OVEN ROASTING VS. OVEN BRAISING METHODS OF COOKING TOP ROUND ROASTS

by

Helen Marshall Young

Thesis submitted to the Graduate Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Human Nutrition and Foods

APPROVED:

Dr. Jean A. Phillips, Chairman

Dr. Richard P. Abernathy

Dr. Sanford J. Ritchey

December, 1972

Blacksburg, Virginia

ACKNOWLEDGMENTS

The author wishes to express her gratitude to Dr. Jean A. Phillips, Major Advisor, for her sincere interest, encouragement, and guidance during this study and throughout this past year of graduate work. Appreciation is also expressed to Dr. Sanford J. Ritchey and Dr. Richard P. Abernathy for their advice and concern.

She is indebted to Dr. Paul P. Graham and two members of the meat judging team for their evaluation and selection of the carcasses and to the eight taste panel members who participated in this research project. Appreciation is also expressed to Dr. Jesse C. Arnold for his assistance with the statistical analysis.

Gratitude is extended to the Roanoke County School Board for the leave of absence and to Dr. Sanford J. Ritchey for the assistantship that provided the financial aid that made this year of graduate study possible.

Very special thanks are extended to her husband, Phil, and five-year old daughter, "Dee", for their help, understanding, and patience during the year.

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

Tenderness of beef, as affected by cooking method, has been studied extensively during the past twenty-five years. Conventional dry and moist heat methods have been studied to determine the effect on selected beef characteristics. Modifications of these methods include: deep-fat frying, microwave roasting, convection roasting, roasting at a low temperature for a long period of time, and pressure cooking.

Recently, a thermal polyester* cooking bag and wrap have become available on the market. Widespread promotional advertising has claimed that meats cooked in these products are more tender, shrink less, and are equally as palatable as meats cooked by dry heat; however, limited data has been found which documents the quality of meat cooked in these newer products. The potential burn hazard of these products has been reported and warnings have been issued.

This study was undertaken to obtain data on (1) the effect of cooking beef by oven braising methods, which include wrapping in foil, cooking in a thermal polyester oven bag, and wrapping in a thermal polyester wrap, and (2) oven roasting. The primary objectives were to investigate the rate of heat penetration and total cooking losses of top round roasts cooked by oven roasting and oven braising methods, and to determine the effect of these heat treatments on the tenderness, juiciness, flavor, and over-all acceptability by objective and sensory evaluations.

*Mylar

CHAPTER II

REVIEW OF LITERATURE

Factors shown to affect the tenderness and palatability of cooked beef include: type of animal, pre- and post-mortem treatment, location of the muscle, method of cooking, and methods of evaluating tenderness (Paul, 1963). Other workers have identified collagen content, pH of the muscle, grade of the carcass, presence or absence of bone or external fat cover during cooking, temperature of the cooking medium, rate of heat penetration, and internal end-point temperature as factors that affect selected characteristics.

Traditionally, less tender cuts of beef (rump, chuck, and round) have been cooked by "moist" heat methods and more tender cuts (rib and loin) by "dry" heat methods. Paul (1963) explained that collagen required moist heat for prolonged periods of time for conversion to gelatin, yet muscle fibers were toughened by extensive heating.

Temperature

Schock et al. (1970) investigated the effects of dry and moist heat methods of cooking on the tenderness and palatability of the semimembranosus muscle. Oven roasting produced the slowest rate of heat penetration, longer cooking time, higher values for total moisture, press fluid, water-holding capacity, and juiciness compared to oven-braising, pressure-braising, or deep-fat frying samples cooked to an internal temperature of 70 C. Reid and Harrison (1971) continued the study and examined the histological characteristics of the samples.

The pressure-braised, deep-fat fried, and oven-braised samples had larger proportions of granular tissue than the oven roasted samples. They concluded that the lesser amounts of granular tissue in the oven roasted samples may have contributed to the greater acceptability of the oven roasts. In contrast, Cover and Shrode (1955) stated that oven roasts were little, if any, juicier or more tender than pot roasts.

Griswold (1955b) noted that braised meat had lower collagen losses than any other method of cooking beef round. Collagen losses were increased as the internal temperature of the roast was increased and collagen losses were greater when the meat was roasted at 250 F. than at 300 F.

Hood (1960) compared dry and moist heat methods of cooking paired roasts of Good and Standard grade. Differences between grades were insignificant; however, the dry heat methods were preferred over the moist heat methods. Seidler and Wood (1965) reported that grade had little effect on cooking losses or yield, however, Choice grade was more preferred than Commercial by a taste panel.

