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THE INFLUENCE OF GRADE, CUT, AND TRIM ON
YIELD AND ACCEPTABILITY OF FRESH
GROUND BEEF

BY

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THESIS

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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY
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INTRODUCTION AND SURVEY OF LITERATURE

Research on the quality characteristics of meat has been extensive, and commensurate with the consumption of the different cuts and forms, with the possible exception of ground beef. A search of the literature reveals practically no studies dealing with the effect of various factors on the composition or palatability of this product. Yet, according to an estimate by the National Live Stock and Meat Board (4), 15 percent, or over two billion pounds, of the beef consumed in 1958 was in the form of ground beef. Further, the Agricultural Marketing Service of the United States Department of Agriculture (9) reports that, ". . . ground beef is considered one of the most popular meat items by school children and it ranks first on the list . . . (of) many if not the majority of consumers according to sectional spot-check surveys."

Although seemingly popular, "hamburger" or "ground beef" appears to be an extremely variable product, from the standpoint of the producer as well as the consumer. In 1944, Tobey (7) reported the fat and moisture contents of "hamburg steak" purchased from local stores. The variability shown in that study would seem to attest the fact that the product does indeed lack uniformity.

This variability had led the Quartermaster Corps of the United States Army (8) and the United States Department of Agriculture (9) to work out definite specifications for this product in order to maintain uniform quality in the ground beef they purchase. The National Restaurant Association (4) has likewise referred to these specifications in order to furnish information to its members.

In essence, these specifications require federally inspected beef skeletal meat of U. S. Utility grade or higher, consisting of not less than

50 percent by weight of square-cut chucks, ribs, loins, or rounds, and the remaining 50 percent or less from flanks, briskets, plates, or shanks. There is to be no added moisture, extenders, or preservatives, and the fat content by chemical analysis must be not less than 15 percent nor higher than 25 percent inclusive.

Extensive studies on meats done at Oklahoma State University and compiled by Leverton and Odell (3) included "lean" and "regular" ground beef, containing 3.9 and 17.1 percent fat and 64.3 and 55.7 percent moisture, respectively.

The United States Department of Agriculture Handbook No. 8 (10) refers to raw hamburger as containing 28.0 percent fat and 55.0 percent moisture. It further mentions "medium fat" beef as containing 16 percent fat in the chuck and 11 percent fat in the round.

Aside from the above information there appears to be no reference material obtainable. In view of the widespread production and consumption of ground beef, and of the relatively limited information available, it would seem important to shed further light on what constitutes desirable ground beef, and to what extent these factors should be controlled by the producer, not only from the standpoint of desirability, but also from the occasionally more realistic standpoint of cost to the consumer.

Accordingly, this study was designed to determine the effect of the grade, the cut, and the trim of the original meat on the fat and moisture contents, cooking losses, and organoleptic qualities of the resulting ground beef.

EXPERIMENTAL PROCEDURE

Twelve carcasses were used for the study, of which six were graded U. S. Standard and six U. S. Commercial. All meat was obtained through the Department of Meats of the University of Illinois from a Peoria packing plant. All selection was done by an experienced grader, working from specifications set up by the head of the Meats Division. While breed and ages of the animals were not known, the weights were controlled so as to obtain a minimum of variation within each grade. One side of each selected animal was delivered to the meats laboratory according to a set pattern which controlled the extent of carcass aging to a range of 7-9 days, at which time all sampling was done, and the ground meat was cooked and judged immediately. Aging temperature was approximately 34-36°F. Weights and aging information are shown in the Appendix in Table 1, p. 21.

Sampling.--One round and one chuck from each side were sampled according to the following procedure:

All external fat was removed, weighed, and ground through a 1/2" breaker plate. The cut was boned; all remaining lean and internal fat were weighed together, and then ground through the 1/2" breaker plate, mixed, and a six-pound random sample was removed.

Half of this sample was immediately reground through a 1/16" plate. The remaining three-pound sample was mixed with a random sample of the ground fat; the amount being determined by the ratio by weight of external fat to weight of lean and internal fat as found originally for each cut. This mixture of external fat and lean and internal fat was then also reground through the 1/16" plate. In other words, the latter sample was representative of the "untrimmed" cut, while the former was representative of the "trimmed" cut,

allowing determinations which, it was hoped, would reflect the effects of both trimmable and non-trimmable fat present in each chuck and each round.

The three-pound samples were ground with a Toledo Size 11 grinder; larger amounts were ground with an Enterprise Size 23 grinder. All grinder parts were thoroughly washed and dried after each grinding, and all meat was refrigerated until needed.

Chemical Analysis.--From each three-pound sample thus prepared, a one-pound sample was removed, and further ground three times through the 1/16" plate with the Toledo grinder. From these, approximately 125-gram portions of the finely divided meat were placed in tightly closed polyethylene sample bottles for chemical analysis.

