as outlined by Snedecor (1956). Simple correlation coefficients between all observations made are presented in Table 7. The data were placed on cards and the calculations were made by using an IBM 650 Digital Computer.

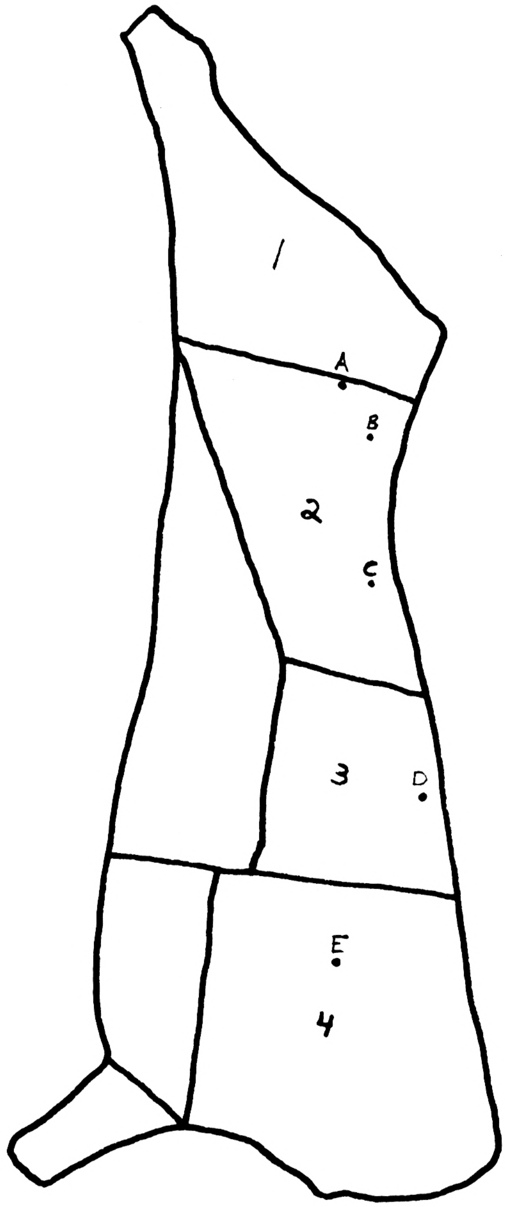
A total of 30 weights and measurements are reported in this study. Weights used include live, chilled carcass, and the untrimmed, trimmed and fat trim weights of the round, loin, rib and chuck. Loin eye data included loin eye area in square inches, depth of fat over the 12th rib and loin eye area per hundred pounds of carcass weight. Grading data include carcass grade, conformation grade and marbling score. Fat probe measurements include round, sirloin, shortloin, sirloin and shortloin average, rib, chuck and an average of five probes.

All weights pertaining to wholesale cuts individually or collectively are on a weight per hundred pounds of carcass basis.

EXPLANATION OF PLATE I

Illustration of carcass side of beef with wholesale cuts numbered and approximate fat probe locations lettered that were used in this study. Numbers 1, 2, 3 and 4 represent the round, loin, rib and chuck with shank on respectively. Point A represents the location of the round probe. The round probe was made on the cut surface of the sirloin from which the round was removed. One leg of the T-square was placed against and parallel to the sacral-caudal vertebrae and at point where the other leg of the T-square bisected the external fat surface, the depth of fat to the superficial muscle was determined perpendicular to the external surface. Point B was the point of the sirloin probe. The point on the sirloin was measured five inches from and perpendicular to the sacral vertebrae between the second and third sacral vertebrae. C is the approximate location of the shortloin probe. The shortloin probe was made 3-$\frac{1}{2}$ lumbar from the lumbar-sacral junction and four inches from and perpendicular to the lumbar vertebrae. The rib probe location is located by D. The point on the rib was measured 4 inches from and perpendicular to the thoracic vertebrae midway between the loin and chuck cut surface. The chuck probe (E) was made at a point one-half of the distance from the brisket side to the most dorsal point over and parallel to the third rib.

PLATE I



CORRELATION ANALYSES

This study was conducted to determine if some simple and inexpensive method could be detected that would assist in predicting percentages of trimmed wholesale cuts, total fat trim from these cuts, and other important carcass characteristics. The four major wholesale cuts referred to in this study represent 70 percent of the carcass weight and about 90 percent of the carcass value.

Since degrees of freedom for all correlations in Table 7 are the same, levels of significance will be identical for all 406 correlations. A correlation of .29 is significant at the .05 level and a correlation of .37 is significant at the .01 level. A correlation of .50 between two variables indicates that the variation in one of the traits is reduced by 25 percent when the other trait is held constant. If r^2, the coefficient of determination, is .25 or higher one trait may be considered valuable for predicting the second trait. We may consider a correlation very good if while holding one variable constant, it accounts for 50 percent of the variation in the second variable. The contents of Table 1, 2, 3, 4 and 5 taken from Table 7, deal with factors with which we are most concerned and which may help us to more accuratly predict beef animal and carcass worth.

Simple correlation coefficients of loin eye area ratio, trimmed and untrimmed round and chuck with other carcass characteristics. Simple correlations between the number of square inches of loin eye area per 100 pounds of carcass weight (hereafter referred to as loin eye area ratio), trimmed and untrimmed round and chuck and other carcass characteristics are found in Table 1. Correlations between trimmed wholesale cuts and loin eye area ratio, trimmed and untrimmed chuck and round are all highly significant. The correlation of .87 between trimmed chuck and trimmed wholesale cuts was the highest and was closely followed by the untrimmed chuck (.83) and trimmed round (.76). This may be accounted for by automaticity resulting from the fact that the trimmed chuck and trimmed round make up 39 and 29 percent respectively of the trimmed wholesale cuts. Untrimmed round was more highly correlated (.52) with the trimmed wholesale cuts than loin eye area ratio (.42). The trimmed chuck accounted for 76 percent of the variation in trimmed wholesale cuts, untrimmed chuck accounted for 69 percent, trimmed round 58 percent, untrimmed round 27 percent and the loin eye area ratio 18 percent. This indicates that loin eye area was a poor indicator of trimmed wholesale cuts when compared with trimmed and untrimmed chuck and round.

Table 1. Simple correlation coefficients of loin eye area ratio, trimmed and untrimmed round and chuck with other carcass characteristics.

	Loin eye area ratio	Trimmed Round	Untrimmed Round	Trimmed Chuck	Untrimmed Chuck
Live weight	-.14	-.15	-.21	-.14	-.16
Carcass weight	-.16	-.19	-.27	-.16	-.19
Carcass grade	-.12	-.34*	-.35*	-.25	-.29*
Conformation grade	-.10	-.24	-.27	-.24	-.33*
Marbling score	-.13	-.35*	-.38**	-.25	-.31*
12th rib fat depth	-.42**	-.41**	-.32*	-.54**	-.48**
Total fat trim	-.32*	-.52**	-.23	-.78**	-.69**
Total trimmed wholesale cuts	.42**	.76**	.52**	.87**	.83**
Trimmed round, loin and rib	.36*	.74**	.52**	.61**	.58**

* Significant at .05 level

** Significant at .01 level

The trimmed round, loin and rib, the most valuable wholesale cuts, as a group were significantly correlated (.36) with loin eye area ratio. They were highly significantly correlated with trimmed round (.74) untrimmed round (.52) trimmed chuck (.61) and untrimmed chuck (.58).

Live and carcass weights were negatively and non significantly correlated with the five traits in Table 1. Carcass grade was negatively but significantly correlated with trimmed round (-.34), untrimmed round (-.35) and untrimmed chuck (-.29). This indicates that as carcass grade increases, the percentage of round and chuck decreases. Loin eye area ratio and trimmed chuck were not significantly correlated with carcass grade. Conformation grade was significantly negatively correlated (-.31) with untrimmed chuck but was not significantly correlated with loin eye area ratio, trimmed and untrimmed round or trimmed chuck. Variations in conformation grade are not paralled by variations in round, chuck or loin eye area ratio.