Bramblett and Vail (1964) reported that beef roasts cooked at 155 F. were more tender and had better flavor and appearance than paired muscles cooked at 200 F.; however, cooking losses were greater and the cooked meat was less juicy. Marshall et al. (1960) reported that the length of time and variability of total time was a problem with low temperature roasting. For these reasons, the practical value of low temperature cookery for home use was questioned. Traditionally, beef has been roasted at approximately 300 F. for institutional and home use (Davenport and Meyer, 1970).

Marshall et al. (1960) roasted top rounds at eight oven temperatures from 200 to 375 F., to internal temperatures of 140 to 176 F. Tenderness was increased with an increase in internal temperature, however, juiciness was decreased. Cover et al. (1962a) and Hunt (1963) also found that cooking losses were increased with an increase in internal end-point temperature.

Foil Wrap

Blaker et al. (1959) cooked hams and beef top rounds wrapped tightly in foil and unwrapped to an end-point temperature of 145 F. The oven roasted top rounds were cooked at 350 F. and the foil wrapped top rounds at 450 F. The difference in cooking temperature was attributed to the insulating effect of the aluminum foil, since a foil wrapped roast in a 450 F. oven reached the same center temperature as an unwrapped roast in a 350 F. oven when both were cooked on a twenty minutes per pound basis. These workers reported that foil wrapped roasts had increased cooking losses, lower meat yield, and an undesirable steamed appearance and flavor. They concluded that the most notable differences in quality were in internal texture and color, and in aroma and flavor.

Hood (1960) compared triceps brachii from U. S. Good and Standard grade carcasses cooked by air (dry heat) and closely wrapped in foil (moist heat). Both treatments were cooked at 300 F. She concluded that cooking method had a greater effect on eating quality than did grade of meat. The roasts cooked by the moist heat lost more weight during cooking, required less time to reach an internal temperature of 170 F., and were judged less juicy and of poorer flavor.

Baity et al. (1969) reported that the method of wrapping meat in foil affected heat transfer and total cooking time. Meat loaves wrapped tightly in aluminum foil had reduced evaporative loss and more rapid heat penetration with concomitant shorter cooking time than meat loaves wrapped loosely in foil.

Tenderness

Cover et al. (1962a, b, c) described six components of tenderness and juiciness as a basis for evaluating the tenderness of beef cooked to end points of 61, 80, and 100 C. These included: softness to tongue and cheek, softness to tooth pressure, ease of fragmentation, mealiness, adhesion, and tenderness of connective tissue. Rogers and Ritchey (1969) noted that judges could detect changes in the above factors within 20 and 26 minutes cooking time in top round steaks cooked at 350 F.; however, differences between 26 and 29 minutes cooking time could not be detected. They concluded that rapid changes in tenderness and juiciness slowed due to a change in the rate of heat penetration.

CHAPTER III

EXPERIMENTAL DESIGN AND PROCEDURE

Samples

Eight U. S. Choice beef top rounds from four carcasses of known history were purchased from a local wholesale meat company. Conformation scores ranged from average choice to top choice, marbling ranged from modest to moderate plus, and total carcass weight ranged from 658 to 768 pounds. After the carcasses were aged 16 days, the semimembranosus muscle was removed from the round, exterior fat was trimmed, and the muscle was cut into four roasts approximately the same size and weight. The thirty-two roasts were individually wrapped in laminated freezer paper, labeled as to the quadrant position in the muscle, and stored at -18 C. (0 F.) for 3 to 4 weeks.

Cooking Methods

After storage, four samples were removed from the freezer and defrosted in the refrigerator at 2 C. for 18 hours and at room temperature for 3 hours prior to cooking. Two roasts from each quadrant position in the muscle were randomly allotted to the four methods of cooking: oven roasted, wrapped tightly in aluminum foil, cooked in a thermal polyester bag, and wrapped in a thermal polyester wrap. Each roast, with wrap or bag, if appropriate, was placed on a rack in a shallow uncovered aluminum pan. The top of the rack was level with the top of the pan to provide maximum exposure to the radiant heat from the oven walls.

The four roasts were cooked in two pre-heated electric ovens set at 149 C. (300 F.). A thermocouple was placed in each oven near the position of each roasting pan to verify the oven temperature, and another thermocouple was placed in the center of each roast to record the internal temperature. The samples were placed in the oven at different intervals in order that all four roasts would be ready for testing at nearly the same time. Preliminary work revealed that the internal temperature of roasts cooked in polyester bags and wraps increased approximately 10 C. (20 F.) when removed from the oven, as compared to 5 C. (10 F.) for foil wrapped roasts and 3 C. (5 F.) for oven roasts. Since all the roasts were cooked to an end-point temperature of 66 C. (150 F.), the out-of-oven temperature rise was a factor in determining the internal temperature at which the roasts were removed from the oven. Eight replications of the procedure and testing methods were conducted; however, only seven replications were reported due to an error in the internal temperature of one of the samples in the second replication.

