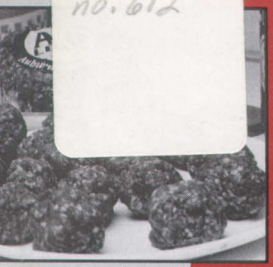
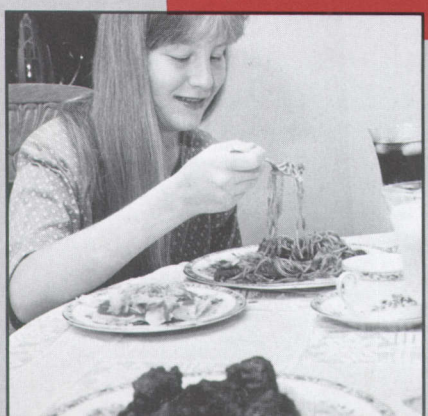


Consumer Response to a New Lean Ground Beef Product: Results from a Home-Use Comparative Test of AU LEAN



Bulletin 612
September 1991
Alabama Agricultural Experiment Station
Lowell T. Frobish, Director
Auburn University
Auburn University, Alabama

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FIRST PRINTING 4M, SEPTEMBER 1991

Consumer Response to a New Lean Ground Beef Product: Results from a Home-Use Comparative Test of AU Lean

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INTRODUCTION

ONE DISTINCT feature of the 1980's was the heightened level of concern and attention Americans gave to good health, and in particular to nutrition and exercise. Health-conscious and active life style consumers now comprise as much as half of the U.S. population *(4)*. Moreover, this health awareness trend should continue throughout the remainder of the 20th Century. Concern about weight control or loss, and fat and calorie contents of the foods people eat will be a hallmark of the decade.

The National Research Council has recommended that Americans reduce their "total dietary fat intake" *(7)*. This warning has been taken seriously by a nutrition-conscious public that has begun to ask about the fat and cholesterol content of the foods it eats. During the 1980's, a movement away from fatty meats to low-fat animal products occurred *(3)*. This change in consumer preference rapidly increased the demand for non-red meats and for less fat in beef products. One consumer survey completed in the mid-1980's revealed that leanness had become one of the most important

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considerations when purchasing ground beef *(2)*. The beef industry must respond to this preference by providing new leaner beef products. Ground beef is the most commonly used form of fresh beef, accounting for 44 percent of the total fresh beef cuts available for consumption. The pressing challenge is to develop new beef products that meet the demands of nutrition and health-conscious consumers *(3)*.

In response to this challenge, research at Auburn University developed a lean ground beef product containing less than 10 percent fat. "The approach combined present knowledge about the texture, juiciness, and flavor of currently produced ground beef products with changes in the technologies used to produce these products" *(6)*. Current market ground beef products range from 20 to more than 30 percent fat. Simple reduction or elimination of fat is the most efficient method for obtaining a lean product, but such a product is considered less palatable and more costly than one with a higher fat content *(6)*. A fat content of 20 percent is generally believed to be the lower range for an acceptable market product. Thus, a "developed" product must be designed to equal or exceed the sensory qualities of currently marketed ground beef products. The consumer research reported here involves findings from sensory taste tests conducted within the consumer's home environment. This study compares AU Lean, a "developed" lean ground beef product with quality enhancers relative to a market product containing 20 percent fat and a lean product without quality enhancers.

DESCRIPTION OF STUDY

Purpose

Approximately 50 percent of all ground beef is purchased by consumers at their local supermarket and prepared in the home *(5)*. To estimate potential market acceptability, newly developed ground beef products require extensive testing to determine consumer response to home-use conditions. However, taste tests conducted within a "laboratory" or a nontypical environment represent the industry standard for determining consumer acceptance *(1)*. This is especially true with foods such as meat products, where product spoilage and preparation present critical variable conditions. Yet, it is important that new meat products be evaluated by consum-

ers in their homes where food is normally prepared and eaten. Few food purchasers fail to consider the food preferences of other household members when selecting a meat product; hence, household tests allow for individual and group evaluations.

The objectives of this household taste test were as follows:

1. To conduct a comparative, home-user taste test of three ground beef products among household food preparers and members using a current (control) market product, a lean product, and AU Lean, a developed lean product;
2. To determine existing meat purchasing preferences and practices of taste panel households and meal preparer attitudes about foods, nutrition, and health; and
3. To analyze interactions among meal preparers' food preferences, practices, and attitudes as they relate to their evaluations of different ground beef products.

Methodology

A taste-test panel was the method used to conduct this study. The goal was to approximate the household conditions within which new food products are actually prepared, cooked, and consumed by typical American households. This procedure required contacting a sample of households and obtaining agreement from the persons who normally plan and prepare the meals to commit their households as study participants.

The motivating inducement for households to volunteer was the free receipt of fresh ground beef in sufficient quantities for all household members. Deliveries of a ground beef product would be made weekly for 4 weeks. In return, the meal preparer would complete a short evaluation of the particular ground beef product provided each week. Every household member eating the product, including the meal preparer, would complete a taste evaluation. The meat was not to be frozen and was to be prepared within a few days of delivery. Each week another delivery of ground beef would be made and the completed product evaluations for the previous week's product collected.

The study involved three ground beef products: Product A (control) — a market product containing 20 percent fat; product B (lean) — a lean product containing less than 10 percent

fat; and product C (AU Lean) — a developed lean product containing less than 10 percent fat plus sensory enhancers *(6)*.