Fat and moisture determinations were made in duplicate on each sample according to the methods for moisture and crude fat determination given by the Association of Official Agricultural Chemists (1, p. 386), with one modification. Weighed amounts of approximately four grams were held overnight in an oven at 50°C, and then dried at 102°C for two hours.

Cooking and Judging.--No attempt was made to incorporate the ground beef into a recipe, for example, meat loaf; rather, it was decided that a better comparison of the meat itself could be made if no other ingredients were present. Also, since many users of ground beef must make use of oven preparation rather than grills because of lack of equipment or time, it was decided that perhaps more meaningful information could be obtained in this manner.

Throughout the development of the entire cooking procedure, an attempt was made to duplicate conditions which would be likely to exist on the institutional level, since it was believed that here might be encountered much of the consumption and many of the problems. Therefore, during preliminary studies the following cooking procedure was devised:

To each two-pound sample of ground beef was added one teaspoon of salt, and the sample was lightly mixed by hand. Using a No. 12 ice cream scoop, the meat was then dipped onto a Hanson dietetic gram scale, and the weight adjusted as necessary to 90 grams. Each patty was shaped quickly by hand to approximately 4" diameter by 1/4" thickness, and placed on a wire rack on an aluminum tray approximately 9" by 13", using a separate tray for each of the four samples being prepared ("trimmed" and "untrimmed" chuck and "trimmed" and "untrimmed" round). Eight patties were prepared from each sample. Weights were recorded for the trays and racks before and after the patties were placed on them.

The four trays were placed in a Hotpoint electric deck oven set at 375°F (190.5°C) which had been allowed to cycle twice to reach uniform heat. The oven thermostat was checked against a calibrated Taylor oven thermometer. Patties were cooked for 15 minutes. The trays were removed from the oven and weighed to determine evaporative loss. After the patties had been served to the judges, the trays were again weighed to determine drippings loss.

The patties were coded and served to a taste panel of six experienced judges, who scored them for flavor, texture, color, and juiciness on a five-point continuum of desirability-undesirability. The scorecard (see Appendix, p. 27) was arranged to allow a maximum of five points for each of the color and juiciness scores, and two five point ratings for each of the flavor and texture scores; flavor was rated both for intensity and desirability, and texture was considered from the standpoints of both tenderness of the meat and compactness of the patty. This was done in an attempt to obtain more critical judgments of the patties; it did not weight the scorecard, since only total scores were analyzed.

Differences due to grade, cut, and trim in fat and moisture contents, yield, and organoleptic qualities were tested for significance by analysis

of variance (2). Percentages of crude fat and moisture were calculated in terms of the original sample weight, and the means for the duplicate samples were used for analysis. Cooking losses were subtracted from original patty weights and percentage yields were calculated on the basis of total weights for all eight patties. Judges scores for the individual characteristics of flavor, texture, color, and juiciness were not analyzed; rather, the total scores for each sample were used. No attempt was made to check the internal consistency of each judge, or the variation between judges.

RESULTS AND DISCUSSION

For purposes of clarity, fat contents, moisture contents, yield and organoleptic qualities as affected by grade, cut, and trim will be discussed separately. In the Appendix, pp. 21 to 27 inclusive, are presented complete raw data for fat and moisture contents, cooking losses, yield, and judges scores; and analysis of variance tables. Grand means and sub-grand means are given in this section. Grand means include all possible replications and variations in that sample differentiation; i.e., a grand mean for chuck includes values for all replications for both grades and both trims. A sub-grand mean omits values for any two of the following: one grade, one cut, one trim. For example, chuck, trimmed omits the values for round and chuck untrimmed.

Fat Content.--Grand means for percentage fat are shown below; the differences between grades, cuts, and trims were highly significant. In other

<u>Sample Differentiation</u>	<u>Mean Percentage Fat</u>
U. S. Commercial	20.2**
U. S. Standard	15.4
Chuck	21.0*
Round	14.6
Trimmed	14.8
Untrimmed	20.9**

**Significantly higher at 1% level

words, U. S. Commercial contained significantly more fat than U. S. Standard, chuck had significantly more fat than round, and untrimmed samples showed significantly higher fat content than trimmed. These percentages are lower than that listed in the United States Department of Agriculture Handbook No. 8 (10), which gives a value of 28.0 percent fat for raw hamburger and vary

around the percentage of 17.1 mentioned by Leverton and Odell (3). However, since this present study is dealing with specific sources rather than just ground beef per se, these discrepancies might be expected. The "medium fat" beef, which contains 16 percent fat in the chuck and 11 percent fat in the round, according to Handbook No. 8 (10), does appear to be quite similar in fat content to that for U. S. Standard chuck and round as shown in the tabulation below, which also shows a further influence of trimming on grade and cut.