Objective Evaluations

Cooking losses. Volatile, drip, and total cooking losses were determined gravimetrically.

Shrinkage. The length, width, and thickness of each sample was measured before and after cooking.

Time. The time required for each roast to reach the internal temperature of 66 C. (150 F.) was recorded.

Shear values. Three ½-inch cores cut parallel to the muscle fiber were obtained from each roast.

Each core was sheared by using a Warner-Bratzler press. The first shear was made in the center of the core, followed by shears in the center of the two cut pieces. The mean of the nine shear values was calculated.

Press fluid. Triplicate determinations of press fluid were made for each roast by using a Carver Press (Sanderson and Vail, 1963).

Total moisture. Percent total moisture was determined by drying duplicate 10 gm. samples of raw and cooked meat in a Brabender Moisture Tester for 60 minutes at 121 C. (Schock et al., 1970).

pH. Duplicate pH measurements were made on each raw and cooked sample using 5 gm. of ground muscle blended with 50 ml. distilled water (Rogers et al., 1967).

Sensory Evaluation

One-half of each roast was sliced into ½-inch slices by using a Toledo Model No. 5410 slicer. The first three slices were discarded to eliminate the natural variance of the outside slices. The next four slices were cut in half and uniformly trimmed for palatability scoring. The remainder of the roast was used for experiments on press fluid, total moisture, cores for shear values, and pH.

A taste panel composed of eight trained members scored the roasts for tenderness, juiciness, flavor, and over-all acceptability. A score card of weighed adjectives ranging from 1 (very undesirable) to 7 (very desirable) was used. Each judge received a sample from the same position in the roast each time.

CHAPTER IV

RESULTS AND DISCUSSION

Cooking Time

Cooking time, on the basis of minutes per pound was 51 minutes per pound for oven roasted meat, and 47, 33, and 31 minutes per pound for foil wrap, polyester bag, and polyester wrap. Cover and Shrode (1955), Blaker et al. (1959), Hood (1960), and Shrode et al. (1970) also reported significantly longer cooking time for roasts cooked by dry heat than for those cooked by moist heat.

Similar to the results of Hood (1960), the roasts wrapped in aluminum foil had a faster rate of heat penetration than did the oven roasts.

Roasts cooked in the thermal polyester bag or wrap had the fastest rate of heat penetration, and the highest temperature rise when removed from the oven. This reaction was probably the result of the steam retained in the space between the meat and the polyester film. Even though some evaporation did occur through the pierced holes in the top of the polyester bags and the loosely overlapped polyester wrap, the meat was surrounded by retained steam which prevented evaporative cooling on the surface of the meat. The polyester films may have retained the steam sufficiently to provide a few pounds of increased pressure, thus elevating the temperature of the steam. The difference in cooking time was significant at the 5 percent level for oven roasted versus polyester wrap treatments, Table 1.

Table 1. Summary of significance

Factor	OR vs. FW	OR vs. PB	OR vs. PW	FW vs. PB	FW vs. PW	PB vs. PW
Volatile loss	++	...	+	+	...	...
Drip loss	...	++	++	...	...	...
pH - Raw	...	...	...	...	...	...
pH - Cooked	...	...	...	...	...	...
Moisture - Raw	...	...	...	...	...	...
Moisture - Cooked	...	...	...	...	...	...
Total cooking loss	...	++	++	...	...	...
Cooking time	...	...	++	...	...	...
Total shrinkage	...	...	...	...	...	...
Warner-Bratzler	...	...	+	...	...	...
Press fluid - Raw	...	...	...	...	...	...
Press fluid - Cooked	...	...	...	...	...	...
Tenderness	...	...	+	...	...	...
Juiciness	...	...	+	...	...	...
Flavor	...	...	+	...	...	...
Over-all acceptability	...	...	+	...	...	...
Number of chews	...	...	...	...	...	...

\+ Significant at 5% level
++ Significant at 1% level
... Non-significant
OR Oven roast
FW Foil wrap
PB Polyester bag
PW Polyester wrap

Cooking Loss and Juiciness

Roasts which were oven roasted had a lower mean percentage total cooking loss than the roasts cooked by the oven braised methods as indicated in Table 2. Meat cooked in either a thermal polyester bag or wrap had approximately 29 percent total cooking loss which was the greatest loss of the four treatments. A comparison of the mean drip loss for the treatments, oven roasted or oven braised (foil wrap, or polyester bag or wrap), indicated that mean drip losses were more than four times greater for those roasts that were oven braised. As expected, the volatile loss was higher for roasts cooked by oven roasting. The difference in total cooking loss between the meat cooked by oven roasting and in the polyester bag and wrap was significant at the 1 per cent level, Table 1.