Marbling score was not significantly correlated with loin eye area ratio and trimmed chuck, but was negatively and highly significantly correlated with untrimmed round and significantly negatively correlated with trimmed round and untrimmed chuck. Although marbling score was significantly correlated with three of these traits, it only accounted for 14 percent or less of the variability in these traits. Neither the round, chuck nor loin eye area ratio were valuable indicators of the degree of marbling.

Loin eye area ratio, trimmed round, trimmed and untrimmed chuck were negatively highly significantly correlated (-.42, -.41, -.54 and -.48) with fat depth at the 12th rib. This indicated that as the percentages of loin eye area ratio, round and chuck increased the 12th rib fat depth decreased. The untrimmed round was significantly negatively correlated with the 12th rib fat depth. Correlations involving total fat trim were similar to those for fat depth at the 12th rib. Total fat trim was highly significantly negatively correlated with trimmed round and chuck and the untrimmed chuck. A significant negative correlation existed between loin eye area ratio and total fat trim. The significant and highly significant negative correlations indicated that as the animal deposits outside fat, thus increasing its fat trim, the pounds of chuck and round per hundred pounds of carcass decrease, thereby decreasing the percentage of edible meat. Loin eye area per hundred pounds also decreased as the total pounds of fat per hundred weight of carcass increased.

The actual loin eye area was not significantly correlated with any characteristics which would lead us to use it as a guide for meatiness.

Simple correlation coefficients of total fat trim, 12th rib fat depth and marbling score with other carcass characteristics. Total fat trim and 12th rib fat depth showed non significant correlations with live and carcass weight, carcass grade, conformation score and marbling score. Marbling score was highly significantly correlated with live weight (.42), carcass weight (.45) and conformation grade (.55). Marbling score was very highly significantly correlated (.97) with carcass grade. When marbling score was held constant, it accounted for 94 percent of the variation of carcass grade. Table 2 shows correlations of fat trim, 12th rib fat depth and marbling scores with other carcass characteristics.

Total fat trim and 12th rib fat depth were highly significantly correlated (.50). Marbling score was not significantly correlated with total fat trim or 12th rib fat depth. Marbling score was not significantly correlated with any of the carcass fat probes, trimmed loin, trimmed wholesale cuts or weight of trim from the wholesale cuts. The round probe was not significantly correlated with total fat trim or 12th rib fat depth. The sirloin probe was highly significantly correlated (.40) with total fat trim but was not significantly correlated (.24) with 12th rib fat depth. Shortloin probe depth was correlated with total fat trim (.63) and accounted for 40 percent of the variation of total fat trim.

Total fat trim (.63) and 12th rib fat depth (.54) were both highly significantly correlated with the shortloin probe.

Table 2. Simple correlation coefficients of total fat trim, 12th rib fat depth and marbling score with other carcass characteristics.

	Total fat trim	12th rib fat depth	Marbling score
Live weight	.06	.21	.42**
Carcass weight	.08	.21	.45**
Carcass grade	.04	.19	.97**
Conformation grade	.04	.24	.55**
Marbling score	.01	.20	
12th rib fat depth	.50**		.20
Round probe	.27	.20	.19
Sirloin probe	.40**	.24	-.08
Shortloin probe	.63**	.54**	-.06
Sirloin-Shortloin average probe	.62**	.45**	-.08
Rib probe	.23	.31*	-.02
Chuck probe	.11	.09	-.18
Five probe average	.54**	.45**	-.07
Trimmed loin	-.67**	-.31*	.01
Loin trim	.89**	.42**	.08
Trimmed wholesale cuts	-.85**	-.51**	-.27
Round trim	.64**	.20	-.02
Rib trim	.58**	.57**	-.01
Chuck trim	.55**	.24	-.23

* Significant at .05 level

** Significant at .01 level

An average of the five probes (.54) and the average of the sirloin and shortloin probes (.62) were highly significantly correlated with total fat trim. Both averages were highly significantly correlated (.45) with the 12th rib fat depth. Rib and chuck probes showed low correlations with total fat trim and 12th rib fat depth although 12th rib fat depth was significantly correlated with rib probe. A highly significant negative correlation (-.67) was noted between the trimmed loin and total fat trim. Trimmed loin was significantly negatively correlated (-.31) with 12th rib fat depth. Loin trim was highly significantly correlated (.89) with total fat trim and trimmed wholesale cuts were negatively highly significantly correlated (-.85) with total fat trim. Smaller but still highly significant relationships were noted between loin trim (.42) and 12th rib fat depth and negatively for trimmed wholesale cuts (-.51) with 12th rib fat depth. Round, rib and chuck trim were all highly significantly correlated, (.64, .58 and .55) with total fat trim. Only rib trim was highly significantly correlated (.57) with 12th rib fat depth. Round and chuck trim were not significantly related to fat depth at the 12th rib.

<u>Simple correlation coefficients of total trimmed wholesale cuts and carcass grade with other carcass characteristics</u>.

Total trimmed wholesale cuts were not significantly correlated with live or carcass weight and conformation grade as shown in Table 3. Carcass grade is significantly negatively correlated (-.31) with trimmed wholesale cuts. Trimmed wholesale cuts were highly significantly negatively correlated with shortloin probe (-.54), average of 5 probes (-.44), loin trim (-.81) and round trim (-.57). As the four fat measurements just mentioned increased the pounds of wholesale cuts per hundred decreased. Trimmed loin and rib, being a part of the trimmed wholesale cuts, were positively and highly significantly correlated with them (.63 and .40).

Carcass grade showed no significant correlation with shortloin probe, average of 5 probes, trimmed loin, loin trim, round trim or trimmed rib. Carcass grade was highly significantly correlated (.63) with conformation grade, and significantly negatively correlated (-.31) with total trimmed wholesale cuts. These two relationships indicated that as carcass grade increased, conformation grade increased and percentage of wholesale cuts decreased.

Table 3. Simple correlation coefficients of total trimmed wholesale cuts and carcass grade with other carcass characteristics.

	Total trimmed wholesale cuts	Carcass grade
Live weight	-.19	.42**
Carcass weight	-.22	.44**
Carcass grade	-.31*	
Conformation grade	-.24	.63**
Shortloin probe	-.54**	-.05
Average of 5 probes	-.44**	-.12
Trimmed loin	-.63**	-.09
Loin trim	-.81**	.12
Round trim	-.57**	.01
Trimmed rib	.40**	-.06
Total trimmed wholesale cuts		-.31*

* Significant at .05 level

** Significant at .01 level

<u>Simple correlation coefficients of loin eye area ratio and untrimmed and trimmed round and chuck with trimmed and untrimmed individual wholesale cuts</u>.

Loin eye area ratio in Table 4 was highly significantly correlated with trimmed round (.39), trimmed chuck (.39), and trimmed rib (.37) but not significantly correlated with trimmed loin (.17). Untrimmed chuck is the only untrimmed wholesale cut that is highly significantly correlated (.37) with loin eye area ratio. Untrimmed loin is slightly negatively correlated (-.06) with the loin eye area ratio. Untrimmed round is highly significantly correlated (.88) with trimmed round. Correlations between untrimmed round and all rib and loin weights are not significant and all except trimmed loin are negative. Trimmed round is highly significantly correlated with untrimmed chuck (.59) and trimmed chuck (.62) and not significantly correlated with rib and loin. Untrimmed chuck and trimmed chuck were closely related with a highly significant correlation of .97. A negative highly significant correlation (-.38) exists between untrimmed chuck and untrimmed loin while the trimmed loin had a significant correlation of .35 with the untrimmed chuck. The trimmed chuck showed no significant correlation with the untrimmed or trimmed rib. Trimmed chuck is negatively and highly significantly correlated (-.37) with untrimmed loin and positively correlated with trimmed loin (.39).

<u>Simple correlation coefficients of fat trim from respective cuts and total fat trim with various probes and fat thickness at 12th rib</u>. Table 5 shows the relationships of the fat probes with trimmed fat of that particular cut and the total fat trim of the carcass. Round probe is not significantly correlated (.16) with the round trim or total fat trim (.27). Loin trim is significantly correlated (.34) with sirloin probe and total fat trim shows a highly significant correlation (.40) with the sirloin probe. The shortloin probe (.61) and average of the sirloin and shortloin probes (.57) are both highly significantly correlated with loin trim. Rib probe was significantly correlated with rib trim and not significantly correlated with total fat trim. The chuck probe was not significantly correlated with either chuck trim or total fat trim. An

average of the 5 probes was significantly correlated (.54) with total fat trim as was 12th rib fat depth (.50).

