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An Evaluation of the Roasteak Procedure and Modifications of the Procedure for Cooking Bottom Round of Beef

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An Evaluation of the Roasteak Procedure and Modifications of the Procedure for Cooking Bottom Round of Beef

BERNICE M. KORSCHGEN, RUTH E. BALDWIN AND MARGARET MANGEL

Previously, a procedure for preroasting and broiling beef, ("roasteak") was evaluated for shoulder clod and chuck roll roasts. Although the range of taste panel scores for palatability characteristics was wide, the mean scores for these forequarter cuts indicated that people would like meat prepared by the roasteak procedure (Korschgen et al., 1963). It was the purpose of this study to evaluate the suitability of the method for bottom round of beef, and to study variations of the roasteak method. The variations included rapid chilling of the roast before slicing and freezing, and blast-freezing the preroasted bottom round prior to slicing it for storage in the freezer. For the latter method, slices broiled while still frozen and slices defrosted prior to broiling were evaluated.

PROCEDURE

Paired rounds of beef were procured and held in frozen storage until needed for testing. For all series of tests (except IIa), meat cooked according to the roasteak procedure (Korschegen et al., 1963) requiring preroasting and broiling slices from the roast was evaluated at the same time as meat prepared by a variation of this procedure. The work was divided into series in order to evaluate the effects of varying the method of handling the meat after the preroasting. These series were:

Series I: Roasteak procedure and Variation I, preroasted rounds chilled, sliced, and slices wrapped individually and stored in a home-type freezer until broiled for testing.

Series II: Roasteak procedure and Variation II, preroasted rounds frozen in a blast-freezer tunnel, sliced while frozen, and slices wrapped individually and stored as for Series I.

Series IIa: Slices from Variation II broiled, thawed and unthawed.

Both subjective and objective evaluations of the meat were included in all series of this work. The details of procedures are given below.

Roasteak Procedure

For the roasteak method (Korschegan et al., 1963), roasts were defrosted, weighed, and placed on wire racks in aluminum roasting pans (10 x 16 x 2 in.). An iron constantan thermocouple was inserted in the center of each roast, and the roasts were cooked to an internal temperature of 110° F in a 300° F oven. Potentiometer records were kept of the time required for the roasts to reach 110° F internal temperature and for the increase in temperature occurring after removal of the roasts from the oven. The record from a thermocouple located in the oven was used as the guide for regulating the roasting temperature. One of each pair of roasts (for the roasteak procedure) was cooled to room temperature, refrigerated overnight, and weighed prior to slicing. To obtain uniform slices, all roasts were trimmed on the ends so that flat surfaces were exposed. Slices, 11/16 inch thick, were cut and numbered consecutively, one through 10, beginning at the end of the roast nearest the aitch bone. The slices were broiled 3 minutes per side on an electric grill [1] with the thermostat set at 400° F. Slices were weighed before and after grilling.

Series I: Eight matched pairs of bottom rounds, four U. S. Good grade and four U.S. Choice grade, were preroasted according to the roasteak procedure described above. Slices from one of each pair of roasts were broiled according to this method. The second of each pair of roasts was used for experimental work, and the data for three of these are reported here. These three roasts were placed in an empty home-type freezer (average -5° F) one hour after removal from the oven. After they had cooled in the freezer for approximately two hours the roasts were weighed and sliced and slices were wrapped individually and stored in the freezer for eight days before the final broiling. These slices were cooked on a grill with the thermostat set at 300° F for a total of 13 minutes and were turned at the end of two, four, and eight minutes.

Series II: Six matched pairs of bottom rounds of beef, three U.S. Good grade and three U.S. Choice Grade, were obtained for this series. One of each pair was prepared according to the roasteak procedure. The second of each pair was preroasted according to the roasteak procedure, weighed, wrapped in heavy duty aluminum

[1] Hotpoint Griddle, Model HGG55, Hotpoint Co. 227 South Seeley Ave., Chicago 12, Illinois.

foil, and immediately placed on the contact plates in a blast-freezer tunnel (air temperature -10° F). After three days of storage in this freezer, the roasts (internal temperature -9°F) were sawed into 10 slices 3/4 inch thick, and wrapped individually in freezer paper. The first six slices of the roasts were used after six days storage in a home-type freezer. The remaining four slices were retained (8 to 43 days) for Series IIa.