Mean score differences for juiciness, Table 2, inversely paralleled the values for cooking losses, in that the roasts cooked in polyester bags or wraps were judged as less juicy and had greater cooking loss. Determination of moisture by using a Brabender Moisture Tester and of press fluid by using a Carver Press, Table 2, did not correlate with the judges' scores for juiciness.

Linear Shrinkage

In comparing the length, width, and thickness of each muscle before and after cooking, considerable variation was found in the changes that took place in dimensions. Differences in conformation were such that accurate measurements were not possible. Bramblett and Vail (1964) also experienced difficulty in comparing these measurements.

Table 2. Mean values for cooking loss, juiciness, moisture, and press fluid of roasts.

Heat treatment	Cooking loss			Juiciness[1]	Moisture[2]		Press fluid[3]	
	Volatile	Drip	Total		Raw	Cooked	Raw	Cooked
	(%)	(%)	(%)		(%)	(%)	(%)	(%)
Oven roast	15.4	5.7	21.1	5.8	65.2	60.1	47.8	51.3
Foil wrap	1.8	22.2	24.0	5.0	65.3	59.5	46.6	47.3
Polyester bag	4.5	24.7	29.2	4.7	63.5	57.5	46.7	48.1
Polyester wrap	3.6	25.0	28.6	4.8	63.3	59.1	47.5	49.7

[1]Mean values from 8 tasters for 7 samples each
[2]Determined by using a Brabender Moisture Tester
[3]Determined by the method of Sanderson and Vail (1963)

The accuracy and validity of this method of measuring cooking changes was so questionable, there was no reason to include mean values for linear shrinkage.

pH

As noted by Schock et al. (1970), no changes in pH were observed between the raw and cooked muscles or between the four heat treatments.

Shear Values and Tenderness

The mean scores for tenderness, flavor, and over-all acceptability were higher for oven roasts, Table 3. The descending order for the other treatments was foil wrap, polyester bag, and polyester wrap. The mean shear value for meat cooked by the four treatments was in direct agreement with the scores from the sensory evaluation. Hood (1960) also found that beef roasts wrapped in aluminum foil were less tender than were unwrapped roasts cooked by dry heat.

Table 3. Shear values and sensory evaluation of roasts

Measurements	Heat treatment (N = 7)			
	Oven roast	Foil wrap	Polyester bag	Polyester wrap
Shear value (lb/½-in core)	5.6	7.0	7.4	7.7
Sensory scores[1]				
Tenderness	6.0	5.1	4.9	4.7
Juiciness	5.8	5.0	4.7	4.8
Flavor	5.9	5.3	5.1	5.0
Over-all acceptability	5.7	5.1	4.9	4.7
Number of chews	18.8	20.6	20.0	22.4

[1] Range. 7 (very juicy, or desirable) to 1 (very tough, dry, or undesirable).

The mean number of chews necessary to masticate the meat was slightly less for oven roasts and increased in the order: polyester bag, foil wrap, and polyester wrap. The reliability of the number of chews as a test for tenderness has been questioned because of the high variability between individuals.

Mean scores for over-all acceptability were significant at the 5 percent level for oven roast versus polyester wrap. No significant differences in palatability scores were found between the oven braised methods. Some of the members of the taste panel commented that the samples cooked in the polyester bag and wrap were often dry and mealy in texture which correlated with the higher mean percentage total cooking loss for these two heat treatments.

The conclusion from the data obtained in this experiment was that oven roasting top round roasts was more successful than cooking by the oven braising methods. The oven roasts were more tender, juicy, and flavorful with less cooking loss than roasts that were wrapped in foil, cooked in a polyester bag, or wrapped in a polyester wrap. However, as noted by Hood (1960), if the cooking time had been extended beyond the internal end-point temperature of 66 C. (150 F.) which would happen in moist heat cookery, the differences in tenderness between the dry and the moist heat methods would probably have been less significant. A higher internal temperature with prolonged cooking in moist heat should favor degradation of collagen which would increase the tenderness of the connective tissue; however, juiciness and flavor would be decreased. In this case, a sauce or gravy would probably be served with the meat which would give an illusion of increased juiciness and flavor.

CHAPTER V

SUMMARY

The semimembranosus muscles from eight U. S. Choice beef top rounds from four carcasses were used to study the effect of oven roasting and oven braising methods on the rate of heat penetration, total cooking losses, and palatability of beef roasts. The oven braising methods included wrapping in foil, cooking in a thermal polyester oven bag, and wrapping in thermal polyester wrap. The roasts were cooked in an electric oven at 149 C. (300 F.) to an internal temperature of 66 C. (150 F.).