Conduct of the taste tests for each of the three ground beef products involved creation of three independent taste panels for replication and comparison purposes. The original design called for 30 households in each panel. Panels were formed to represent all population segments within a mid-sized test city. A system of random telephone numbers was used to provide a diverse sample of household types. Subscriber households selected were contacted by telephone. Household meal preparers or spouses were informed about the study and asked whether the household would be willing to participate. All volunteer households were asked to provide answers to a few background questions designed to provide information concerning the location of their house within the city, the household size, times when a household member was usually at home, and a few descriptive household characteristics. When the required sample of at least 90 volunteer households had been identified, each household was randomly assigned to one of the three taste-test panels.

The testing process was initiated with the delivery of ground beef products for the first week, table 1. The three taste panels were provided a different ground beef product, product A (market), B (lean), and C (AU Lean, developed), for each of the first 3 test weeks. This varied the order that each product was received as a control for any order effect associated with the sequencing of the three products. Household meal preparers were instructed to form the product as patties, but any seasoning and cooking method could be used. For a fourth delivery, all three panels received AU Lean (C) and were instructed to use it in any meat dish they

TABLE 1. DELIVERY SCHEDULE FOR DIFFERENT GROUND BEEF PRODUCTS BY WEEK, NOVEMBER-DECEMBER, 1989, OPELIKA, ALABAMA

Test panels	Weeks[1]			
	First	Second	Third	Fourth
Panel I	Product A	Product B	Product C	Product C
Panel II	Product B	Product C	Product A	Product C
Panel III	Product C	Product A	Product B	Product C

[1]The week of Thanksgiving was skipped so that a 1-week break occurred between the third and fourth deliveries.

desired. They were encouraged, but not required, to prepare the product in some form other than patties.

Evaluations for each of the three test products were conducted at each of three distinct stages in the meal preparation process as the meal preparer readied the ground beef product for serving. The three evaluation stages are identified as the preparing, cooking, and eating stages. Five traits rated at the preparing stage are the overall appearance, color, leanness, smell, and workability. Cooking stage traits involve ratings of the amount of fat produced, the amount of shrinkage, and the overall appearance. The four traits considered in the eating stage include general liking, tenderness, flavor, and juiciness. Each trait was assessed on a scale of 0 - 5, with the low score indicating the most desirable, or best, rating.

At the close of the 4-week test period, a separate attitudinal questionnaire was given to each household meal preparer. This household member was asked to provide information describing the household's food purchasing behaviors, attitudes about and uses of ground beef, attitudes toward food, nutrition, and health, and other selected household characteristics.

Study Location

The community chosen for this consumer study was Opelika, Alabama, a medium-sized city with a population estimated at 24,500 in 1986. As a county seat, it possesses a diverse economic and social structure, including a sizeable professional-managerial sector provided by a substantial industrial base, a regional medical center, and close proximity to a major state university. The racial composition of the city in 1980 was 33 percent black, and more than 11 percent of the population was 65 years of age or older. Some 18 percent of households were classified as being below the poverty line. The city had a per capita income of $9,183 in 1985.

Sample Selection

The randomization procedure for identifying household telephone numbers was implemented by determining all telephone three-digit prefixes for the Opelika area. A random

number procedure was used to create a list of 2,000 four-digit suffixes. These suffix numbers were cross-referenced with the city directory to find currently active telephone numbers appearing with any of the three operational prefixes. This process continued until a random sample of 400 in-service household numbers and names was identified. Other in-service numbers from the 2,000 were to be generated later, if needed, to obtain a minimum of 90 volunteer households. Each household was contacted by telephone and asked whether the members would be willing to participate in a 4-week product evaluation study. Households volunteering to participate were asked several descriptive questions about the location of their house and selected household characteristics.

Each volunteer household was randomly assigned to one of three taste panels. Selected household characteristics compared for the three taste panels were: location within the community, household socioeconomic status, race, age of household head, household composition, and number of household members.

A description of household participation for each test panel over the 4 weeks of the study is presented in table 2. As expected with any research involving multiple testing over a period of time, some sample participant mortality occurred.

TABLE 2. SUMMARY OF PANEL HOUSEHOLD PARTICIPATION IN GROUND BEEF TASTE TEST BY WEEK, NOVEMBER-DECEMBER 1989

Participation by test week and type	Panel I (n=30)		Panel II (n=30)		Panel III (n=31)	
	No.	Pct.	No.	Pct.	No.	Pct.
By week						
Week 1	25	83	25	83	31	100
Week 2	25	83	23	77	31	100
Week 3	20	67	24	80	29	94
Week 4	19	63	21	70	27	87
Total participants	89	74	93	78	118	95
By type						
Completed all four evaluations	17	57	19	63	27	87
Completed at least one evaluation	26	87	27	90	31	100
Completed the attitudinal survey	22	73	24	80	29	94

Note: Four households in Panel I and three in Panel II failed to complete any of the evaluations and were dropped from the study after the second week.

Only 69 percent of the 91 households beginning the study participated fully by completing their evaluation forms for all 4 weeks. Seven households (8 percent) failed to complete any of the evaluations satisfactorily and were eliminated from the study. An additional 23 percent failed to complete evaluations for at least one of the four taste tests, but were retained as study participants. The actual number and percentage of households completing the four taste-test evaluations varied some among the three panels. Failure to complete the evaluations was most pronounced for the fourth week when no further deliveries of ground beef were provided and respondents were asked to mail their evaluation forms. Extensive telephone reminders and actual door-to-door pick-up was required to obtain the level of participation finally achieved.