Sample Differentiation	Mean Percentage Fat	Difference
U. S. Commercial, trimmed	16.4	
U. S. Standard, trimmed	13.2	3.2
U. S. Commercial, untrimmed	24.1	
U. S. Standard, untrimmed	17.7	6.4*
Chuck, trimmed	19.0	
Round, trimmed	10.5	8.5*
Chuck, untrimmed	23.2	
Round, untrimmed	18.7	4.5
U. S. Commercial Chuck	24.2	
U. S. Standard Chuck	18.0	6.2
U. S. Commercial Round	16.3	
U. S. Standard Round	12.9	3.4

*Significantly greater at 5% level

As might be expected, differences between grades were decreased by trimming (6.4 versus 3.2) indicating that the external fat was largely responsible for the variation between grades in fat content. However, the differences in fat content between cuts were increased by trimming, indicating that internal fat was more responsible for the variation between cuts. It would appear, then, that fat content of the two primal cuts of chuck and round from the two grades tested would be quite different, due to 1) the external fat variation, due to grade; and 2) the internal fat variation, due to cut.

This tendency can be illustrated diagrammatically, as is done in Figures 1 and 2, by plotting the percent fat contents for grades and cuts before and after trimming. The difference in the slope of the two lines is indicative of the significance of the differences in fat content. Grade, however, did not significantly affect the differences in fat content between cuts. As can be seen in Figure 3, the slope of the lines is more similar, suggesting that the differences in fat contents between grades are not significant when considering each cut separately.

Figure 1
Influence of Trim on Grade Fat Content

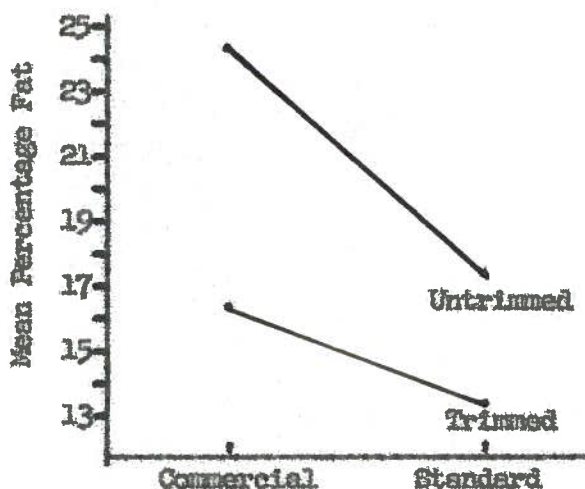
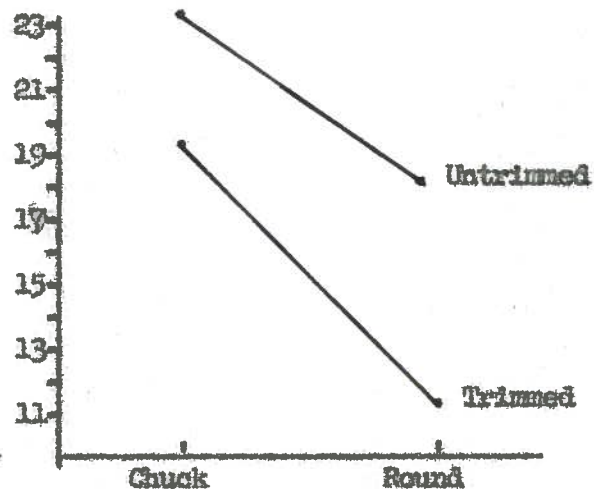
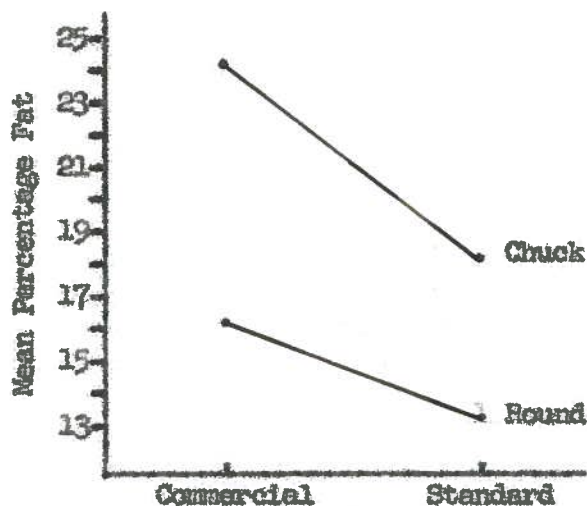


Figure 2
Influence of Trim on Cut Fat Content



In other words, U. S. Commercial chuck had a higher fat content than U. S. Standard chuck, and U. S. Commercial round had a greater amount of fat than U. S. Standard round, although both grades of chuck had more fat than the corresponding grade of round, regardless of whether or not the cut had been trimmed.

Figure 3
Influence of Cut on Grade Fat Content



Moisture Content.--Grand means for percentage moisture contents are shown below; the differences between grades, cuts, and trims were highly significant. It can readily be seen from these percentages that U. S. Standard contained significantly more moisture than U. S. Commercial, round had significantly more moisture than chuck, and trimmed samples showed significantly

Sample Differentiation	Mean Percentage Moisture
U. S. Commercial	60.0
U. S. Standard	64.3**
Chuck	59.3
Round	64.5**
Trimmed	64.2**
Untrimmed	59.7

**Significantly higher at 1% level

higher moisture content than untrimmed. It is interesting to note that these values are in inverse relationship to the values for fat content, as shown previously.