Cooking losses, shrinkage, cooking time, shear values, press fluid, moisture, and pH were determined for each sample. Eight taste panel members scored the roasts for tenderness, juiciness, flavor, and overall acceptability.

Based on observations made within this study, it was concluded that less tender cuts of meat may be oven roasted more successfully than cooked by oven braised methods. Oven roasting required a longer cooking time because of the slower rate of heat penetration; however, the advantages included less cooking loss, increased tenderness, juiciness, and flavor. In addition, oven roasting would provide a substantial saving for the homemaker, in the cost of the bag or wrap and in less loss of meat weight.

LITERATURE CITED

1. Alsmeyer, R. H., Thornton, J. W., Hiner, R. L., and Bollinger, N. C. 1966. Beef and pork tenderness measured by the press, Warner-Bratzler, and STE methods. Food Tech. 20: 683-685.

2. Anonymous. 1972. Oven cooking bags--a possible hazard. J. Am. Dietet. Assoc. 60: 322.

3. Anonymous. 1972. Roasting bag makers agree to provide use, safety information to the consumer. FDA Papers. 6: 25.

4. Baity, Margaret R., Ellington, Arye, E., and Woodburn, Margy. 1969. Foil wrap in oven cooking. J. Home Ec. 61: 174-176.

5. Blaker, Gertrude G., Newcomer, J. L., and Stafford, William D. 1959. Conventional roasting vs. high-temperature foil cookery. J. Am. Dietet. Assoc. 35: 1255-1260.

6. Bramblett, V. D. and Vail, G. E. 1964. Further studies on the qualities of beef as affected by cooking at very low temperatures for long periods. Food Tech. 18: 245-248.

7. Cover, Sylvia, Ritchey, S. J., and Hostetler, Robert L. 1962a. Tenderness of beef. I. The connective tissue component of tenderness. J. Food Sci. 27: 469-475.

8. Cover, Sylvia, Ritchey, S. J., and Hostetler, Robert L. 1962b. Tenderness of beef. II. Juiciness and the softness components of tenderness. J. Food Sci. 27: 476-482.

9. Cover, Sylvia, Ritchey, S. J., and Hostetler, Robert L. 1962c. Tenderness of beef. III. The muscle-fiber components of tenderness. J. Food Sci. 27: 483-488.

10. Cover, Sylvia, Ritchey, S. J., and Hostetler, Robert L. 1962d. Tenderness of beef. IV. Relations of shear force and fiber extensibility to juiciness and six components of tenderness. J. Food Sci. 27: 527-535.

11. Cover, Sylvia and Shrode, Myrtis Conry. 1955. The effect of moist and dry heat cooking on palatability scores and shear force values of beef from animals of different levels of fleshing. J. Home Ec. 47: 681-685.

12. Davenport, Marilyn McCammon and Meyer, Bernadine H. 1970. Forced convection roasting at 200 and 300 F. J. Am. Dietet. Assoc. 56: 31-33.

13. Griswold, Ruth M. 1955a. The effect of different methods of cooking beef round of commercial and prime grades. I. Palatability and shear values. Food Research. 20: 160-170.

14. Griswold, Ruth M. 1955b. The effect of different methods of cooking beef round of commercial and prime grades. II. Collagen, fat, and nitrogen content. Food Research. 20: 171-179.

15. Griswold, Ruth M. 1962. The Experimental Study of Foods. Illinois: Houghton-Mifflin Co. p. 123.

16. Hood, Maude Pye. 1960. Effect of cooking method and grade on beef roasts. J. Am. Dietet. Assoc. 37: 363-365.

17. Hostetler, Robert L. and Ritchey, S. J. 1964. Effect of coring methods on shear values determined by Warner-Bratzler shear. J. Food Sci. 29: 681-685.

18. Hunt, Fern E., Seidler, Lois R., and Wood, Levelle. 1963. Cooking choice grade, top round beef roasts. J. Am. Dietet. Assoc. 43: 353-356.

19. Laakkonen, E., Wellington, G. H., and Sherbon, J. W. 1970. Low-temperature, long-time heating of bovine muscle. I. Changes in tenderness, water-binding capacity, pH, and amount of water soluble components. J. Food Sci. 35: 175-177.

20. Law, Helen M., Yang, S. P., Mullins, Autis M., and Fielder, Mary M. 1967. Effect of storage and cooking on qualities of loin and top round steaks. J. Food Sci. 32: 637-641.

21. Machlik, S. M. and Draudt, H. N. 1963. The effect of heating time and temperature on the shear of beef semitendinosus muscle. J. Food Sci. 28: 711-718.