Panel Characteristics

Data presented in table 3 show that although the three panels were not identical in composition, they did not differ sharply on any of the five household characteristics selected for comparison. No panel was consistently deviant from the other two panels across all characteristics. Panel III consisted of more adult couples and minority households. Panel I included more households with three or more members and more households with an older food preparer. The average age for this panel was 53 years. Panel II had the largest proportion of households with annual incomes below $30,000. Percentage differences between the panels on the various characteristics were not large considering the small sample of households in each panel. No difference exceeded

TABLE 3. SELECTED HOUSEHOLD CHARACTERISTICS OF THE THREE TASTE TEST PANELS, 1989

Household characteristics	Panel I	Panel II	Panel III
	Pct.	*Pct.*	*Pct.*
Couple (head and spouse)	73	75	90
Minority	27	29	35
Three or more members	55	45	45
Income below $30,000	39	55	50
Average age of heads[1]	53	51	47

[1]Mean years.

17 percentage points, with 8 percentage points representing the least difference from low to high panel.

RESULTS
Taste-Test Findings

This study involves independent product evaluations by two types of consumers: the actual meal preparer and the household members or meal partakers. The most comprehensive evaluation is provided by the meal preparers. Their evaluations involve separate assessments made at three distinct meal preparation stages: preparing, cooking, and eating. The second evaluation involves all household members at the eating (tasting) stage. While only one person per household responded as the meal preparer, the household members included all those eating the product when served. Results of these two evaluations are presented separately with major attention given the multistage evaluations made by the meal preparers.

Meal Preparer Evaluations

Household meal preparers rated the delivered ground beef product for each week on 12 traits. Five traits were associated with preparing the product for cooking and three involved traits that appeared during the cooking process. The remaining four traits were associated with the actual eating of the cooked product at the dinner table. Ratings for all product traits tested at the various stages are reported.

PREPARING STAGE. Product traits evaluated at the food preparing stage included overall appearance, color, leanness, smell, and workability. Table 4 presents the comparative mean ratings for each of the three ground beef products. All household meal preparers are aggregated by product without regard to taste-test panel or order in which the product was used (i.e., first, second, or third week).

The results show that ratings for the leanness trait differed significantly between the market product (A) and the lean products (B and C). The mean rating for the market control product (A) was 1.37, compared to mean ratings of 0.63 and 0.53 for AU Lean (C) and the lean product (B), respectively. The percentages of preparers giving the leanest

TABLE 4. MEAL PREPARER EVALUATIONS OF THREE GROUND BEEF PRODUCTS WHILE PREPARING PATTIES, WEEKS 1 THROUGH 3

Preparing traits	Evaluation, by ground beef product		
	Product A (market) (n=79)	Product B (lean) (n=76)	Product C (AU Lean) (n=73)
	Pct.	*Pct.*	*Pct.*
Appearance			
0-good	50	73	64
1	27	22	26
2	14	4	7
3	8	0	3
4	1	0	0
5-poor	0	1	0
Mean rating	0.82[1]	0.37	0.48
Color			
0-good	55	71	67
1	27	21	17
2	9	4	12
3	5	4	4
4	4	0	0
5-poor	0	0	0
Mean rating	0.75[2]	0.39	0.53
Leanness			
0-lean	38	66	59
1	23	21	25
2	15	11	14
3	15	1	0
4	6	0	2
5-fatty	3	1	0
Mean rating	1.37[1]	0.52	0.63
Smell			
0-good	60	70	63
1	25	24	28
2	8	5	8
3	4	0	0
4	2	1	1
5-poor	1	0	0
Mean rating	0.68[2]	0.38	0.49
Workability			
0-easy	54	66	63
1	29	22	21
2	13	11	11
3	4	1	1
4	0	0	4
5-hard	0	0	0
Mean rating	0.66	0.46	0.63

[1]Difference between this mean rating and those for the other two panel means was significant at the .05 level.

[2]Difference between this mean rating and that for product B was significant at the .05 level.

rating of "0" reflect the nature of this difference. Only 38 percent of the preparers rated the market product (A) "0" for leanness, whereas 59 percent did so for AU Lean (C) and 66 percent for the lean product (B).

Traits of overall product appearance, color, and smell revealed similar rating patterns. But the workability trait reflected little difference between the mean rating scores for the three ground beef products. The observed ratings differences were statistically significant for all of the traits (except workability) evaluated at the food preparing stage. However, the market product (product A) consistently received the least favorable (highest) mean score ratings. Also, AU Lean (C) received intermediate ratings more similar to the most favorable (lowest) mean score rating awarded the lean product (B). This pattern holds for all traits except workability, where the market product (A) and AU Lean (C) received similar mean score ratings of 0.66 and 0.63, respectively. However, the percentage distributions reveal that this mean rating for AU Lean (C) is the result of four preparers (4 percent) who gave the product "4" ratings.

Further analysis focused on variability in panel evaluations controlling for the sequence or order in which the panel received each ground beef product (i.e., first, second, or third week). Theoretically, sequence variations in the trait ratings should not exist across the three panels with similar differences in trait ratings observed for all three panels.