Twenty minutes before each taste panel sampled them, the slices of meat were unwrapped, weighed, and placed in a refrigerator. These blast-frozen slices were cooked eight minutes per side on an electric grill with the thermostat set at 300° F.

Series IIa: Slices 7, 8, 9, and 10 from the blast-frozen roasts were used to make direct comparisons between meat broiled in the thawed and unthawed state. Slices 7 and 9 were not thawed and were cooked as were the slices from the blast-frozen roasts described above. Slices 8 and 10 were defrosted at room temperature (2 hours, 70°F) and grilled as for the roasteak method.

Subjective and Objective Evaluation

For all series of this research, six experienced judges evaluated the samples of meat for flavor, tenderness, juiciness, and general acceptability using a hedonic scale ranging from 1, "dislike extremely," to 9, "like extremely." Judges remained the same for each series of tests, but composition of the panel differed between Series I and Series II. Two samples from paired broiled slices representing two methods of preparation were given to each judge on one plate. To minimize the effects of color on samples, red lights were used for illumination in the taste panel room.

The Warner-Bratzler shear instrument was used for objective testing in all series of this research. The force in pounds required to shear one-inch cores was measured. All samples were allowed to come to room temperature before shearing.

Series I: Slices numbered 3, 6, and 9 from the roasts were used for organoleptic testing; and slices 2, 5, and 8 were tested with the Warner-Bratzler shear instrument (Figure 1). Slices 1, 4, 7, and 10 were part of another study. Six one-half inch strips were cut from the slices for taste panel testing (Figure 1). From slices adjacent to those used for taste panel evaluation, cores were obtained for the objective testing. Positions on the slices from which cores