Leverton and Odell (3) report moisture contents of 55.7 and 64.3 percent for "regular" and "lean" ground beef, respectively, which is consistent with the findings of the present study. The United States Department of

Agriculture Handbook No. 8 (10) lists 55.0 percent moisture for ground beef, which is considerably less than the present study shows.

Again, trimming showed a further influence on the variation between grades and between cuts. These sub-grand means are shown below. Trimming decreased the difference between grades, (4.2 versus 2.9) and when the amounts

Sample Differentiation	Mean Percentage Moisture	Difference
U. S. Commercial, trimmed	63.2	2.9
U. S. Standard, trimmed	66.1	
U. S. Commercial, untrimmed	56.8	4.2*
U. S. Standard, untrimmed	62.6	
Chuck, trimmed	61.6	6.1*
Round, trimmed	67.7	
Chuck, untrimmed	58.1	3.2
Round, untrimmed	61.3	
U. S. Commercial Chuck	57.0	5.7*
U. S. Standard Chuck	62.7	
U. S. Commercial Round	63.0	3.0
U. S. Standard Round	66.0	

*Significantly greater at 5% level

of external fat in the mixture were decreased, moisture contents were greater. However, trimming increased the difference between cuts, indicating that external fat content did not influence the moisture content within the cut as much as did some other characteristic inherent in the cut itself. Previously, it was shown that trimmed chuck contained more fat than did trimmed round. In light of this, it can perhaps be concluded that this "inherent characteristic" of the cut which seems to influence moisture content is the fat content, since the higher percentage moistures are found in the cut with the lower percentage fat contents.

This tendency can also be illustrated diagrammatically, as is done in Figures 4 and 5, by plotting the differences in moisture contents for

grades and cuts before and after trimming. The difference in the slope of the two lines is indicative of the significance of the differences in moisture content.

Figure 4
Influence of Trim on Grade Moisture Content

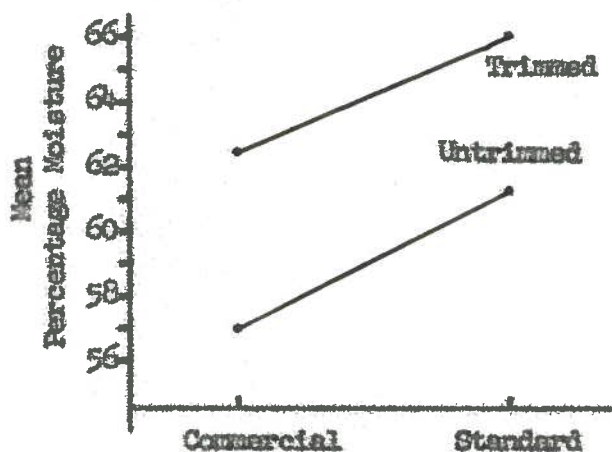
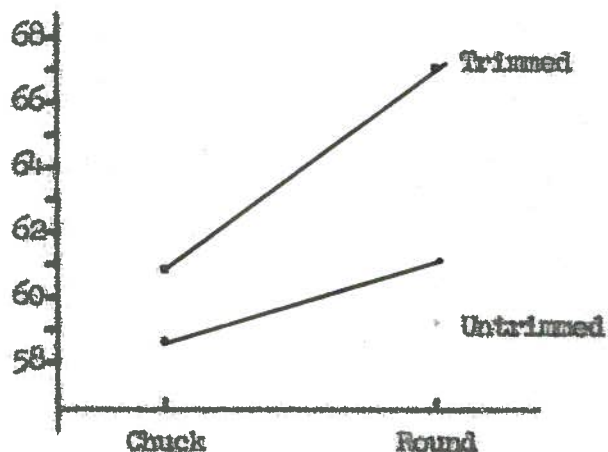
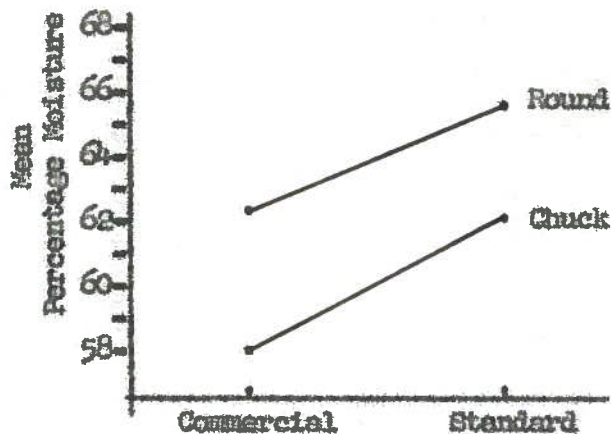


Figure 5
Influence of Trim on Cut Moisture Content



Although there was not significant variation between grades with respect to fat content to the two cuts, this was not the case with moisture contents, as can be seen in the previous table, and diagrammatically in Figure 6. In this study, round showed less variation in moisture content than did chuck when comparing U. S. Commercial with U. S. Standard grades.