Appendix table 1 gives no indication of any order or sequence variation for the traits of smell and workability. However, different patterns did appear for specific panel groups when the traits of color, appearance, and leanness were evaluated. The market product (A) was consistently rated less desirable by Panels II and III for appearance and leanness, but not by Panel I. In addition, Panel II rated the market product (A) as having a less desirable color than the two lean products.

It is not clear whether these differences between panels are merely the result of the small sample sizes involved when comparing the individual panels independently, or if they represent a sequence effect associated with the order in which the products were received and prepared (week effect). Nevertheless, all trait ratings for the market product (A) were considerably less favorable than were the ratings for

the lean products, B and C. Relatively small ratings variations among panel households can cause these differences to appear significant under controlled conditions. This explanation is believed most pertinent to the situation here. However, future studies involving these products should consider the possible time sequence impact on product ratings at the preparing stage.

COOKING STAGE. Three product traits associated with the cooking stage were tested. These included the amount of fat produced, the amount of shrinkage, and the overall appearance. Table 5 reports the comparative mean meal preparer ratings and the percentage distributions for each of the three ground beef products.

TABLE 5. MEAL PREPARER EVALUATIONS OF THREE GROUND BEEF PRODUCTS WHILE COOKING PATTIES, WEEKS 1 THROUGH 3

Cooking traits	Evaluation, by ground beef product		
	Product A (market) (n=79)	Product B (lean) (n=77)	Product C (AU Lean) (n=73)
	Pct.	*Pct.*	*Pct.*
Amount of fat			
0-small	25	65	58
1	31	23	27
2	11	8	12
3	14	3	3
4	13	1	0
5-excessive	6	0	0
Mean rating	1.77[1]	0.51	0.60
Amount of shrinkage			
0-small	34	55	54
1	37	34	34
2	20	9	11
3	3	1	1
4	5	1	0
5-excessive	1	0	0
Mean rating	1.11[1]	0.59	0.60
Overall appearance			
0-good	52	66	63
1	27	24	29
2	11	9	7
3	9	1	1
4	1	0	0
5-poor	0	0	0
Mean rating	0.81[1]	0.45	0.47

[1]Product A is significantly different from products B and C, which are not different from each other. Difference between this mean rating and those for the other two panel means was significant at the .05 level.

Results of the meal preparers' evaluations during the cooking stage were decisively favorable toward the lean products. Both lean ground beef products (B and C) received significantly better cooking ratings than the market product (A) for all three traits. These differences were particularly pronounced for the amount of fat. Only 25 percent of preparers gave the market product (A) the best rating of "0" for this trait, compared to 58 percent for AU Lean (C) and 65 percent for the lean product (B). The mean ratings were 1.77 for the market product (A) compared to 0.60 and 0.51 for AU Lean (C) and the lean product (B), respectively. Similar percentage patterns and mean ratings occurred for the traits of shrinkage and overall appearance.

Differences in cooking trait ratings for the three ground beef products occurring among the panel groups are reported in Appendix table 2. The distinctively poor ratings given to the market product (A) during cooking were consistent for the amount of fat trait across all three panels. However, Panel I differentiated between the market product (A) and the two lean ground beef products only for the amount of fat trait. Panel I reported relatively little difference on the shrinkage and general appearance traits among the three products. Panels II and III consistently revealed strong preferences for both lean products on these same traits. Perhaps exposure to a lean product prior to the market product caused this difference.

EATING STAGE. The final evaluation stage is that of eating the product in a meal situation. Four eating traits were tested: general liking, tenderness, flavor, and juiciness. Although other members of the household usually participated in eating the meal, only the taste responses of the meal preparers are reported here to achieve evaluator consistency over all three stages.

Comparative evaluations of the three products are reported in table 6. The results revealed no statistical differences in mean ratings for any of the four eating traits. Mean rating scores for juiciness were virtually the same for all three products. Greater differences were observed for the remaining three traits, with AU Lean (C) consistently having the most desirable (lowest) scores. These meal preparers "liked" AU Lean (C) better than the market product (A),

TABLE 6. MEAL PREPARER EVALUATIONS OF THREE GROUND BEEF PRODUCTS DURING EATING OF PATTIES, WEEKS 1 THROUGH 3

Eating traits	Evaluation, by ground beef product		
	Product A (market) (n=79)	Product B (lean) (n=77)	Product C (AU Lean) (n=73)
	Pct.	*Pct.*	*Pct.*
Like			
0-like very much	40	40	42
1	24	26	29
2	13	22	21
3	9	7	7
4	11	4	1
5-dislike very much	1	1	0
Mean rating	1.34	1.12	0.96
Tenderness			
0-very tender	40	43	45
1	28	32	26
2	14	12	19
3	8	7	8
4	8	5	0
5-very tough	2	1	2
Mean rating	1.20	1.03	0.95
Flavorfulness			
0-very good	38	38	40
1	21	29	32
2	23	17	21
3	8	8	7
4	9	6	1
5-very poor	1	2	0
Mean rating	1.32	1.27	0.96
Juiciness			
0-very juicy	24	31	30
1	27	27	25
2	25	18	19
3	13	9	14
4	9	8	8
5-very dry	2	7	4
Mean rating	1.61	1.55	1.58

rated it better for tenderness, and found it more flavorful. While the lean product (B) was rated more desirable than AU Lean (C) at the preparing and cooking stages, it was consistently rated less desirable at the eating stage.