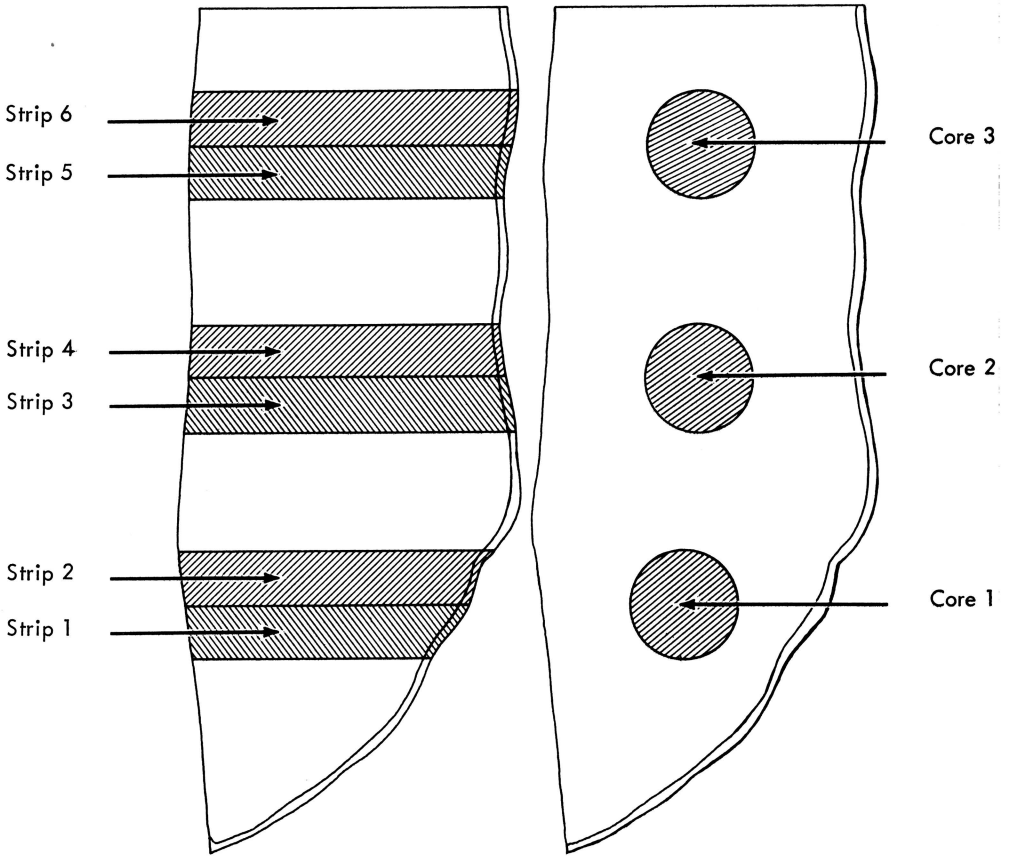

Fig. 1 - Tracings of adjacent slices of bottom round of beef showing locations of strips used for taste panel and cores used for shearing (Series I).

were taken were similar to those used for taste panel strips in the adjacent slices. In one tasting session each judge evaluated three plates of samples representing two methods of preparation for the roasts from one animal. The position of strips was rotated among judges for the first six animals. Since there were eight animals and six judges, for the last two animals, sample position was randomly assigned.

Series II: For this phase of the work, taste panel samples were cubes cut from the center of each slice, and cores for shearing were taken from each side of the slice (Figure 2). Each judge re-

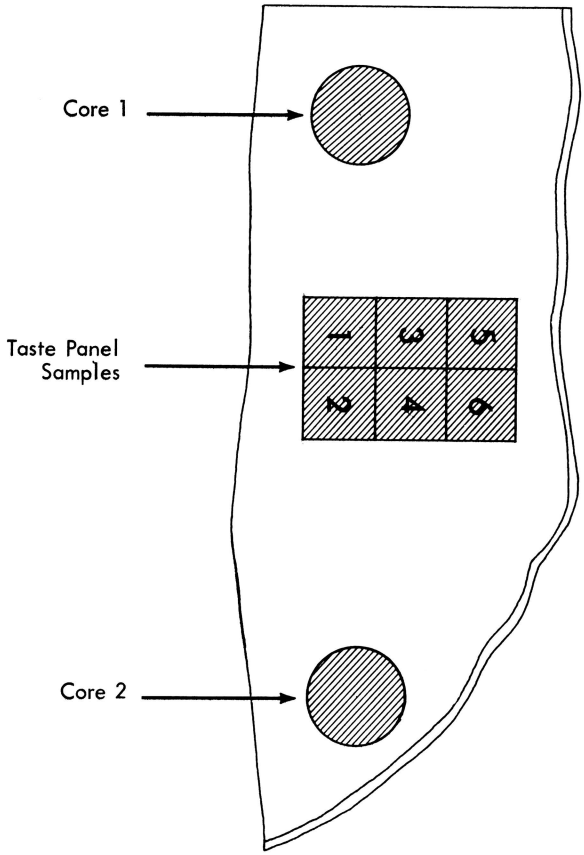

Fig. 2 - Tracing of one slice of bottom round of beef showing locations of cubes used for taste panel and cores used for shearing (Series II).

ceived a sample from the same position in each slice at each tasting session. Samples representing two methods of preparation of roasts from one animal were placed on one plate and six plates were presented to each judge each session.

Series IIa: Slices from two blast-frozen roasts were prepared each day. Judges received cubes from the same locations in each slice. At each tasting session judges evaluated four plates of samples representing slices broiled in the thawed and unthawed state from two animals.

Statistical Procedure

Random selection of grade was made for the order of replications, and side of carcass was randomized for method of preparation. Since data from previous work (Rodgers et al., 1964) showed no significant differences in palatability characteristics and shear values between U.S. Good and U.S. Choice grade rounds of beef, data from the two grades were pooled in this study. For the palatability characterisitics the six judges' scores were averaged for each slice of meat; this mean was used as one observation in the statistical analysis. Likewise, the mean of the shear values of the cores for one slice of meat was used as one observation. Means were determined for both objective and subjective characteristics for each series of tests, and t-tests were used to determine difference in these characteristics between variations of the procedure.