To assist in evaluating the data, Table 6 contains the means and standard deviations of the 30 characteristics which are included in this study. Table 7 contains the simple correlation coefficients of all the traits.

Table 4. Simple correlation coefficients of loin eye area ratio and untrimmed and trimmed round and chuck with trimmed and untrimmed individual wholesale cuts.

	Loin eye area ratio	Round untrimmed	Round trimmed	Chuck untrimmed	Chuck trimmed
Round untrimmed	.26				
Round trimmed	.39**	.88**			
Chuck untrimmed	.37**	.40**	.59**		
Chuck trimmed	.39**	.39**	.62**	.97**	
Rib untrimmed	.24	-.26	-.09	.03	-.01
Rib trimmed	.37**	-.13	.04	.26	.25
Loin untrimmed	-.06	-.28	-.25	-.38**	-.37**
Loin trimmed	.17	.01	.24	.35*	.39**

* Significant at .05 level

** Significant at .01 level

Table 5. Simple correlation coefficients of fat trim from respective cuts and total fat trim with various probes and fat thickness at 12th rib.

	Fat trim on respective cut	Correlation with total fat trim
Round probe	.16	.27
Sirloin probe	.34*	.40**
Shortloin probe	.61**	.63**
Sirloin-Shortloin average probe	.57**	.62**
Rib probe	.34*	.23
Chuck probe	.11	.11
Five probe average		.54**
12th rib fat depth		.50**

* Significant at .05 level

** Significant at .01 level

Table 6. Means and standard deviations of characteristics studied.

	Mean	Standard deviation
Live weight	1298	96
Carcass weight	780	62
Carcass grade	18.06	1.61
Conformation grade	19.89	.83
Marbling score	5.27	1.04
Loin eye size	12.15	1.34
12th rib fat depth	.84	.20
Round probe	1.21	.24
Sirloin probe	.86	.21
Shortloin probe	.73	.20
Sirloin and shortloin average probe	.80	.17
Rib probe	.78	.26
Chuck probe	1.12	.31
Average of 5 probes	.95	.14
Square inch loin eye/100# carcass	1.57	.15
Loin untrimmed/100# carcass	17.54	.58
Loin trimmed/100# carcass	13.78	.65
Loin trim/100# carcass	4.51	.83
Total fat trim/100# carcass	9.15	1.28
Total trimmed wholesale cuts/100# carcass	70.00	2.07
Trimmed round, loin and rib/100# carcass	42.61	1.30
Round untrimmed/100# carcass	22.84	.75
Round trimmed/100# carcass	20.24	.80
Round trim/100# carcass	2.51	.36

Table 6. (Cont')

	Mean	Standard deviation
Rib untrimmed/100# carcass	9.61	.39
Rib trimmed/100# carcass	8.52	.39
Rib trim/100# carcass	.91	.25
Chuck untrimmed/100# carcass	28.79	.99
Chuck trimmed/100# carcass	27.40	1.01
Chuck trim/100# carcass	1.21	.29

Table 7. Simple correlation coefficients of each characteristic studied with all other characteristics.

	L.W.	Ca.W.	Ca.Gr.	Co.G.	M.S.	L.D.A.	F.D.	Ro.Pr.	Si.Pr.	Sh.Pr.	Si.-Sh.Pr.	Ri.Pr.	Ch.Pr.	Avg.Pr.	L.D.A./100	Lo.U.	Tr.Lo.	Lo.Tri.	T.F.Tri.	T.Tri.W.C.	Tri.Ro.L.&Ri.	Ro.U.	Tri.Ro.	Ro.Tri.	Ri.U.	Tri.Ri.	Ri.Tri.	C.U.	Tri.C.	C.Tri.
L.W.																														
Ca.W.	.97																													
Ca.Gr.	.42	.44																												
Co.G.	.47	.54	.63																											
M.S.	.42	.45	.97	.55																										
L.D.A.	.55	.55	.21	.30	.21																									
F.D.	.21	.21	.19	.24	.20	-.21																								
Ro.Pr.	.31	.40	.11	.41	.19	.10	.20																							
Si.Pr.	.07	.09	-.09	.10	-.08	.10	.24	.41																						
Sh.Pr.	.05	.06	-.05	.08	-.06	-.13	.54	.28	.41																					
S-S.Pr.	.07	.09	-.09	.10	-.08	-.02	.45	.41	.84	.84																				
Ri.Pr.	.27	.16	-.02	-.06	-.02	.10	.31	-.14	.16	.28	.26																			
Ch.Pr.	-.14	-.14	-.22	-.07	-.18	-.08	.09	-.01	.24	.26	.30	.02																		
Avg.Pr.	.19	.20	-.12	.13	-.07	.04	.45	.49	.73	.72	.87	.43	.56																	
L.D.A./100	-.14	-.16	-.12	-.10	-.13	.73	-.42	-.21	.06	-.21	-.09	-.01	.02	-.12																
L.U.	-.03	.02	.07	.08	.10	-.04	.21	.44	.39	.35	.44	.04	.01	.39	-.06															
Tri.L.	-.17	-.16	-.09	-.09	.00	.03	-.31	.03	-.12	-.44	-.33	-.21	-.12	-.27	.17	.32														
L.Tri.	.15	.20	.12	.21	.08	-.03	.42	.37	.34	.61	.57	.10	.06	.48	-.22	.44	-.64													
T.F.Tri.	.06	.08	.04	.04	-.01	-.20	.50	.27	.40	.63	.62	.23	.11	.54	-.32	.31	-.67	.89												
T.Tri.W.C.	-.19	-.22	-.31	-.24	-.27	.19	-.51	-.25	-.24	-.54	-.47	-.18	-.13	-.44	.42	-.24	.63	-.81	-.85											
Tr.Ro.L.Ri.	-.19	-.23	-.30	-.20	-.23	.15	-.40	-.18	-.13	-.49	-.37	-.12	-.11	-.34	.36	-.09	.70	-.74	-.75	.92										
Ro.U.	-.21	-.27	-.35	-.27	-.38	.03	-.32	-.20	.15	-.23	-.04	.01	.08	-.05	.26	-.28	.01	-.32	-.23	.52	.52									
Tr.Ro.	-.15	-.19	-.34	-.24	-.35	.19	-.41	-.26	-.01	-.38	-.23	-.09	-.02	-.24	.39	-.25	.24	-.49	-.52	.76	.74	.88								
Ro.Tri.	-.12	-.13	.01	-.05	-.02	-.36	.20	.16	.30	.36	.39	.18	.22	.40	-.33	-.03	-.49	.38	.64	-.57	-.51	.10	-.37							
Ri.U.	-.03	-.08	-.12	-.07	-.08	.15	.10	-.09	-.18	-.06	-.14	.16	-.12	-.09	.24	.18	.27	-.09	-.07	.19	.31	-.26	-.09	-.30						
Tri.Ri.	-.09	-.16	-.06	-.05	-.01	.21	-.30	-.17	-.34	-.28	-.37	-.08	-.08	-.32	.37	-.01	.40	-.37	-.41	.40	.44	-.13	.04	-.33	.77					
Ri.Tri.	-.09	.11	-.01	-.09	-.01	-.12	.57	.06	.27	.32	.35	.34	-.08	.32	-.24	.30	-.18	.43	.58	-.45	-.34	-.26	-.30	.13	.22	-.39				
C.U.	-.16	-.19	-.29	-.33	-.31	.16	-.48	-.33	-.28	-.43	-.42	-.18	-.06	-.42	.37	-.38	.35	-.71	-.69	.83	.58	.40	.59	-.46	.03	.26	-.40			
Tri.C.	-.14	-.16	-.25	-.24	-.25	.19	-.54	-.29	-.32	-.48	-.48	-.21	-.13	-.48	.39	-.37	.39	-.72	-.78	.87	.61	.39	.62	-.52	-.01	.25	-.48	.97		
C.Tri.	-.10	-.15	-.19	-.28	-.23	-.24	.24	-.14	.17	.32	.29	.24	.11	.23	.17	-.12	-.37	.23	.55	-.33	-.29	.04	-.15	.39	.11	-.03	.31	-.11	-.31	