Panel Comparisons

Appendix table 3 reports the same taste comparisons for each of the three taste panels. Consistent with the findings above, there were no significant statistical differences in

mean ratings observed among the three ground beef products for any of the taste panels. Generally, the pattern of preference among products A, B, and C was similar, but some variation was found between panels. Panel II preparers who received the market product (A) following the lean products (B) and AU Lean (C) liked it much less (m=1.75) than did members of the other two panels, while liking the lean products (B and C) about the same as members of the other two panels. A similar pattern was observed for Panel II and tenderness. Ratings for flavorfulness and juiciness were only marginally consistent with this order effect for the market product (A). However, these findings do suggest that the market product (A) may suffer from downgrading when tested following the leaner products.

Household Member Evaluations

Extending the taste test to other participating household members, table 7 shows the mean ratings for each product. The first observation is that all ratings are less favorable (higher scores) than those of the meal preparers. These panel participants probably did not see or work with the products prior to consuming them at the dinner table. Also, these household members represented a much wider variability in sex, age, and other personal characteristics. Given these facts, the more critical (higher) ratings awarded all three of the test products seem understandable.

The same pattern of taste ratings reported by the meal preparers was observed here as well. AU Lean (C) received the most desirable mean ratings on general liking (1.29), tenderness (1.29), and flavorfulness (1.15), where the lower score represents the more desirable product. Virtually no difference was found in ratings for the juiciness of the three products, a finding consistent with that for the meal preparers. A further observation is that the current market product (A) containing 20 percent fat received the least desirable rating, i.e., had the highest scores on the liking, tenderness, and flavorfulness traits.

Composite Meal Preparer Ratings

In order to provide a single multi-trait rating of the three ground beef products under test, a composite rating measure

TABLE 7. HOUSEHOLD MEMBER EVALUATIONS (OTHER THAN MEAL PREPARER) OF PATTIES OF THREE GROUND BEEF PRODUCTS DURING EATING STAGE, WEEKS 1 THROUGH 3

Eating traits	Evaluation, by ground beef product		
	Product A (market) (n=55)	Product B (lean) (n=63)	Product C (AU Lean) (n=62)
	Pct.	*Pct.*	*Pct.*
Like			
0-like very much	18	29	24
1	33	29	40
2	22	25	26
3	7	9	5
4	16	6	2
5-dislike very much	4	2	3
Mean rating	1.85	1.41	1.29
Tenderness			
0-very tender	24	27	32
1	34	38	30
2	11	16	24
3	13	8	8
4	16	9	1
5-very tough	2	2	5
Mean rating	1.69	1.43	1.29
Flavorfulness			
0-very good	24	24	31
1	18	32	32
2	31	22	29
3	13	6	8
4	11	10	0
5-very poor	3	6	0
Mean rating	1.82[1]	1.65	1.15
Juiciness			
0-very juicy	11	19	15
1	23	25	27
2	33	19	21
3	22	16	16
4	7	11	11
5-very dry	4	10	10
Mean rating	2.02	2.03	2.11

[1]Product A is significantly different from product C at the .05 level.

was constructed for each observation stage. For the preparing stage, the five independent trait ratings of 0 through 5 for appearance, color, leanness, smell, and workability were summed for each household evaluator. The same procedure was used to create a composite cooking stage measure based on the amount of fat, amount of shrinkage, and overall appearance, and a composite eating stage measure consisting of overall liking, tenderness, flavorfulness, and juiciness.

Table 8 reports the comparative ratings for the three

TABLE 8. MEAL PREPARER COMPOSITE EVALUATIONS OF PATTIES OF THREE GROUND BEEF PRODUCTS DURING PREPARING, COOKING, AND EATING, WEEKS 1 THROUGH 3

Product rating score	Evaluation score, by use stages and ground beef products								
	Preparing stage			Cooking stage			Eating stage		
	A	B	C	A	B	C	A	B	C
25	—	—	—	—	—	—	—	—	—
23-24	—	—	—	—	—	—	—	—	—
21-22	—	—	—	—	—	—	—	—	—
19-20	—	—	—	—	—	—	—	1.3	—
17-18	2.5	—	—	—	—	—	1.3	1.3	1.4
15-16	3.8	—	—	—	—	—	6.3	3.9	—
13-14	1.3	2.6	2.7	—	—	—	5.0	2.6	1.4
11-12	6.3	1.3	1.4	3.8	—	—	3.8	5.2	5.4
9-10	3.8	1.3	4.1	6.4	1.3	1.4	7.6	7.8	6.8
7-8	8.9	3.9	8.2	12.7	3.9	1.4	11.4	9.1	12.3
5-6	11.4	10.5	4.1	15.2	3.9	8.2	17.7	14.3	19.2
3-4	10.1	13.2	20.5	13.9	19.5	17.8	11.4	14.3	13.7
1-2	27.9	14.5	19.2	27.9	24.7	31.5	19.0	16.9	14.3
0 (best)	24.1	52.6	39.7	20.3	46.8	39.7	16.5	23.4	27.4
Preparers	(79)	(76)	(73)	(79)	(77)	(73)	(79)	(77)	(73)
Mean score	4.28	2.08	2.77	3.70	1.55	1.67	5.47	5.04	4.44
Scale range		0-25			0-15			0-20	
F ratio		6.569			17.115			.942	
Probability		.0017(S)			.0000(S)			.3916(NS)	
Direction		A from B & C			A from B & C			None	

ground beef products. Summarizing across all traits considered at each stage, the composite scores reveal that the market product (A) consistently received the least favorable rating (had the higher rating scores). At the preparing and cooking stages, these differences were statistically significant when compared to both the lean product (B) and AU Lean (C), although in both cases the ratings for the lean product (B) and AU Lean (C) were more similar to each other than to the market product (A).