Figure 6
Influence of Cut on Grade Moisture Content



In other words, U. S. Standard round had a higher moisture content than U. S. Commercial round, and U. S. Standard chuck had a greater amount of moisture than U. S. Commercial chuck. Furthermore, both grades of round contained consistently more moisture than the corresponding grade of chuck, although U. S. Standard chuck had significantly greater moisture content than U. S. Commercial--in fact, almost as high as that found in the round of U. S. Standard grade.

Yield.--Cooking losses, both evaporative and drippings, are reported in the Appendix in Table 6. Mean evaporative loss showed a range of 14.4-16.7 percent; mean drippings loss showed a range of 16.4-23.2 percent. Because of the importance of these figures in relation to cost, they will be discussed here in terms of yield rather than in terms of losses. Grand means are shown below; differences between grades and trims were not significant, but cut was highly significant. These percentages illustrate that, for yield, the only significant variable demonstrated was that of cut.

<u>Sample Differentiation</u>	<u>Mean Percentage Yield</u>
U. S. Commercial	65.4
U. S. Standard	66.3
Chuck	63.9
Round	67.8**
Trimmed	65.4
Untrimmed	66.4

**Significantly higher at 1% level

Round gave a significantly higher yield than did chuck. Variations for the cut between grades and between trims were not significant, indicating that for the grades and trims studied, the round consistently gave a higher yield than the chuck, regardless of which grade was used and whether or not the cut had been ground before or after trimming.

Leverton and Odell (3), because of the cooking method employed in studying ground beef, do not report a dripping loss, but they do list evaporative losses as 24.5 and 25.0 percent for "lean" and "regular" ground beef, respectively. Both raw and cooked weights for the patties are given, which reveal the yields to 75.0 percent for "lean" and 75.4 percent for "regular" ground beef. Thus there are indications that although evaporative losses are lower with the oven method of preparation used in the present study, the overall yield is not as great as when beef patties are grilled. In order to verify this supposition, however, further research would need to be conducted, using both oven and grill preparation on meat from the same source.

Organoleptic Qualities.---Grand means for all six judges for each variation tested are shown below; grade and trim differences were not significant, but cut was again highly significant.

Sample Differentiation	Judges' Mean Score
U. S. Commercial	19.3
U. S. Standard	19.0
Chuck	19.8**
Round	18.5
Trimmed	19.0
Untrimmed	19.3

**Significantly higher at 1% level

Regardless of grade or trim, the judges showed a significant preference for patties made from the chuck over those made from the round. It must be noted, however, that out of a possible 30 points, the highest mean score, that for chuck, was only 19.8. If we consider a score of 30 as very good, 24 as good, 18 as fair, 12 as poor, and 6 as very poor; it is apparent that the patties which the judges considered the most desirable of the four were receiving scores only slightly above a "fair" rating. Due to the fact that no ingredients were added to the ground beef in preparing the patties, as was

elaborated upon in the experimental procedure, the patties were probably not as desirable as they might otherwise have been, either in flavor, texture, color, or juiciness.

It is interesting that the taste panel did prefer patties made from the chuck, which generally is lower in cost than the round. This might find practical application especially where other ingredients should not be mixed into a beef patty, such as in some hospital therapeutic diets. However, since the yield was significantly greater from patties made from the round, in recipes which can allow added ingredients, this cut might be the more economical choice.

One variable in the cooking procedure might possibly have contributed to the judges' preference for the patties made from ground chuck. The meat was first dipped with a No. 12 size ice cream scoop, and then weighed to 90 grams on a Hanson dietetic scale. Since fat weighs less than lean, the patties were the same size when dipped, but, depending on the fat content, different sizes after being adjusted to constant weight. Although this weight adjustment was necessary to insure accuracy in determining yield, the leaner patties were slightly smaller and therefore prone to cook sooner than the ones with more fat.

Another possibility is that since fat can affect juiciness because of differences in the rate of heat transfer, as pointed out by Siemers and Hanning (6), there would therefore be differences in the degree of heat transfer with differences in the fat content. Either or both of these factors--size and fat content--could have caused the leaner patties to be slightly more done, and perhaps less juicy, than those with higher fat content. These differences could have been slight enough that variation in trim or grade would have been masked, but variations between cuts would not have been.

Gross examination of the mean individual ratings fails to shed much light on the matter, although the chuck does appear to be commanding slightly higher ratings on both juiciness and compactness and tenderness of the patty than the round, as can be seen in the table below. Intensity and desirability of flavor scores seem to be slightly higher for the trimmed cuts. These tendencies, however, are so slight as to scarcely be worthy of mention.