22. Marshall, Nancy, Wood, Levelle, and Patton, Mary Brown. 1959. Cooking choice grade, top round roasts. Effect of size and internal temperature. J. Am. Dietet. Assoc. 35: 569-573.

23. Marshall, Nancy, Wood, Levelle, and Patton, Mary Brown. 1960. Cooking choice grade, top round beef roasts. Effect of internal temperature on yield and cooking time. J. Am. Dietet. Assoc. 36: 341-345.

24. Nielsen, Mabel M. and Hall, Florence Turnbull. 1965. Dry-roasting of less tender beef cuts. J. Home Ec. 57: 353-356.

25. Paul, Pauline C. 1963. Influence of methods of cooking on meat tenderness. In Proceedings Meat Tenderness Symposium. pp. 225-241. Campbell Soup Company, Camden, New Jersey.

26. Pearson, A. M. 1963. Objective and subjective measurements for meat tenderness. In Proceedings Meat Tenderness Symposium. pp. 135-160.

27. Reid, Helen Charlene and Harrison, Dorothy L. 1971. Effects of dry and moist heat on selected histological characteristics of beef semimembranosus muscle. J. Food Sci. 36: 206-208.

28. Ritchey, S. J. and Hostetler, Robert L. 1964. Relationships of free and bound water to subjective scores for juiciness and softness and to changes in weight and dimensions of steaks from two beef muscles during cooking. J. Food Sci. 29: 413-419.

29. Rogers, P. J., Goertz, G. E., and Harrison, D. L. 1967. Heat induced changes of moisture in turkey muscles. J. Food Sci. 32: 298-304.

30. Rogers, Patricia J. and Ritchey, S. J. 1969. Sensory differentiation of beef tenderness and juiciness components over short intervals of cooking time. J. Food Sci. 35: 434-435.

31. Sanderson, M. and Vail, G. E. 1963. A method for determining press fluid on cooked beef. J. Food Sci. 28: 596-599.

32. Schock, Dianne R., Harrison, Dorothy L., and Anderson, Lois L. 1970. Effects of dry and moist heat treatments on selected beef quality factors. J. Food Sci. 35: 195-198.

33. Seidler, Lois R. and Wood, Levelle. 1965. Effect of grade on quality of roast beef chuck. Preparation losses, yield, cooking time, and acceptance. J. Am. Dietet. Assoc. 46: 205-206.

34. Smith, G. C., Carpenter, Z. L., and King, G. T. 1969. Considerations for beef tenderness evaluations. J. Food Sci. 34: 612-617.

35. Wilcoxon, Frank and Wilcox, Roberta A. 1964. Some Rapid Approximate Statistical Procedures. New York: Lederle Laboratories. pp. 11-12, 35-37.

36. Woolsey, Annette P. and Paul, Pauline C. 1969a. External fat cover influence on raw and cooked beef. 1. Fat and moisture content. J. Food Sci. 34: 554-556.

37. Woolsey, Annette P. and Paul, Pauline C. 1969b. External fat cover influence on raw and cooked beef. 2. Cooking time, losses, press fluid, and shear force values. J. Food Sci. 34: 568-569.

APPENDIX A

SENSORY EVALUATION

APPENDIX A

SENSORY EVALUATION

I. Triangle Test - Test used to select judges for taste panel.

Directions: Two of the samples of roast beef are identical and one is different. Circle the letter of the odd sample.

Sample
A
B
C

II. Instructions for Taste Panel

1. Arrive promptly at the testing room at 2:00 P. M. on June 19, 20, 21, 22, 23, 26, 27, and 28, 1972.
2. Avoid eating or smoking during the hour prior to testing.
3. Eat the "warm-up" sample first to remove bias for the first sample tasted.
4. Rinse the mouth with water between each taste.
5. Place the meat fibers lengthwise between the molars to deter- the amount of pressure exerted to break through the meat. Tender meat should feel like "well chewed chewing gum".
6. Count the chews required until ready to swallow.
7. Record results independently.
8. Avoid communicating your impressions to the other panel members upon leaving the tasting room.
9. Always sit in the same booth each time.