Correlation of .29 significant at .05 level
Correlation of .37 significant at .01 level

Codes for observations

L.W. —Live weight
Ca.W. —Carcass weight
Ca.Gr.—Carcass grade
Co.Gr.—Conformation grade
M.S. —Marbling score
L.D.A.—Longissimus dorsi area
F.D. —12th rib fat depth
Ro.Pr.—Round probe
Si.Pr.—Sirloin probe
Sh.Pr.—Shortloin probe

Si.-Sh.Pr.—Sirloin and Shortloin probe average
Ri.Pr. —Rib probe
Ch.Pr. —Chuck probe
Avg.Pr. —Average of 5 probes
L.D.A./100—Longissimus dorsi area per 100# carcass weight
Lo.U. —Loin untrimmed
Tri.Lo. —Trimmed loin
Lo.Tri. —Loin fat trim
T.F.Tri. —Total fat trim
T.Tri.W.C.—Total trimmed wholesale cuts

Tri.Ro.L.&Ri.—Trimmed round loin & rib
Ro.U. —Round untrimmed
Tri.Ro. —Trimmed round
Ro.Tri. —Round fat trim
Ri.U. —Rib untrimmed
Tri.Ri. —Trimmed rib
Ri.Tri. —Rib fat trim
C.U. —Chuck untrimmed
Tri.C. —Trimmed chuck
C.Tri. —Chuck fat trim

DISCUSSION

Prior to drawing any conclusions it would be well to review some of the conditions involved in this study. The mean weight of the 48 carcasses was 780 pounds which is heavier than generally termed as ideal for market weight. The steers were large and the heavy weight was not necessarily an indication of excessive fatness. The steers in this study were all fed on basically the same ration, handled in the same manner and were randomly selected from a group of 143. The standard deviations of the carcass characteristics, noted in Table 6, in general were small, indicating a high degree of consistency within the measurements.

Loin eye area ratio used in this study was highly significantly correlated (.42) with total trimmed wholesale cuts. This correlation was very similar with that noted (.43) by Cole et al. (1960) when comparing loin eye area with total separable carcass lean. Highly significant correlations of .57 on a within year basis and .28 on a within year and breed basis were also noted in their work between loin eye area and carcass separable lean.

The trimmed chuck was the best indicator of total trimmed wholesale cuts in this study as a highly significant correlation of .87 was obtained. This also resembled the correlation of .93 noted by Cole et al. (1960) between separable lean of the chuck and separable lean of the entire carcass. Total separable lean was highly significantly correlated with the separable lean of the sirloin (.80) and shortloin (.75). In this study the trimmed loin was highly significantly correlated (.63) with trimmed wholesale cuts. Trimmed rib, although highly significantly correlated (.40) with trimmed wholesale cuts, was not as highly correlated as was separable lean of the rib with total separable carcass lean (.79) in the Cole et al. (1960) study.

It was interesting to note the similarity between the correlations in this study and those of Cole et al. (1960). This study involved the trimmed round, loin, rib and chuck correlated with the loin eye area expressed per hundred pounds of carcass weight. In the Cole et al. (1960) study the wholesale cuts were separated into bone, fat and separable lean and correlated with the actual loin eye area. Their correlations were calculated on a within year, within year and breed, and disregarding year and breed basis.

The actual loin eye area in this study was not significantly correlated with any of the wholesale cuts individually or the cuts as a whole. Boughton (1958) experienced similar results with correlations of .11 for steers and .08 for heifers between loin eye area and percentage of wholesale cuts. It can be stated, from the results of this work, that the trimmed round and chuck are very good indicators of the total trimmed wholesale cuts. The untrimmed round and chuck are also good indicators, but cannot account for the amount of variation obtained by using trimmed round and chuck. The trimmed chuck and round accounted for 76 and 58 percent of the variation in trimmed wholesale cuts, while loin eye area ratio accounted for only 18 percent. In the study by Cole et al. (1960) the separable lean of chuck and round accounted for 86 and 90 percent of the variation and loin eye area 18 percent or less of separable carcass lean on a within year and breed basis or disregarding year and breed effects.

It must be remembered that individual wholesale cuts are a part of total trimmed wholesale cuts which accounts to some degree for the high correlations noted. However, this automaticity would be a factor in any carcass work where a portion was compared with a total of which it was a part.

Although untrimmed chuck and round were not as good indicators as trimmed cuts, using them as indicators of trimmed wholesale cuts would be economical, easy to obtain and their weight would account for more of the variation (27 to 69 percent) than area of loin eye ratio (18 percent). Untrimmed chuck (-.69), trimmed chuck (-.78) and trimmed round (-.52) were negatively highly significantly related with total fat trim. This indicated that as fat trim increased the percentage of these cuts in the carcass decreased. As fat in cattle increases the percent of trimmed and untrimmed chuck and trimmed round decreases. Area of loin eye ratio also indicated this but at lower levels (-.54 to -.41) than wholesale cuts. Kropf and Graf (1959) found that as the carcass weight and grade increased, percentage of fat also increased.

When the three most valuable of the four wholesale cuts, round, loin and rib were considered, the correlations with loin eye area ratio, trimmed round and chuck and untrimmed chuck were lower than those noted with the four trimmed wholesale cuts. The untrimmed round showed identical correlations (.52) with total trimmed wholesale cuts and trimmed round, loin and rib. The loin eye area ratio is significantly correlated (.36) with trimmed round, loin and rib while it was highly significantly correlated (.42) with the total trimmed wholesale cuts. The addition of the chuck changed the correlation from significant to highly significant. Very little change was noted between the correlations of trimmed round with total trimmed wholesale cuts (.76) and with trimmed round, loin and rib (.74). The correlation decreased from .87 for trimmed chuck with total trimmed wholesale cuts to .61 with trimmed round, loin and rib. A similar decrease from .83 to .58 was noted between untrimmed chuck and total trimmed wholesale cuts and trimmed round, loin and rib. The trimmed round may be considered to be the best indicator of the trimmed round, loin and rib from the results of this study. The shortloin probe provides a good negative indicator of the three major cuts trimmed with a correlation of -.49.

Trimmed loin was highly significantly correlated (.70) with the three major cuts trimmed while the loin trim was a highly significant negative indicator with a correlation of -.74. Total fat trim was a negative indicator with a highly significant correlation of -.75 with the three major cuts trimmed. The trimmed round, loin and rib were highly significantly correlated (.92) with the total trimmed wholesale cuts.

A small negative correlation (-.13) was noted between loin eye area ratio and marbling score. Bray and Merkel (1957) also observed a low correlation between loin eye area and marbling score in their work with U.S. Prime and Choice Hereford steers. This indicated that we cannot predict marbling scores using loin eye area ratio as a criterion. The loin eye area ratio was slightly negatively correlated (-.10) with carcass conformation grade. Although it has been thought that a large loin eye area was associated with a desireable carcass conformation, the results of this study indicate that this was not true. Results also show a small but significant correlation of unadjusted loin eye area with conformation grade. The negatively significant correlations between untrimmed chuck (-.29), untrimmed round (-.35) and trimmed round (-.34) with carcass grade do not account for enough of the variation in carcass grade to be considered as important indicators. Loin eye area ratio is slightly negatively correlated with carcass grade. According to this, if the loin eye area ratio does influence carcass grade, it has a depressing effect. Unadjusted loin eye area showed a low correlation (.20) with carcass grade. This coincides with a .10 correlation noted by Clifton (1952) between loin eye area and carcass grade. The loin eye area and loin eye area ratio used in this study were poor indicators of carcass grade.

Live weight and carcass weight were both negatively correlated with the loin eye area ratio. The loin eye area was highly significantly correlated with carcass weight (.55) and live weight (.55). When the loin eye area was adjusted to carcass weight, as it was in this study, negative correlations were noted with carcass weight (-.16) and live weight (-.14). Live and carcass weight may serve as an indicator of unadjusted loin eye area but not for the loin eye area ratio used in this study. Live and carcass weight were poor indicators of untrimmed and trimmed round and chuck.