	Flavor		Juiciness	Texture		Color
	Intensity	Desirability		Compactness	Tenderness	
U. S. Commercial Chuck						
trimmed	3.4	3.7	3.1	3.0	3.3	3.3
untrimmed	3.2	3.5	3.3	3.2	3.6	3.3
U. S. Commercial Round						
trimmed	3.3	3.3	2.8	2.7	3.2	3.1
untrimmed	3.2	3.3	2.6	3.4	3.3	2.9
U. S. Standard Chuck						
trimmed	3.2	3.5	3.3	3.3	3.4	3.2
untrimmed	3.0	3.1	3.1	3.0	3.4	3.0
U. S. Standard Round						
trimmed	3.4	3.3	2.9	2.8	3.1	3.1
untrimmed	3.1	3.0	2.9	3.0	3.3	3.1

A further study of organoleptic qualities of ground beef from different sources with the intent of learning more about the influence of fat content on yield and on flavor, texture, and juiciness of the patties should be interesting. It is conceivable that a mixture, i.e., part chuck and part round, would satisfy the requirements better than one cut alone.

Even experienced judges often vary in their concept of desirability of a product. Such appeared to be the case with the six judges in the present study. It might therefore be well to determine how a large a taste panel would be necessary to evaluate an item such as ground beef patties accurately.

SUMMARY AND CONCLUSIONS

Trimmed and untrimmed chucks and rounds from six U. S. Commercial and six U. S. Standard carcasses were ground and tested for fat and moisture contents, yield, and organoleptic qualities.

Fat contents were significantly higher in U. S. Commercial grade than in U. S. Standard, in chuck than in the round, and in the untrimmed than in the trimmed samples. Moisture contents were significantly higher in U. S. Standard grade than in U. S. Commercial, in the round than in the chuck, and in the trimmed than in the untrimmed samples. Trimming decreased the variation between grades and increased the variation between cuts with respect to both fat and moisture contents. The tendency of the chuck to have a significantly higher fat content than the round was true for both grades; while the tendency of the round to have a significantly higher moisture content than the chuck was not as pronounced in U. S. Standard as it was in U. S. Commercial.

Yield was significantly greater from round than from chuck, regardless of grade. This tendency was discussed from the standpoint of both percentage evaporative and drippings losses and percentage yield, and the possible implications as to cost.

The taste panel showed significant preference for patties made from ground chuck, again regardless of grade, although this preference only rated the patties as "fair"--19.8 points out of a possible total of 30. The results of the organoleptic scores appear to show very little of a clear-cut nature, possibly due to the fact that none of the patties were considered very desirable in the form in which they were presented to the judges, e.g., without added ingredients. This similarity of the meat, when tasted alone might possibly indicate that, at least for the grades, cuts, and trims studied, these factors do not need to be given primary consideration.

Referring to the specifications for ground beef used by the Quartermaster Corps of the United States Army (8), the United States Department of Agriculture (9), and the National Restaurant Association (5), it can be seen that grade, cut, and trim of the original meat are dealt with on an apparently general basis, but that fat content range for the finished product is specifically listed.

For those individuals and institutions purchasing ground beef in quantities too small to take advantage of such specifications, the information obtained in this study could prove useful. The percentage yield data, considered in the light of the fat and moisture contents shown, could offer some insight into what constitutes a practical ground beef purchase.

LIST OF REFERENCES

1. Association of Official Agricultural Chemists. 1955. Official Methods of the Association of Official Agricultural Chemists. Washington, D. C.
2. Dixon, W. S. and Massey, F. S. 1957. Introduction to Statistical Analysis. McGraw-Hill Company, New York.
3. Leverton, Ruth M. and Odell, G. V. 1958. Nutritive Value of Cooked Meats. Oklahoma Agricultural Experiment Station, Oklahoma State University, Miscellaneous Publication No. MP-49. Stillwater, Oklahoma.
4. National Live Stock and Meat Board. Personal communication, November, 1958.
5. National Restaurant Association. Personal communication, November, 1958.
6. Siemers, L. L. and Hanning, F. 1953. Study of certain factors influencing the juiciness of meat. Food Research 18:113.
7. Tobey, E. R. 1944. Analysis of hamburger steak. Maine Agricultural Experiment Station. Official Inspection Bulletin No. 191.
8. United States Army. Quartermaster Corps. Personal communication, November, 1958.
9. United States Department of Agriculture, Agricultural Marketing Service. Personal communication, November, 1958.
10. United States Department of Agriculture, Handbook No. 8. Composition of Foods, Raw, Processed and Prepared. 1950. U. S. Government Printing Office, Washington, D. C.