The key comparison is at the eating stage where taste is at issue. These composite rating scores show AU Lean (C) with the lowest (better) scores compared to both the market product (A) and the lean product (B). Neither of these comparisons was statistically significant, but the differences were most pronounced between AU Lean (C) and the market product (A). Since the technological challenge was to create a ground beef product that would at least meet the taste preferences of American consumers, these results clearly indicate that AU Lean, the developed product (C), achieves this goal.

Product Ratings Analysis

In this section, attention is given to the analysis of AU Lean (C) ratings. For this purpose, the composite measure ratings at the preparing, cooking, and eating stages represent the dependent variable analyzed. The several issues to which answers are sought involve: (1) whether the ratings differences between AU Lean (C) and the market product (A) are significant; (2) whether the cooking method used is associated with product ratings; (3) whether meal preparer and household characteristics are related to how ground beef products are evaluated; and (4) whether attitudes of meal preparers are associated with AU Lean (C) ratings in any predictable way.

Composite Product Evaluation Measures

Meal preparer evaluations for AU Lean (C) are summarized by creating independent composite rating measures for each of the three evaluation stages. Each composite measure was developed by summing the rating scores for all traits

associated with the particular evaluation stage. At the initial meal preparing stage, five ground beef traits were evaluated using a 6-point scale. The most favorable rating was assigned a score of "0" and the less favorable a score of "5". A composite score across all five traits included in ratings for the preparing stage had a possible range of scores from 0 to 25. Table 9 reports the distribution of preparing stage scores for 73 household meal preparers. The results show that 40 percent gave AU Lean (C) the best possible rating of 0 for all five traits. The worst or poorest rating score was a 14. About 79 percent of the scores were 4 or less, indicating a very favorable evaluation of the raw product.

TABLE 9. DISTRIBUTION OF HOUSEHOLD MEAL PREPARER RATINGS FOR AU LEAN (C) AND THE MARKET PRODUCT (A) ON THREE COMPOSITE EVALUATION MEASURES: PREPARING, COOKING, AND EATING STAGES

Rating scores	Evaluation stages					
	Preparing		Cooking		Eating	
	C	A	C	A	C	A
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
25	—	—	—	—	—	—
24	—	—	—	—	—	—
23	—	—	—	—	—	—
22	—	—	—	—	—	—
21	—	—	—	—	—	—
20	—	—	—	—	—	—
19	—	—	—	—	—	—
18	—	—	—	—	—	—
17	—	2.5	—	—	1.4	1.3
16	—	—	—	—	—	6.3
15	—	3.8	—	—	—	—
14	2.7	—	—	—	—	2.5
13	—	1.3	—	—	1.4	2.5
12	—	3.8	—	1.3	2.7	3.8
11	1.4	2.5	—	2.5	2.7	—
10	2.7	2.5	—	1.3	2.7	2.5
9	1.4	1.3	1.4	5.1	4.1	5.1
8	4.1	5.1	—	7.6	8.2	5.1
7	4.1	3.8	1.4	5.1	4.1	6.3
6	1.4	5.1	2.7	8.9	13.7	6.3
5	2.7	6.3	5.5	6.3	5.5	11.4
4	8.2	2.5	1.4	6.3	11.0	2.5
3	12.3	7.6	16.4	7.6	2.7	8.9
2	11.0	11.4	15.1	11.4	6.8	3.8
1	8.2	16.5	16.4	16.5	5.5	15.2
0	39.7	24.1	39.7	20.3	27.4	16.5
Preparers	(73)	(79)	(73)	(79)	(73)	(79)
Mean score	2.77	4.28	1.67	3.70	4.43	5.47
F-ratio	6.569		17.115		.942	
Significance	$p < .002$ (S)		$p < .001$ (S)		$p > .05$ (NS)	

The same procedure was used in constructing a composite measure for the three traits used to test the cooking stage: amount of fat, amount of shrinkage, and overall appearance while cooking. Summed scores for these three traits resulted in a composite measure with possible scores ranging from 0 to 15, with the lowest score indicating the most desirable rating. Forty percent of the meal preparers gave AU Lean (C) the best possible ratings on all three cooking stage traits. Moreover, 88 percent of the scores for AU Lean (C) were 3 or better (less than 4).

A composite measure for the four eating (tasting) stage traits (overall liking, tenderness, flavor, and juiciness) was constructed using the same procedure described above. The possible range of scores for the eating measure was 0 to 20, with the lowest score indicating the most desirability. Data reported in table 9 reveal a wide range of scores for AU Lean at this evaluation stage, including a few highly unfavorable ratings. Only 27 percent of these preparers gave the most desirable ratings for all four eating traits. This proportion increased to 53 percent when considering scores of 4 or less (better). An additional 36 percent gave AU Lean (C) ratings of 5 through 9.

Market Product (A) and AU Lean (C) Comparisons

The question arises as to how these composite measures of the three evaluation stages for AU Lean (C) compare to similar measures for the market product (A). These two comparisons are readily observed in table 9. First, the range of composite ratings is wider at all three evaluation stages for the market product (A) than for AU Lean (C). Second, a considerably smaller proportion of meal preparers gave the market product (A) the best possible rating of zero at all three evaluation stages. The percentages were nearly twice as large for AU Lean (C) at both the preparing and cooking stages, i.e., by 16 and 19 percentage points, respectively.