It was apparent from this work that live and carcass weight were not signficiantly correlated with total fat trim and 12th rib fat depth. This indicated that the total trim per hundred pounds of carcass and 12th rib fat depth do not necessarily increase as the steer or carcass become heavier. This is in disagreement with work by Kropf and Graf (1959), that showed an increase in fat trim as the grade and weight increased. Carcass grade cannot be determined by total fat trim or 12th rib fat depth as the correlations between these traits were low and non significant.

Carcass grade was very highly significantly correlated (.97) with marbling score. Since carcass grade and marbling score were so closely related it was not surprising to note that marbling score was not significantly correlated with fat trim or 12th rib fat depth. Correlations of .42 and .45, which are highly significant, were noted between marbling score, and live and carcass weight. As the live and carcass weight increased, an increase in marbling and no significant change in fat trim or 12th rib fat depth were noted. Heavier carcasses were associated with higher marbling scores and lower total fat trim per hundred pounds and shallower fat depth at the 12th rib. Results that somewhat paralled these were reported by Simone et al. (1957). They found in a 207 day feeding trial that after 185 days on feed, average fat content of the carcass decreased and average fat content of the eye muscle (marbling) increased.

Individual fat probes or averages were not significantly correlated with marbling. Fat trim from the four wholesale cuts did not approach a significant level when correlated with marbling score. Three of the four fat trim percentages showed negative correlations with marbling. The various fat indicators used in this work, definitly showed no relationship between outside fat cover and marbling score. Low correlations were noted by Bray and Merkel (1957) between marbling score and 12th rib fat cover. It may be concluded from these results, that a steer does not need to have excessive outside fat in order to have a high marbling score. This is important from an economical standpoint, as excessive outside fat is undesireable from the producers, packers and consumers point of view.

The 12th rib fat depth has at times been used as an indicator of degree of fatness. In this study the shortloin, sirloin and shortloin average and the average of five probes were more highly correlated (.63, .62 and .54) with total fat trim, than was 12th rib fat depth (.50). Although the .50 correlation was highly significant, it would appear that using the shortloin probe or shortloin and sirloin average would be a more efficient method of determining total fat trim. The shortloin probe could account for 40 percent of the variation in total fat trim. The round (.27), rib (.23) and chuck (.11) probes were not significantly correlated and thus were not good indicators of total fat trim.

Loin trim (.89), round trim (.64), rib trim (.58) and chuck trim (.55) were all highly significantly correlated with total fat trim. It was not surprising that loin trim showed the highest correlation, as it made up 49 percent of the total fat trim. Round, rib and chuck trim made up 27, 10 and 13 percent respectively of the total fat trim.

Trimmed wholesale cuts were negatively highly significantly correlated

(-.85) with total fat trim. It may be assumed that as the total fat trim increased, the percentage of trimmed wholesale cuts decreased. The trimmed wholesale cuts were negatively highly significantly correlated with total fat trim in nearly the same order as they rated on a percentage basis of total wholesale cuts. The percentage of total wholesale cuts and negative correlation for each of the trimmed cuts with total fat trim were; chuck 39 percent (-.78), round 29 percent (-.50), loin 20 percent (-.67) and rib 12 percent (-.41). The shortloin (.54), shortloin-sirloin average probe (.45) and the average of five probes (.45) were all highly significantly correlated with 12th rib fat depth. The chuck probe showed almost no correlation and round, sirloin and rib probes did not show as highly significant correlations as noted above. The shortloin probe showed the highest relationship of all probe measurements with 12th rib fat depth. The shortloin probe as indicated earlier showed the highest correlation with total fat trim. Loin trim (.42) and rib trim (.57) were highly significantly correlated with 12th rib fat depth while round and chuck trim were .20 and .24 respectively. These correlations were not as high as those noted between trim from the cuts and total fat trim. Correspondingly, trimmed loin and wholesale cuts did not show the high negative correlations with 12th rib fat depth, that was noted with total fat trim, although they were highly significant.

The shortloin probe was not as highly negatively correlated (-.54) with trimmed wholesale cuts as was total fat trim (-.85), but considering the simplicity of the shortloin probe in comparison with obtaining total fat trim, it seemed to be the most practical of the two. The shortloin probe proved to be a good practical indicator of total trimmed wholesale cuts. It was negatively highly significantly correlated (-.54) and could account for 29 percent of the variation in trimmed wholesale cuts. This correlation and variation percentage was not as high as those obtained from the chuck, round and loin, but it would be a measurement which could be obtained without damaging the carcass or going to the expense of cutting or trimming the carcass. Since the shortloin probe showed a highly significant positive correlation (.63) with total fat trim, and a highly significantly negative correlation (-.54) with total trimmed wholesale cuts, it stood out in this work as an indicator which deserves further consideration. Trimmed loin (.63) and rib (.40), although highly significantly correlated with trimmed wholesale cuts, would not give as accurate an indication of trimmed wholesale cuts as trimmed chuck and round.

Loin trim was negatively highly significantly correlated (-.81) with trimmed wholesale cuts. This correlation was not as high as that for total fat trim (-.84) with trimmed wholesale cuts. If the trim from only one wholesale cut was to be used to assist in determining trimmed wholesale cuts per hundred pounds of carcass, the loin trim would be the most accurate indicator. The trim from the round, rib and chuck were all significantly or highly significantly correlated negatively with the trimmed wholesale cuts, but not as high as loin trim.

Carcass grade and conformation grade would not serve as adequate indicators of trimmed wholesale cuts as the negative correlations were -.31 and -.24 respectively. Carcass grade was negatively significantly correlated with trimmed wholesale cuts, but would account for a small percent of the variation in the trimmed wholesale cuts. Carcass grade was highly significantly correlated with only four other carcass characteristics in this study. They were; marbling score (.97), conformation grade (.63), carcass weight (.44) and live weight (.42). Marbling score and conformation grade may be said to be the only two reliable indicators of carcass grade according to this work. Wheat and Holland

(1959) noted a smaller correlation (.25) between carcass conformation and after ribbing carcass grade.

The only highly significant correlations noted, when comparing individual wholesale cuts with other wholesale cuts, were between the chuck and round. The untrimmed round was a fair indicator of untrimmed chuck with a highly significant correlation (.40), a similar correlation (.39) existed between untrimmed round and trimmed chuck. Neither trimmed nor untrimmed round were good indicators of the pounds of rib or loin, trimmed or untrimmed. Untrimmed and trimmed chuck were of some value in determining percentages of untrimmed and trimmed loin, but the accuracy was low although the correlations were either significant or highly significant. The trimmed round was highly significantly correlated with the chuck, either trimmed (.62) or untrimmed (.59). The assumption may be drawn that a heavy trimmed round indicates a heavy trimmed or untrimmed chuck or that a heavy chuck was a good indicator of a heavy trimmed round. The untrimmed chuck (.97), round (.88) and rib (.77) were highly significantly correlated with their trimmed counterparts. The correlation of untrimmed loin with trimmed loin (.32) was less than half of that noted for the other three wholesale cuts. This may be accounted for by the fact that the fat trim made up 25 percent of the untrimmed loin, 10 and 11 percent of the untrimmed rib and round and only four percent of the untrimmed chuck.

Loin eye area ratio was highly significantly correlated with trimmed round (.39), trimmed chuck (.39), trimmed rib (.37) and with only one untrimmed cut, the chuck (.37). The loin eye area ratio is slightly negatively correlated (-.06) with the untrimmed loin and had a low correlation (.17) with the trimmed loin. When unadjusted loin eye area was used, extremely low correlations were still noted with the untrimmed (-.04) and trimmed loin (.03). These low correlations were surprising, as the longissimus dorsi muscle is a large component of the loin. There are several possible reasons for this lack of relationship. Since about one-fourth of the untrimmed loin weight is fat, it is possible that this variable could account for a certain portion of the lack of relationship. The inside fat trim of the loin cut could be a factor contributing to the low relationship. However, when the fat was trimmed to a standard depth, the correlation was only slightly improved and still did not approach significance. Length of loin could possibly be a factor. Orme (1959) found that when carcass length was combined with an average of three loin eye area measurements, the correlation increased from .52 to .61. Percent of bone in the loin cut, may also alter the weight enough to cause the lack of relationship. Cole et al. (1960) noted a significant correlation of .26 with loin eye area and separable shortloin lean and a non significant relationship of .21 with sirloin lean. The above two correlations were using absolute values on a within year and breed basis. The correlations increased on the with in year basis to .40 for sirloin lean and .44 for shortloin lean, which were both highly significant. Separable sirloin lean (.22) and shortloin lean (.44) were both highly significantly correlated with loin eye area, when year and breed effects were ignored.