III. Score Card

Name _____

Date _____

Score card for roast beef

Sample	Tenderness	Juiciness	Flavor	Over-all acceptability	Number of chews	Comments
A						
B						
C						
D						

Descriptive terms for scoring:

Tenderness	Juiciness	Flavor & Acceptability
7 - very tender	7 - very juicy	7 - very desirable
6 - tender	6 - juicy	6 - desirable
5 - moderately tender	5 - moderately juicy	5 - moderately desirable
4 - acceptable	4 - acceptable	4 - acceptable
3 - slightly tough	3 - slightly dry	3 - slightly undesirable
2 - tough	2 - dry	2 - undesirable
1 - very tough	1 - very dry	1 - very undesirable

APPENDIX B

OBJECTIVE EVALUATION

APPENDIX B

OBJECTIVE EVALUATION

Table 4. Warner-Bratzler shear values[1]

Sample	Oven roast	Foil wrap	Polyester bag	Polyester wrap
	(lb)	(lb)	(lb)	(lb)
1	4.3	5.9	5.9	6.9
2	4.2	6.9	7.0	11.8
3	7.5	7.5	7.6	5.9
4	4.3	8.0	7.7	8.1
5	7.4	5.8	9.0	6.9
6	4.9	7.7	5.9	8.6
7	6.9	7.2	8.8	5.7
Mean	5.6	7.0	7.4	7.7

[1]Each value represents a mean of nine shears for each roast

Table 5. pH of raw and cooked roasts[1]

Sample	Oven roast		Foil wrap		Polyester bag		Polyester wrap	
	Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked
1	5.5	5.6	5.5	5.5	5.4	5.5	5.4	5.5
2	5.5	5.5	5.5	5.5	5.4	5.5	5.4	5.5
3	5.5	5.5	5.5	5.7	5.5	5.6	5.6	5.4
4	5.5	5.5	5.5	5.5	5.5	5.6	5.5	5.5
5	5.3	5.5	5.4	5.5	5.4	5.6	5.4	5.5
6	5.5	5.5	5.5	5.5	5.4	5.5	5.5	5.5
7	5.5	5.6	5.5	5.6	5.5	5.5	5.7	5.5
Mean	5.5	5.5	5.5	5.5	5.4	5.5	5.5	5.5

[1]Each value represents a mean of two determinations

Table 6. Moisture of raw and cooked roasts[1]

Sample	Oven roast		Foil wrap		Polyester bag		Polyester wrap	
	Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
1	67.0	56.7	66.6	53.8	61.8	53.7	64.3	51.3
2	66.0	62.2	62.9	58.7	64.4	60.1	67.5	58.2
3	64.1	62.9	65.8	60.8	66.0	61.9	65.4	59.9
4	62.4	59.1	63.9	58.4	62.4	58.1	63.5	58.9
5	61.3	64.0	64.9	60.8	62.1	58.1	59.2	63.1
6	66.5	57.6	67.9	61.3	62.7	55.9	62.3	60.2
7	69.2	58.5	64.9	63.0	64.8	54.7	61.0	62.3
Mean	65.2	60.1	65.3	59.5	63.5	57.5	63.3	59.1

[1]Each value represents a mean of two determinations

Table 7. Press fluid of raw and cooked roasts[1]

Sample	Oven roast		Foil wrap		Polyester bag		Polyester wrap	
	Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
1	50.6	51.7	48.4	48.2	46.3	53.1	49.7	51.2
2	47.1	48.0	48.7	45.8	49.5	47.7	47.4	45.7
3	48.6	57.0	45.3	43.8	45.7	48.3	47.4	53.1
4	46.8	53.4	45.6	46.0	43.2	43.0	47.8	46.4
5	47.7	49.5	42.4	47.6	48.0	46.3	47.6	51.9
6	43.4	53.3	46.0	48.3	46.8	48.6	47.6	43.5
7	50.6	46.5	49.8	51.1	47.1	49.6	45.2	56.4
Mean	47.8	51.3	46.6	47.3	46.7	48.1	47.5	49.7

[1]Each value represents a mean of three determinations

Table 8. Cooking losses, cooking time, and linear shrinkage of roasts.