The percentage difference in the proportion of meal preparers who gave the market product (A) and AU Lean (C) the most favorable ratings of "0" at the eating stage was only 11 percentage points larger for the developed product (C). Although this difference is small, it represents a very positive result since the product development goal was to achieve

a lean ground beef product that compares favorably with currently marketed ground beef products. These taste evaluations for the eating stage show that AU Lean (C), the developed product, not only compares well in taste to fattier ground beef, but even marginally surpasses the current market product in taste.

Meal Preparer Characteristics and AU Lean (C) Evaluations

One question that would readily be asked about these product evaluations and especially about the ratings for AU Lean (C) is whether they varied with the background of the meal preparers. To answer this question, seven descriptive characteristics of the preparer and household were analyzed in relation to AU Lean (C) ratings, table 10.

The study households included only nine in which a male was the meal preparer. When the ratings of AU Lean (C) by these men are compared with those of women preparers, the men rated AU Lean (C) much better than did the women at all three evaluation stages. The mean ratings differences were rather large, but because of the small number of men, they were not statistically significant.

Consistent differences in AU Lean (C) ratings at all three evaluation stages were noted for the meal preparer's race. Black preparers rated the developed product better than did white preparers. The ratings difference between black and white preparers was statistically significant at the eating stage, where blacks gave the product a favorable rating of 2.39 compared to a rating of only 5.38 by whites. Differences observed between black and white preparers at the preparing and cooking stages were not significant.

Age was found to be directly associated with better ratings of AU Lean (C). Older meal preparers gave better ratings than younger preparers, and this was a progressive pattern over four age levels. These ratings differences were not statistically significant at the cooking stage but were significant at the preparing stage between the oldest and youngest age levels. The comparative differences were even greater at the eating stage, however, where both of the two older age groups were significantly different from both of the two younger age groups. Clearly, age is associated with the evaluations of this ground beef product.

TABLE 10. MEAL PREPARER COMPOSITE EVALUATIONS OF PATTIES OF AU LEAN (C) AND THE MARKET PRODUCT (A) DURING PREPARING, COOKING, AND EATING STAGES, WEEKS 1 THROUGH 3

Evaluation factor and number of participants	Mean score, by stage and product					
	Preparing stage		Cooking stage		Eating stage	
	A	C	A	C	A	C
By sex						
Male (n=10) (n=9)	1.20[1]	0.78	1.40[1]	0.56	2.80	3.89
Female (n=61) (n=59)	4.69	3.07	4.09	1.76	5.83	7.08
[1]Males significantly differed from females at the .05 level.						
By race						
White (n=58) (n=50)	4.76	3.14	4.12	1.88	6.34[1]	5.38[1]
Black (n=21) (n=23)	2.95	1.96	2.52	1.22	3.05	2.39
[1]Whites significantly differed from blacks at the .05 level.						
By age						
Under 35 (n=13) (n=14)	4.92	4.71[1]	5.23	2.21	7.15	6.86[1,2]
35-54 (n=24) (n=21)	5.25	2.71	4.04	1.76	6.17	5.81[3,4]
55-64 (n=18) (n=18)	3.28	2.44	2.78	1.11	4.22	3.28
65 or over (n=15) (n=14)	2.80	1.14	2.93	1.07	3.93	1.29
[1]Those under 35 years of age significantly differed from those 65 or over at the .05 level.						
[2]Those under 35 years of age significantly differed from those 55-64 at the .05 level.						
[3]Those 35-54 years of age significantly differed from those 65 or over at the .05 level.						
[4]Those 35-54 years of age significantly differed from those 55-64 at the .05 level.						
By education						
No HS diploma (n=15) (n=16)	2.40	1.69	3.27	.75	4.80	2.75
HS diploma (n=20) (n=19)	4.35	2.00	2.90	1.05	4.90	2.89
Some college (n=18) (n=19)	3.50	3.00	3.44	1.84	4.78	4.74
College degree (n=16) (n=12)	6.19[1]	5.00[1,2]	5.44[2]	3.00[1,2]	7.13	8.58[1,2,3]
[1]Those with a college degree significantly differed from those with no high school diploma at the .05 level.						
[2]Those with a college degree significantly differed from those with only a high school diploma at the .05 level.						
[3]Those with a college degree significantly differed from those with some college at the .05 level.						
By occupation						
White collar (n=16) (n=13)	5.38	4.92[1,2]	3.63	2.85[1,2]	6.06	6.46[1]
Sales-skilled (n=31) (n=33)	4.16	2.42	4.10	1.33	5.42	4.15
Semi-unskilled (n=10) (n=10)	3.60	1.30	3.60	.70	3.80	1.80
[1]Those with white collar jobs significantly differed from those in semi-skilled or unskilled jobs at the .05 level.						
[2]Those with white collar jobs significantly differed from those in sales or skilled jobs at the .05 level.						