APPENDIX

Table 1

Weight in Pounds of Sides and Cuts and Aging Periods for Carcasses

Animal No.	U. S. Commercial						U. S. Standard					
	1	2	3	4	5	6	7	8	9	10	11	12
Side	285	283	313	319	345	278	244	281	244	271	243	275
Hindquarter	142	140	154	149	160	133	116	132	120	134	122	128
Forequarter	143	143	158	170	185	145	128	149	124	137	121	147
Round												
Lean and Internal Fat	42.5	45.5	49.5	46.5	46.9	44.2	46.5	48.5	42.6	48.6	43.0	46.5
External Fat	9.9	8.3	8.1	6.8	5.9	5.9	3.9	2.5	3.8	2.9	4.1	3.4
Added Fat ¹	.70	.55	.50	.40	.27	.40	.25	.16	.27	.18	.29	.22
Chuck												
Lean and Internal Fat	42.6	66.5	66.5	68.0	77.3	Not Available	60.9	61.5	52.7	59.0	50.0	60.0
External Fat	7.4	8.5	7.0	7.6	4.2	"	2.4	1.7	2.9	3.2	3.4	1.5
Added Fat ¹	.50	.40	.32	.34	.16	"	.12	.08	.16	.16	.20	.75
Excut Carcass Aging, Days	9	9	9	7	7	7	7	7	7	7	8	7

¹Weight of external fat added to 3/4 trimmed sample to give equivalent of untrimmed meat.

Table 2
Mean Percentage Fat Contents of Ground Beef

Replications	1	2	3	4	5	6	Means
Commercial Chuck, trimmed	22.0	20.5	20.3 ¹	25.2	22.1	18.2	21.4
" " , untrimmed	25.2 ²	28.3	26.1	33.6 ²	23.9	24.6	27.0
" Round, trimmed	11.0	9.3	11.4	14.1	10.5	11.7	11.3
" " , untrimmed	22.6 ²	24.3	22.5	23.1 ²	17.8	17.5	21.3
Standard Chuck, trimmed	11.5	18.9	20.5	13.5	18.8	16.8	16.7
" " , untrimmed	12.9	20.5	23.1	18.2	23.6	18.1	19.4
" Round, trimmed	7.7	11.0	10.5	9.0	10.8	9.3	9.7
" " , untrimmed	14.2	15.0	20.4	15.6	18.2	13.1	16.1

¹Only 1 sample available.

²Over $\pm .5$ deviation between duplicate determinations.

Table 3
Analysis of Variance of Mean Percentage Fat Contents

	Degrees of Freedom	Sum of Squares	Mean Squares	F
Total	47	1667.48		
Replications	5	87.05		
Grade	1	273.61	273.61	39.26**
Cut	1	505.70	505.70	72.55**
Grade X Cut	1	22.14	22.14	3.18
Trim	1	455.10	455.10	65.29**
Grade X Trim	1	31.04	31.04	4.45*
Cut X Trim	1	48.40	48.40	6.94*
Grade X Cut X Trim	1	.44	.44	0.06
Error	35	244.00	6.97	

*Significant at 5% level.

**Significant at 1% level.

Table 4

Mean Percentage Moisture Contents of Ground Beef

Replications	1	2	3	4	5	6	Means
Commercial Chuck, trimmed	58.2	59.8	60.3	57.4	58.9	61.8	59.4
" " , untrimmed	54.3	53.5	55.1	50.4	57.6	56.3	54.5
" Round, trimmed	66.7	67.7	66.8	65.6	68.1	66.5	66.9
" " , untrimmed	58.9	56.0	57.6	57.6	62.5	61.6	59.0
Standard Chuck, trimmed	67.9	62.3	60.2	65.9	61.9	64.0	63.7
" " , untrimmed	67.1	61.1	58.5	62.3	58.2	62.8	61.7
" Round, trimmed	70.3	67.6	67.9	68.6	67.5	68.9	68.5
" " , untrimmed	65.1	64.4	59.9	63.8	61.8	66.4	63.6

Table 5

Analysis of Variance of Mean Percentage Moistures Contents

	Degrees of Freedom	Sum of Squares	Mean Squares	F
Total	47	1060.62		
Replications	5	53.07		
Grade	1	230.57	230.57	52.76**
Cut	1	261.34	261.34	59.80**
Grade X Cut	1	21.32	21.32	4.88*
Trim	1	290.09	290.09	66.38**
Grade X Trim	1	25.22	25.22	5.77*
Cut X Trim	1	25.80	25.80	5.90*
Grade X Cut X Trim	1	.03	.03	0.01
Error	35	153.18	4.37	

*Significant at 5% level.