Future studies may be justified which would determine if the loin eye tracing would be of more value, as an indicator of loin meatiness, if it were made in some other location. The shortloin probe was the most valuable probe from the standpoint of determing total fat trim and perhaps a loin eye measurement at some point other than the 12th rib would be a more suitable indicator of total trimmed wholesale cuts or separable lean.

The shortloin probe was highly significantly correlated (.61) with loin trim and (.63) with total fat trim. The only probe correlation which approached this, was the shortloin-sirloin average which was highly significantly correlated (.62) with total fat trim. The average of the 5 probes and 12th rib fat depth were fair indicators, as they were highly significantly correlated (.54 and .50) with total fat trim. The shortloin probe accounted for 40 percent of the variation in total fat trim while the five probe average accounted for 29 percent. The rib, chuck and round probes are not significantly correlated with total fat trim. The sirloin probe was highly significantly correlated (.40) with total fat trim, but the correlation was so much lower than that noted for the shortloin, that there seemed to be no need of using the sirloin probe. Round and chuck probes could not be used as indicators of round or chuck fat trim, as correlations were low and non significant. Rib and sirloin probes are significantly correlated with trim from rib (.34) and loin (.34). The sirloin and shortloin probe average was highly significantly correlated (.57) with loin trim and the shortloin probe showed a higher correlation (.61) with loin trim.

SUMMARY

Forty-eight Hereford steers, fed at the Fort Hays Branch Station of the Kansas Agricultural Experiment Station, were the steers used in this study. The 48 were randomly selected from 143 two year old steers finished at the Hays Branch. Their mean carcass weight was 780 pounds, with a standard deviation of 62 pounds.

Simple correlation coefficients were calculated between 29 carcass characteristics and one live characteristic considered in the study. Carcass observations included; carcass and conformation grade, marbling score, longissimus dorsi area, 12th rib fat depth, and 5 carcass fat probe depths, untrimmed, trimmed and fat trim of the round, loin, rib and chuck and carcass weight. Live

weight was also considered. The outside fat of the wholesale cuts was trimmed to one-quarter inch depth. All weights and loin eye area were adjusted by dividing by carcass weight and multiplying by 100.

The trimmed chuck (.87), untrimmed chuck (.83), trimmed round (.76) and untrimmed round (.52) were more highly significantly correlated with total trimmed wholesale cuts, than the loin eye area ratio (.42) or actual loin eye area (.19). The chuck and round accounted for 27 to 76 percent of the variation in total trimmed wholesale cuts, while loin eye area accounted for only 18 percent.

Carcass grade was very highly correlated with marbling score (.97), which indicates the very dominant influence of marbling in determining carcass grade under present U. S. D. A. standards. Other characteristics significantly correlated with carcass grade were conformation grade (.55), carcass weight (.45) and live weight (.42). Carcass grade was negatively significantly correlated with total trimmed wholesale cuts (-.31), trimmed round (-.34) and untrimmed round (-.35). As carcass grade increased the pounds of trimmed and untrimmed round and total trimmed wholesale cuts per 100 pounds carcass weight decreased.

Total fat trim (-.01) and shortloin probe (-.06) were non significantly negatively correlated with marbling score. Marbling score was not significantly correlated with 12th rib fat depth (.20). Exterior fat indicators were poor indicators of marbling score. The shortloin probe was a very good indicator of total fat trim (r=.63) and exceeded 12th rib fat depth and other measurements as predictors of total fat trim. Shortloin probe was also a good indicator of trimmed wholesale cuts as it showed a negative correlation of -.54 with total trimmed wholesale cuts. The shortloin probe may, in the future, be used as an indicator of carcass meatiness and fat trim.

When the chuck, a cut that contains more seam fat than the other cuts, is not considered with trimmed round, loin and rib the correlations with round and shortloin probe are still very good. Trimmed round (.74) and untrimmed round (.52) were highly significantly correlated with the three major trimmed wholesale cuts. Shortloin probe was highly significantly negatively correlated (-.49) with the trimmed round, loin and rib.

Loin eye area ratio or unadjusted loin eye area in this study was not a good indicator of total pounds of untrimmed or trimmed loin per hundred pounds of carcass.

This study indicated that area of loin eye and 12th rib fat depth can be over emphasized as measures indicating total trimmed wholesale cuts. Additional studies need to be made before breeders place too much emphasis on these traits in their breeding improvement programs. The weight of the round is easily obtained, contains a small amount of inside and outside fat, is a large portion of the carcass and in this study was a more important measure of total trimmed wholesale cuts than loin eye area.

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APPENDIX

Table 8. Data from the Hereford steers used in this study.

Carcass Number	Live Weight	Carcass Weight	Left Side Weight	Right Side Weight	R.Fore Quarter Weight	R.Rear Quarter Weight	Carcass Grade	Conformation Grade	Marbling Score	Loin Eye Area	Fat Depth 12th Rib	Round Probe
146	1315	771	394	380	196	184	G+	C	5	10.67	1.3	.9
186	1310	800	405	395	197	198	C-	C-	6	12.31	1.2	1.1
30	1450	852	434	416	215	201	G	C	4	12.09	.8	1.3
169	1405	837	419	420	220	200	C	C	6	11.52	.9	.6
113	1270	774	389	385	198	187	G	G+	4	11.94	1.1	1.1
130	1205	747	374	374	188	186	G-	C-	4	11.35	.9	1.0
212	1185	714	360	354	178	176	C-	C	6	10.76	.8	1.4
63	1290	774	396	377	194	183	G-	C+	4	13.57	.8	1.3
177	1180	715	356	356	183	173	C	C-	6	10.97	.9	1.0
44	1115	666	339	326	170	156	G-	C	4	9.93	.9	1.3
89	1425	885	443	434	223	211	C-	C	6	15.84	.7	1.6
76	1485	890	449	441	220	221	C	C+	7	12.98	.9	1.4
160	1475	872	442	432	222	210	G-	C-	4	14.20	.9	1.4
36	1100	639	324	316	163	153	S+	C	3	9.49	.9	1.1
206	1315	795	405	392	200	192	G-	C+	4	13.53	.9	1.0
103	1260	751	381	369	191	178	G-	C-	4	13.27	.6	1.0
22	1260	744	375	369	188	181	C-	C	6	13.77	1.0	1.0
155	1290	777	387	388	202	186	G+	C+	5	10.91	1.0	1.3
181	1195	695	350	345	176	169	G-	C+	4	9.92	1.0	1.2
216	1485	904	452	442	229	213	C-	C+	6	12.20	1.1	1.6
49	1330	821	413	405	210	195	G+	C	5	13.87	.4	1.0
175	1350	821	414	405	206	199	C-	C	6	13.80	1.2	1.5
67	1250	732	370	364	190	174	C	C+	7	12.82	.7	1.2
222	1400	857	426	432	227	205	C-	C+	6	11.53	1.0	1.3

Table 8. (Cont')