RESULTS AND DISCUSSION

Weights and Cooking Times for Bottom Round of Beef

A summary of the means for time required for preroasting the bottom rounds of beef to 110°F internal temperature is given in Table 1. The mean raw weights for the roasts ranged from 13.0 to 13.9 pounds. Compared to a previous study (Korschgen et al., 1963), these roasts were larger than the forequarter cuts used for the laboratory testing but comparable in weight to those used in the consumer phase of the work.

The time required for preroasting ranged from 186 to 267 minutes, and the number of minutes per pound for the preroasting ranged from 14 to 19. However, internal temperature, which was used to determine cooking stage, is the only reliable guide for preparation of meat by the roasteak method. Taste panel scores for flavor have shown significant differences between meats varying as little as 10° F in internal temperature for preroasting (Korschgen et al., 1963).

The roasts were removed from the oven when the internal temperature was 110° F, but there was a continued rise in temperature, and the mean maximum internal temperature of 133° F was attained in approximately one hour.

TABLE 1. SUMMARY OF MEAN WEIGHTS AND TIMES REQUIRED TO PREROAST BOTTOM ROUNDS OF BEEF TO 110° F INTERNAL TEMPERATURE.

Method	Number of observations	Raw weight		Time for preroasting	
		Range	Mean	Mean	Mean
		Lb.	Lb.	Total min.	Min./lb.
			Series I		
Roasteak	8	10.7-16.0	13.3	256	19
Variation I, (frozen, home-type freezer)	3	13.1-15.1	13.9	267	19
			Series II		
Roasteak	6	12.5-13.6	13.0	186	14
Variation II, (blast-frozen)	6	12.4-13.4	13.2	195	15

Cooking Losses

Since conditions of preroasting were controlled and roasts were paired, little difference in cooking losses would have been expected among series of roasts. Actually, however, the mean total losses during preroasting for the roasteak procedure were 16.8 percent and 11.2 percent for Series I and II, respectively, as compared to 18.2 percent for roasts which were chilled, sliced and slices frozen (Series I, Table 2), and 10.1% for roasts which were subjected to blast-freezing (Series II, Table 2). The speed of the blast-freezing may have retarded juice loss. In previous work using forequarter of beef total losses for preroasting averaged 16.0 percent for shoulder clod and 14.0 percent for chuck roll roasts (Korschgen et al., 1963). The difference in cooking losses between the two studies was probably due to the physical composition of the rounds and forequarter cuts of beef.

Losses during broiling were considerably higher for the meat from the blast-frozen roasts than for the meat from unfrozen roasts. There was opportunity for greater loss of juices prior to and during slicing for the slices prepared by the roasteak procedure, than for the slices obtained from the roasts which were blast-frozen. In the latter case, drip did not occur during the slicing process, and much of the juice which might have been lost was frozen before drainage occurred. This may have contributed to higher broiling osses for slices from the blast-frozen roasts (Table 2).

TABLE 2. MEAN COOKING LOSSES DURING PREROASTING AND BROILING OF BOTTOM ROUND OF BEEF PREPARED BY THE ROASTEAK METHOD AND VARIATIONS.

Method	Cooking Losses	
	%	%
	Series I	
	Roasteak	Variation I, (frozen, home-type freezer)
Preroasting (8 roasteak, 3 variation I)		
Evaporation	11.7	12.2
Drippings	5.2	6.0
Total	16.8	18.2
Broiling (24 roasteak slices, 9 variation I slices)	12.6	12.8
	Series II	
	Roasteak	Variation II (blast-frozen)
Preroasting (3 roasteak, 3 variation II)		
Evaporation	7.6	7.8
Drippings	3.6	2.3
Total	11.2	10.1
Broiling (30 roasteak slices, 30 variation II slices)	13.0	22.2
	Series IIa	
	Variation II, (blast-frozen, not defrosted)	Variation II, (blast-frozen, defrosted)
Broiling (10 slices each)	19.5	17.6

Subjective and Objective Evaluation

The mean scores of the taste panels in both series of tests indicated that slices from the bottom round were liked when they were prepared by the roasteak procedure and by all variations of the method used. However, mean scores of taste panels were higher for flavor, tenderness, juiciness, and general acceptability for bottom round when it was prepared by broiling after roasting than when the meat was preroasted and then frozen again either in a home-type (Series I) or in a blast-freezer (Series II) before broiling (Table 3).