**Significant at 1% level.

Table 6

Percentage Cooking Losses of Ground Beef Patties

Replications	Evaporative						Drippings						Means	
	1	2	3	4	5	6	1	2	3	4	5	6		
Commercial Chuck trimmed	16.3	19.5	17.0	15.8	14.7	17.5	16.7	21.1	13.6	17.5	24.3	16.5	15.0	18.0
Commercial Chuck untrimmed	16.1	14.0	16.8	17.7	13.2	13.4	15.2	22.0	30.3	23.5	28.3	19.2	15.8	23.2
Commercial Round trimmed	14.1	17.2	20.0	16.8	13.9	15.3	16.2	16.8	24.2	11.2	17.1	13.8	15.1	16.4
Commercial Round untrimmed	14.4	17.9	15.8	15.0	12.2	14.2	14.9	20.0	20.0	15.5	23.2	13.2	13.8	17.6
Standard Chuck trimmed	20.1	16.4	15.1	14.3	12.1	14.9	15.5	16.9	16.7	19.1	20.8	22.1	20.7	20.0
Standard Chuck untrimmed	17.8	13.7	12.6	15.6	13.5	15.9	14.8	19.4	19.3	19.7	21.6	24.7	19.3	20.7
Standard Round trimmed	14.8	14.3	13.4	14.0	12.2	16.0	14.4	19.2	15.9	20.8	16.3	16.9	13.6	17.1
Standard Round untrimmed	16.1	18.5	14.2	12.3	13.3	16.4	15.2	19.1	12.4	17.0	19.1	19.3	14.4	16.9

Table 7

Mean Percentage Yields of Ground Beef Patties

Replications	1	2	3	4	5	6	Means
Commercial Chuck, trimmed	62.6	66.9	63.5	59.9	68.8	67.5	65.2
" " , untrimmed	61.9	55.7	59.7	54.0	67.6	70.8	61.6
" Round, trimmed	69.1	58.6	68.8	66.1	72.3	69.6	67.4
" " , untrimmed	65.6	62.1	68.7	61.8	74.6	72.0	68.0
Standard Chuck, trimmed	61.0	64.9	65.8	64.9	65.8	64.4	64.5
" " , untrimmed	62.8	67.0	67.7	62.8	61.8	64.8	64.5
" Round, trimmed	66.0	69.8	69.8	69.7	70.9	68.4	68.4
" " , untrimmed	64.8	69.1	68.8	68.6	67.4	69.2	68.0

Table 8

Analysis of Variance of Mean Percentage Yields

	Degrees of Freedom	Sum of Squares	Mean Squares	F
Total	47	835.89		
Replications	5	200.58		
Grade	1	10.09	10.09	0.87
Cut	1	180.97	180.97	15.63**
Grade X Cut	1	0.26	.26	0.02
Trim	1	11.80	11.80	1.02
Grade X Trim	1	7.20	7.20	0.62
Cut X Trim	1	7.52	7.52	0.65
Grade X Cut X Trim	1	12.61	12.61	1.09
Error	35	404.86	11.56	

**Significant at 1% level.

Table 9
Mean Total Scores¹ of Judges for Ground Beef Patties

Replications	1	2	3	4	5	6	Means
Commercial Chuck, trimmed	20.2	17.7	20.7	20.2	21.3	19.9	20.0
" " , untrimmed	20.5	20.0	18.7	19.5	20.2	20.8	20.0
" Round, trimmed	18.3	20.0	19.2	17.8	19.0	17.0	18.6
" " , untrimmed	17.7	18.5	19.3	20.0	18.2	19.0	18.8
Standard Chuck, trimmed	19.5	21.6 ²	19.8	19.2	20.8	19.8	20.1
" " , untrimmed	18.2	21.2 ²	19.0	17.8	18.2	19.8	19.0
" Round, trimmed	19.3	18.8 ²	19.0	17.7	19.0	18.2	18.7
" " , untrimmed	19.0	18.8 ²	18.2	18.8	15.2	18.7	18.1

¹Based on possible total of 30 points.

²Means of 5 judges scores.

Table 10
Analysis of Variance of Mean Total Scores of Judges

	Degrees of Freedom	Sum of Squares	Mean Squares	F
Total	47	68.70		
Replications	5	2.36		
Grade	1	1.33	1.33	1.12
Cut	1	18.50	18.50	15.55**
Grade X Cut	1	0.05	.05	0.04
Trim	1	1.54	1.54	1.29
Grade X Trim	1	2.53	2.53	2.13
Cut X Trim	1	0.48	.48	0.40
Grade X Cut X Trim	1	0.04	.04	0.03
Error	35	41.87	1.19	

**Significant at 1% level.

SCORE CARD

JUDGE _____

DATE _____

SAMPLE NUMBER			
A	B	C	D

FLAVOR

Intensity

- 5 very pronounced _____
- 4 pronounced _____
- 3 slightly pronounced _____
- 2 perceptible _____
- 1 imperceptible _____

Desirability

- 5 very desirable _____
- 4 desirable _____
- 3 slightly desirable _____
- 2 slightly undesirable _____
- 1 undesirable _____

JUCINESS

- 5 very juicy _____
- 4 juicy _____
- 3 slightly dry _____
- 2 dry _____
- 1 very dry _____

TEXTURE

Compactness

- 5 very light _____
- 4 light _____
- 3 slightly compact _____
- 2 compact _____
- 1 very compact _____

Tenderness

- 5 very tender _____
- 4 tender _____
- 3 slightly tough _____
- 2 tough _____
- 1 very tough _____

COLOR

- 5 reddish brown _____
- 4 pinkish brown _____
- 3 pale brown _____
- 2 pale _____
- 1 very pale _____