Carcass Number	Live Weight	Carcass Weight	Left Side Weight	Right Side Weight	R. Fore Quarter Weight	R. Rear Quarter Weight	Carcass Grade	Conformation Grade	Marbling Score	Loin Eye Area	Fat Depth 12th Rib	Round Probe
16	1215	713	363	362	190	172	G-	C	4	11.74	.6	1.0
164	1230	718	365	355	184	171	G-	C-	4	12.01	.6	1.0
168	1280	789	401	390	204	186	G	C-	5	10.91	.7	1.4
210	1320	800	406	407	214	193	G	C	5	11.04	1.2	1.3
15	1230	722	363	361	191	170	G+	C	6	10.52	.8	1.1
224	1210	719	365	356	190	166	G+	C	5	13.20	.8	.8
187	1390	821	414	406	214	192	C-	C	6	13.19	.7	1.0
132	1355	813	410	405	205	200	C+	C-	7	12.50	.9	1.3
68	1155	694	350	343	176	167	G+	C-	5	10.49	.4	1.0
192	1225	743	374	369	192	177	C-	C	6	10.11	.9	1.3
5	1205	744	375	369	186	183	G-	C	4	12.01	.6	1.6
81	1315	792	399	393	205	188	P-	C+	7	13.29	.9	1.0
183	1185	712	358	352	182	170	G	C-	5	10.17	.9	1.1
165	1370	799	401	396	205	191	C-	C	6	12.93	.8	1.2
121	1345	810	407	401	209	192	C-	C+	6	13.54	.7	1.0
189	1230	729	367	362	192	170	G-	C-	4	13.50	.5	.9
106	1490	903	458	444	229	215	C-	C	6	13.55	.9	1.5
4	1405	862	435	423	222	201	C-	C+	6	11.20	.8	1.3
47	1285	784	394	388	203	185	C-	C+	6	12.99	.9	1.5
57	1315	785	400	389	199	190	G+	C+	5	12.39	.7	1.3
145	1280	771	390	384	198	186	G+	C	5	12.83	.6	1.2
38	1275	764	387	379	197	182	C-	C	6	11.88	.8	1.1
37	1290	791	399	394	192	202	G+	C+	5	11.91	1.0	1.8
41	1360	847	426	421	222	199	C+	C+	7	12.14	.9	1.6

Table 9. Data from the Hereford steers used in this study.

Carcass Number	Sirloin Probe	Shortloin Probe	Rib Probe	Chuck Probe	Loin Untrimmed	Loin Inside Trim	Loin Outside Trim	Loin Trimmed	Round Untrimmed	Round Trimmed	Round Trim	Rib Untrimmed
146	.7	.8	1.3	1.4	68.00	7.75	9.25	52.50	86.75	77.75	8.50	38.75
186	1.0	1.2	1.0	1.2	72.25	8.75	15.25	50.25	88.25	76.25	12.00	36.25
30	.7	.5	.9	.9	69.75	9.00	7.75	55.50	98.50	86.00	11.75	37.25
169	.7	.5	.8	.8	72.50	10.25	10.00	55.25	92.75	82.75	9.50	40.50
113	.7	.8	1.0	.9	65.25	10.50	8.00	50.75	87.50	76.75	10.00	36.50
130	1.0	.7	.4	1.7	64.00	10.75	6.00	52.25	87.75	78.50	9.00	34.50
212	1.1	.5	.7	1.2	64.25	8.75	7.75	50.25	84.00	74.00	9.50	32.00
63	1.2	.8	.7	1.2	66.25	8.00	12.25	49.50	88.50	78.00	10.25	36.25
177	1.0	.8	1.1	1.1	63.00	7.75	9.50	47.50	81.00	70.00	10.50	30.75
44	.9	.9	.7	1.1	56.50	4.75	10.25	42.50	77.25	68.50	8.25	31.50
89	1.1	.9	.8	1.2	79.25	10.00	12.50	59.75	96.50	86.00	10.00	42.00
76	1.2	.6	1.4	1.5	81.25	8.75	12.25	62.75	104.50	91.75	12.50	41.25
160	1.2	.9	1.3	1.2	74.25	8.50	10.50	58.00	103.00	91.50	11.50	41.50
36	.9	.8	.8	1.2	55.50	5.75	7.00	44.50	73.50	64.00	9.00	30.00
206	.9	.7	1.0	1.4	68.50	10.50	11.00	52.00	87.00	79.75	6.75	39.25
103	.8	.6	.7	1.6	63.00	8.25	8.25	49.00	86.00	76.25	9.50	36.00
22	1.1	.9	.8	1.3	66.50	6.00	8.50	53.50	85.25	77.00	8.00	34.75
155	1.1	1.1	.9	1.6	66.50	9.25	9.75	49.75	87.75	75.00	12.50	37.50
181	1.0	1.0	.9	1.1	64.00	7.75	9.00	48.50	80.00	70.00	9.50	34.50
216	1.0	1.0	.7	1.4	80.50	11.00	9.75	62.25	96.75	84.00	12.50	43.50
49	.5	.5	.4	1.1	70.25	10.00	4.75	57.75	94.50	85.75	8.75	38.00
175	1.0	.9	.8	1.2	73.50	11.50	10.75	55.50	89.50	79.50	9.00	41.50
67	.7	.4	.7	1.2	61.75	7.25	5.00	51.75	82.00	73.75	8.00	36.50
222	.8	.9	.9	1.2	76.00	11.50	8.50	58.50	93.25	84.50	9.00	42.25

Table 9. (Cont')

Carcass Number	Sirloin Probe	Shortloin Probe	Rib Probe	Chuck Probe	Loin Untrimmed	Loin Inside Trim	Loin Outside Trim	Loin Trimmed	Round Untrimmed	Round Trimmed	Round Trim	Rib Untrimmed
16	.8	.6	.8	1.1	62.75	9.25	4.50	52.25	82.75	73.00	9.00	35.75
164	.8	1.0	1.2	1.5	61.75	8.75	7.25	47.75	82.50	74.00	8.50	35.00
168	.8	.6	.8	1.2	69.25	10.75	6.00	56.25	82.50	71.75	10.75	36.50
210	1.0	.9	1.1	1.0	67.00	9.00	9.25	52.50	94.25	82.00	12.00	39.00
15	.8	.7	.5	1.4	60.50	5.25	6.25	49.50	81.75	70.75	10.75	35.50
224	1.0	.5	.8	1.1	62.50	8.75	4.25	54.25	82.50	75.00	7.50	37.00
187	.7	.4	.7	1.1	68.75	10.75	6.00	56.00	95.00	85.50	8.50	39.50
132	1.0	.9	.5	1.2	70.75	6.50	11.00	52.00	90.00	78.00	10.75	36.25
68	1.1	.8	.7	1.0	61.00	6.50	6.50	50.00	80.50	71.50	8.75	32.25
192	.6	.7	.7	1.3	66.00	11.50	9.50	49.75	79.25	67.00	12.00	37.75
5	1.1	.6	.6	1.0	70.00	9.75	10.25	52.75	84.25	75.00	8.75	35.75
81	.7	.7	.8	.8	67.00	10.75	11.50	49.50	86.25	74.75	11.50	39.00
183	.5	.6	.5	.9	64.00	7.75	5.25	53.25	80.50	73.00	7.50	35.00
165	.5	1.1	1.0	1.0	71.50	8.50	12.00	54.75	87.75	77.50	9.50	39.50
121	.7	.6	1.1	1.1	65.75	9.00	5.50	54.00	96.25	83.25	11.50	37.25
189	.5	.4	.7	1.0	60.50	6.75	3.25	53.00	83.00	76.25	7.00	34.75
106	1.1	.7	.9	.4	80.50	11.00	9.50	64.75	97.25	87.75	9.25	44.25
4	.7	.7	.5	1.1	71.50	12.25	6.75	58.00	95.00	86.00	8.75	38.25
47	.8	.5	.6	1.0	69.25	8.00	5.00	59.25	85.00	76.00	8.75	40.00
57	1.1	.6	.6	1.0	67.00	6.00	12.50	50.50	92.75	81.00	11.50	37.25
145	.7	.5	.5	1.0	66.00	6.25	8.25	53.50	96.00	86.50	9.50	37.00
38	.6	.6	.7	.1	66.00	11.25	8.00	51.00	87.00	77.75	9.00	37.50
37	1.1	1.1	.4	1.3	72.75	12.50	15.00	52.50	89.25	78.00	11.00	36.25
41	.7	.6	.4	1.0	73.25	7.75	7.00	60.25	95.25	86.75	8.25	38.25

Table 10. Data from the Hereford steers used in this study.