The differences were not significant by t-tests for any of the palatability characteristics or shear values in Series I. But, in Series II, the differences between the taste panel scores for meat prepared by the regular roasteak procedure and the blast-frozen variation were significant for all palatability characteristics as well as for shear values.

TABLE 3. DIFFERENCES BY T-TESTS IN MEANS FOR PALATABILITY SCORES AND SHEAR VALUE OF BOTTOM ROUNDS OF BEEF PREPARED BY THE ROASTEAK METHOD AND VARIATIONS.

Attribute	Series I[2]		Series II[2]		Series IIa[2]	
	Roasteak	Variation I (frozen, home-type freezer)	Roasteak	Variation II (blast-frozen)	Variation II Not Defrosted	Variation II Defrosted
Flavor	7.0	6.7	7.7**	7.1	6.9	6.9
Tenderness	6.6	6.1	7.8**	7.2	7.1	7.3
Juiciness	6.8	6.2	7.9**	7.0	6.9	6.7
General acceptability	6.8	6.4	7.8**	7.1	7.0	7.0
Shear value (lbs/1-in. core)	23.3	26.0	22.7	25.1**	20.0	20.2

** Significant at 1% level.

[1] Ranges of scores: 1, "dislike extremely" to 9, "like extremely".

[2] Observations: Series I, 24/roasteak procedure, 9/variation I; Series II, 30/method; Series IIa, 10/method. For palatability characteristics, each observation represents the mean of 6 judges' scores. For shear values, each observation represents the mean of the values for the cores.

No significant differences in panel scores were observed between slices defrosted prior to broiling and slices broiled while frozen (Series IIa). In a previous study (Korschgen et al., 1963), panel scores for frozen slices of chuck roll prepared by the roasteak method, frozen, and defrosted prior to broiling, were below the acceptable rating for flavor and general acceptability.

The differences in panel scores noted between the bottom rounds prepared by roasteak procedure and by variations of the procedure were not quite as great as for the forequarter cut in the earlier study (Korschgen et al., 1963) prepared by roasteak and modified roasteak methods. The more rapid chilling of the roasts introduced in the work reported herein may have contributed to the apparent maintenance of quality, but it must be borne in mind that both cuts of meat and panel composition differed.

SUMMARY

The suitability of the roasteak procedure previously described for forequarter cuts (Korschgen et al., 1963) and variations introduced by freezing the preroasted meat were evaluated for bottom round of beef. Preroasting of the whole bottom round to an internal temperature of 110°F and slicing and broiling were the essential steps for preparation of the meat. The variations included: (I) freezing of slices of preroasted meat in a home-type freezer, and (II) freezing the preroasted bottom round in a blast-tunnel freezer. In the latter case, slices broiled both in the thawed and in the unthawed state were evaluated.

Freezing slices from preroasted meat in a home-type freezer or blast-freezing the whole preroasted bottom round resulted in lower taste panel mean scores for flavor, tenderness, juiciness, and general acceptability and higher shear values. However, taste panel mean scores indicated that the meat prepared by either the roasteak method or its variations was liked.

LITERATURE CITED

Korschgen, Bernice M., Ruth E. Baldwin, Margaret Mangel, Jean Clifford Chisholm, Cecelia Pudelkewicz, Helen Gordon, H.D. Naumann, and C. Braschler. 1963. An evaluation of a new cooking method for shoulder clod and chuck roll roasts of beef. Mo. Agr. Expt. Sta. Research Bull. No. 825.

Rodgers, Cleta, Margaret Mangel, and Ruth Baldwin. 1964. Further comparisons of dry-heat methods for round steak. Food Technol. 18, p. 130.

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