Sample	Initial wt. (g)	Volatile loss (%)	Drip loss (%)	Total cooking loss (%)	Cooking time (min/lb)	Linear shrinkage (cm)
I. Oven roast						
1	1067	12.8	7.1	19.9	41.7	1.9
2	1450	16.6	5.5	22.1	50.9	2.5
3	1395	15.6	6.9	22.4	49.5	1.8
4	1259	17.5	3.8	21.3	52.9	0.5
5	782	15.6	5.3	20.9	57.0	2.0
6	970	14.1	5.7	19.8	48.1	0.0
7	937	15.6	5.7	21.4	55.6	2.2
Mean	1123	15.4	5.7	21.1	50.8	1.6
II. Foil wrapped						
1	1200	1.4	19.1	20.5	41.5	4.6
2	1525	1.3	24.1	25.4	28.6	2.7
3	1086	1.8	25.5	27.4	34.7	4.0
4	1042	3.9	23.3	27.2	59.1	5.0
5	1075	1.0	17.3	18.3	47.3	1.5
6	506	1.7	24.1	25.7	58.6	3.0
7	883	1.8	21.9	23.6	59.0	3.5
Mean	1045	1.8	22.2	24.0	47.0	3.5
III. Polyester bag						
1	1112	2.8	20.0	22.8	25.7	1.7
2	1478	3.5	28.4	31.9	27.6	4.5
3	1441	3.8	26.9	30.7	36.2	+1.0
4	795	7.8	26.1	33.9	34.3	+1.0
5	1021	5.0	22.0	27.0	33.3	3.0
6	1128	5.1	26.9	32.0	34.9	1.0
7	725	3.2	22.9	26.1	36.3	2.0
Mean	1100	4.5	24.7	29.2	32.6	1.5
IV. Polyester wrap						
1	1146	1.8	28.6	30.4	32.8	0.5
2	1358	3.5	21.2	24.7	30.1	4.3
3	1644	4.3	26.8	31.1	31.8	1.0
4	712	6.6	23.7	30.3	26.8	1.2
5	917	3.3	25.9	29.2	32.2	5.0
6	1070	2.3	25.3	27.7	31.8	5.3
7	1032	3.1	23.5	26.6	32.2	3.0
Mean	1126	3.6	25.0	28.6	31.1	2.9

Table 9. Palatability scoring for roasts.

Sample	Tender-ness	Juici-ness	Flavor	Over-all acceptability	No. of chews
I. Oven roast					
1	5.4	4.8	5.5	5.0	17.4
2	6.1	5.8	5.6	5.9	18.4
3	6.0	6.3	6.1	5.9	18.6
4	6.4	6.3	6.3	6.3	19.8
5	6.1	5.9	5.9	6.1	18.3
6	6.0	6.2	5.8	5.1	17.6
7	5.7	5.6	5.8	5.8	21.4
Mean	6.0	5.8	5.9	5.7	18.8
II. Foil wrapped					
1	5.3	4.4	5.3	4.9	19.4
2	4.3	4.5	4.5	4.5	24.5
3	5.3	4.9	5.5	5.3	19.8
4	4.9	5.5	6.3	5.5	24.3
5	6.4	5.9	5.6	5.8	16.3
6	4.5	4.9	5.0	4.8	20.0
7	5.5	4.6	5.0	5.2	20.0
Mean	5.1	5.0	5.3	5.1	20.6
III. Polyester bag					
1	5.3	5.4	5.6	5.5	17.5
2	4.3	3.9	4.8	4.4	22.5
3	3.3	3.4	4.2	3.6	24.0
4	5.1	4.6	5.4	5.1	20.5
5	5.5	5.8	5.6	5.5	20.1
6	5.6	4.9	5.4	5.0	15.6
7	5.1	5.2	5.0	4.9	19.6
Mean	4.9	4.7	5.1	4.9	20.0
IV. Polyester wrap					
1	4.3	4.1	4.4	4.0	20.3
2	3.4	4.0	4.1	3.9	25.0
3	4.6	4.2	5.1	4.6	22.5
4	4.9	4.8	5.5	5.0	28.9
5	5.3	5.7	4.9	5.1	19.9
6	4.8	5.6	5.6	5.1	20.8
7	5.6	4.9	5.4	5.1	19.6
Mean	4.7	4.8	5.0	4.7	22.4

The vita has been removed from the scanned document

OVEN ROASTING VS. OVEN BRAISING METHODS OF COOKING TOP ROUND ROASTS

by

Helen Marshall Young

Abstract

The semimembranosus muscles from eight U. S. Choice beef top rounds from four carcasses were used to study the effect of oven roasting and oven braising methods on selected beef characteristics. Roasts from different locations in the muscle were randomly allotted to the four methods of cooking: oven roasted, wrapped in foil, cooked in a thermal polyester bag, and wrapped in a thermal polyester wrap. The roasts were cooked to an internal temperature of 66 C. (150 F.) in two electric ovens set at 149 C. (300 F.)

Mean percentage total cooking loss was less for oven roasts than the oven braised methods. Volatile loss was higher for the oven roasts, and mean drip losses were more than four times greater for oven braised roasts. Determination of moisture by using a Brabender Moisture Tester and of press fluid by using a Carver Press were not significant. Roasts cooked in thermal polyester bags and wraps increased approximately 10 C. (20 F.) when removed from the oven as compared to 5 C. (10 F.) for foil wrapped roasts and 3 C. (5 F.) for oven roasts. Mean scores for tenderness, juiciness, flavor, and over-all acceptability were higher for oven roasts. The descending order for the other treatments was foil wrap, polyester bag, and polyester wrap. The mean shear value was slightly less for the oven roast than the oven braised methods.