Carcass Number	Rib Trimmed	Rib Trim	Chuck Untrimmed	Chuck Trimmed	Chuck Trim	Flank	Brisket	Plate	Loin Eye 100# Car.
146	32.75	5.50	106.50	100.25	5.50	22.00	15.75	33.75	1.40
186	30.75	4.75	106.00	101.00	4.25	26.50	17.50	35.25	1.56
30	33.50	3.00	121.25	115.25	5.25	24.00	22.00	35.75	1.45
169	35.50	4.50	120.25	113.00	6.75	24.00	20.00	36.25	1.37
113	31.50	4.75	111.00	103.50	6.75	22.50	18.25	32.00	1.55
130	29.50	4.25	106.75	101.25	5.00	21.50	17.25	27.75	1.52
212	27.75	4.00	97.50	94.75	2.75	19.50	17.75	28.75	1.52
63	31.50	3.75	113.25	107.25	5.50	19.75	15.50	28.00	1.80
177	27.50	3.25	103.25	98.75	3.75	22.25	18.25	30.25	1.54
44	27.00	3.75	100.25	94.50	5.50	18.75	13.00	24.75	1.52
89	37.50	4.50	122.50	116.75	5.00	26.25	23.00	37.75	1.82
76	35.25	5.00	123.25	115.75	6.50	26.25	19.25	36.25	1.47
160	35.25	5.50	126.50	119.25	6.50	24.75	19.25	33.25	1.64
36	26.75	2.50	92.50	87.50	4.00	17.75	14.75	25.25	1.50
206	33.75	4.25	113.75	108.00	4.75	24.75	16.00	30.75	1.73
103	32.25	2.75	109.50	104.50	3.75	21.25	16.75	29.25	1.80
22	31.50	2.50	107.25	102.50	3.50	22.50	16.75	29.25	1.87
155	33.00	3.50	110.75	103.25	7.50	23.50	20.00	22.75	1.41
181	30.50	3.00	96.00	90.75	4.25	19.75	15.00	29.75	1.44
216	38.50	3.75	126.75	120.75	4.75	27.75	19.50	39.75	1.38
49	35.00	2.25	123.75	118.50	3.75	20.75	18.00	22.00	1.71
175	35.50	4.75	112.00	106.00	4.50	23.25	17.25	34.00	1.70
67	33.00	2.50	106.25	101.25	3.50	21.50	14.75	31.25	1.76
222	36.75	4.50	122.50	116.50	4.50	24.00	19.75	40.75	1.33

Table 10. (Cont')

Carcass Number	Rib Trimmed	Rib Trim	Chuck Untrimmed	Chuck Trimmed	Chuck Trim	Flank	Brisket	Plate	Loin Eye 100# Car.
16	33.25	2.00	105.50	100.50	3.75	15.00	15.75	31.00	1.62
164	32.25	1.75	102.00	96.75	5.25	18.75	15.00	29.75	1.69
168	33.25	3.00	110.50	105.25	5.00	22.75	18.25	35.25	1.40
210	32.25	4.75	114.50	108.25	4.75	18.25	17.50	30.00	1.36
15	31.75	3.00	103.50	96.25	6.50	18.25	18.25	32.00	1.46
224	33.50	3.00	111.00	104.75	5.25	16.50	12.75	28.25	1.85
187	37.00	2.25	119.25	114.25	3.75	19.25	20.75	34.25	1.62
132	32.75	3.25	113.00	107.50	4.50	23.50	14.50	39.00	1.54
68	28.25	3.50	99.50	94.00	4.75	17.75	16.50	27.50	1.53
192	32.25	4.75	99.50	94.50	4.75	21.50	18.25	34.75	1.37
5	31.75	3.25	105.75	100.75	3.25	20.00	16.50	25.00	1.63
81	34.00	4.25	108.50	102.75	4.75	21.00	18.25	37.00	1.69
183	30.50	3.50	105.50	101.00	3.00	15.50	15.25	26.75	1.44
165	35.25	3.75	114.75	109.00	4.75	18.75	16.00	35.25	1.62
121	34.00	2.25	116.00	112.00	4.00	18.00	16.75	38.00	1.69
189	30.75	3.00	110.50	106.50	3.00	16.00	16.00	29.25	1.86
106	37.75	6.25	126.00	121.50	4.00	23.25	18.75	39.75	1.53
4	34.75	2.50	122.50	120.00	2.75	20.25	20.75	39.25	1.32
47	36.00	3.00	109.75	104.75	4.25	20.75	18.75	35.25	1.67
57	34.25	2.25	111.50	107.00	4.50	21.25			1.59
145	34.00	2.25	114.50	109.50	3.75	16.25			1.67
38	33.25	3.25	107.25	103.00	6.50	18.25			1.57
37	32.00	3.25	104.50	98.50	5.75	21.75			1.51
41	35.00	2.00	128.50	123.25	3.75	23.00			1.44

RELATIONSHIPS OF LOIN EYE AREA AND OTHER BEEF CARCASS CHARACTERISTICS WITH TRIMMED WHOLESALE CUTS AND FAT TRIM

by

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The longissimus dorsi muscle weight, specific gravity, length and cross sectional area have been used in studies to determine the edible or lean meat portion of beef carcasses. Results obtained range from highly significant correlations to observations of little relationship. This study was conducted to determine if loin eye area or some other carcass characteristic was highly associated with the four major trimmed wholesale cuts which are the round, loin, rib and chuck.

The carcasses of 48 two year old Hereford steers were used in this study. U.S. Grades represented were one Prime, one Standard, 21 Choice and 25 Good. Simple correlation coefficients were calculated between each characteristic and the 29 other characteristics used. Carcass observations were U.S. carcass and conformation grade and marbling score, loin eye area, 12th rib fat depth, five carcass fat probes and untrimmed, trimmed and fat trim weights from the round, loin, rib and chuck. Carcass and live weights were also used. The loin eye area and all weights were adjusted by dividing by carcass weight and multiplying by 100.

The trimmed chuck (.87), untrimmed chuck (.83), trimmed round (.76) and untrimmed round (.52) were more highly significantly correlated with total trimmed wholesale cuts, than the loin eye area ratio (.42) or actual loin eye area (.19). The chuck and round accounted for 27 to 76 percent of the variation in total trimmed wholesale cuts, while loin eye area accounted for only 18 percent.

Carcass grade was very highly correlated with marbling score (.97), which indicates the very dominant influence of marbling in determining carcass grade under present U. S. D. A. standards. Other characteristics significantly correlated with carcass grade were conformation grade (.55), carcass weight (.45) and live weight (.42). Carcass grade was negatively significantly correlated with total trimmed wholesale cuts (-.31), trimmed round (-.34) and untrimmed round (-.35). As carcass grade increased the pounds of trimmed and untrimmed round and total trimmed wholesale cuts per 100 pounds carcass weight decreased.

Total fat trim (-.01) and shortloin probe (-.06) were non significantly negatively correlated with marbling score. Marbling score was not significantly correlated with 12th rib fat depth (.20). Exterior fat indicators were poor indicators of marbling score. The shortloin probe was a very good indicator of total fat trim (r=.63) and exceeded 12th rib fat depth and other measurements as predictors of total fat trim. Shortloin probe was also a good indicator of trimmed wholesale cuts as it showed a negative correlation of -.54 with total trimmed wholesale cuts. The shortloin probe may, in the futute, be used as an indicator of carcass meatiness and fat trim.

When the chuck, a cut that contains more seam fat than the other cuts, is not considered with trimmed round, loin and rib the correlations with round and shortloin probe are still very good. Trimmed round (.74) and untrimmed round (.52) were highly significantly correlated with the three major trimmed wholesale cuts. Shortloin probe was highly significantly negatively correlated (-.49) with the trimmed round, loin and rib.

Loin eye area ratio or unadjusted loin eye area in this study was not a good indicator of total pounds of untrimmed or trimmed loin per hundred pounds of carcass.

This study indicated that area of loin eye and 12th rib fat depth can be over emphasized as measures indicating total trimmed wholesale cuts. Additional studies need to be made before breeders place too much emphasis on these traits in their breeding improvement programs. The weight of the round is easily obtained, contains a small amount of inside and outside fat, is a large portion of the carcass and in this study was a more important measure of total trimmed wholesale cuts than loin eye area.