Continued

TABLE 10 (CONTINUED). MEAL PREPARER COMPOSITE EVALUATIONS OF PATTIES OF AU LEAN (C) AND THE MARKET PRODUCT (A) DURING PREPARING, COOKING, AND EATING STAGES, WEEKS 1 THROUGH 3

Evaluation factor and number of participants			Mean score, by stage and product					
			Preparing stage		Cooking stage		Eating stage	
			A	C	A	C	A	C
By household income								
Below $10k	(n=9)	(n=9)	2.44	1.89	3.00	1.11	2.78	1.56[1,2]
$10k-29.9	(n=21)	(n=20)	3.95	2.05[3]	3.38	1.35	5.67	3.20[3,4]
$30k-49.9	(n=19)	(n=17)	4.11	4.65[5]	3.84	2.18	5.74	7.18
$50k above	(n=13)	(n=11)	4.77	1.73	3.92	1.82	5.46	5.82

[1]Those earning below $10k significantly differed from those earning $30k-49.9k at the .05 level.
[2]Those earning below $10k significantly differed from those earning $50k or above at the .05 level.
[3]Those earning $10k-29.9k significantly differed from those earning $30k-49.9k at the .05 level.
[4]Those earning $10k-29.9k significantly differed from those earning $50k or above at the .05 level.
[5]Those earning $30k-49.9k significantly differed from those earning $50k or above at the .05 level.

Education revealed an indirect association with AU Lean (C) ratings. The more education the meal preparer had, the more critically the developed product was evaluated. This pattern was consistent at all three evaluation stages. Moreover, the ratings differences were statistically significant between both of the two least education levels and the highest education level representing those meal preparers with college degrees.

Three broad occupational categories were used to identify managerial-professional, sales, and skilled trades and semiskilled-unskilled levels. The findings show again the inverse relation between socioeconomic status and ratings of AU Lean (C). Meal preparers in white collar occupations were significantly less favorable in their ratings than were those in semiskilled and unskilled occupations at the preparing, cooking, and eating stages. They were also significantly less favorable than those in sales and skilled occupations in the preparing and cooking stages.

Household income is the last variable considered. A sizeable number of households failed to provide information on this characteristic as well as the previous occupation variable. Nevertheless, for households that reported an income level, there was again observed an indirect relationship with

AU Lean (C); that is, the higher the household income, the poorer the product rating, except at the highest income level. None of these differences was significant at the cooking stage, but several comparisons were significant at the other stages. At the preparing stage, meal preparers with the highest incomes had the most favorable rating and significantly so compared to the ratings of the middle income levels. However, at the eating stage both of the lowest income meal preparer levels differed significantly in their AU Lean (C) ratings from both of the high income levels.

These findings suggest rather strongly that socioeconomic status is associated with consumer ratings of AU Lean (C). But why does this relationship exist and why in the direction that it does, i.e., meal preparers from lower socioeconomic backgrounds rating the product better than those from higher level backgrounds? Is this relationship unique to AU Lean, or does it occur for all ground beef products? Table 10 includes the composite mean ratings for the market control product (A) containing 20 percent fat. The rating patterns are very similar to those observed for AU Lean (C) at all three evaluation stages. Differences in the mean ratings for the two products were discussed earlier and are not the relevant consideration here. However, older, less educated, blacks, males, and lower income households consistently rated both ground beef products better than did preparers at other levels of these characteristics.

Cooking Method

No instructions were given to the household meal preparers concerning the method of cooking that should be used. More than half (55 to 58 percent) of the households that reported a cooking method specified that they fried their patties. Another 17 percent of households broiled and 15 percent grilled, while the remainder used a variety of other methods. Evaluations of the three ground beef products at the cooking and eating stages with cooking method controlled are reported in tables 11 through 13.

COOKING STAGE RATINGS. Household meal preparers who fried the three ground beef products rated AU Lean (C) as showing less fat and shrinkage than the market product

TABLE 11. MEAL PREPARER COOKING EVALUATIONS OF PATTIES OF THREE GROUND BEEF PRODUCTS ACCORDING TO COOKING METHOD, WEEKS 1 THROUGH 3

Cooking method	Evaluation, by ground beef product		
	Product A (market)	Product B (lean)	Product C (AU Lean)
Fried	(n=44)	(n=45)	(n=43)
Small amount of fat			
Percent rating	27	71	54
Mean rating	1.77[1]	0.38	0.70
Small amount of shrinkage			
Percent rating	32	67	51
Mean rating	1.18[1]	0.47	0.70
Overall good appearance			
Percent rating	52	69	56
Mean rating	0.80[2]	0.38	0.58
Broiled	(n=12)	(n=15)	(n=15)
Small amount of fat			
Percent rating	17	47	67
Mean rating	2.08[1]	0.80	0.47
Small amount of shrinkage			
Percent rating	8	40	60
Mean rating	1.58[3]	0.93	0.47
Overall good appearance			
Percent rating	33	60	73
Mean rating	0.92[3]	0.67	0.27
Grilled	(n=15)	(n=12)	(n=10)
Small amount of fat			
Percent rating	21	65	55
Mean rating	1.64[1]	0.55	0.45
Small amount of shrinkage			
Percent rating	43	46	55
Mean rating	0.93	0.64	0.45
Overall good appearance			
Percent rating	57	64	73
Mean rating	0.79	0.36	0.27

[1]Product A is significantly different from products B and C at the .05 level.
[2]Product A is significantly different from product B at the .05 level.
[3]Product A is significantly different from product C at the .05 level.

(A), table 11. They did not discriminate between AU Lean (C) and the market product (A) with regard to overall appearance, although the ratings for AU Lean (C) were more desirable than those for the market product (A).

As a cooking method, broiling provided the most distinct results between the market product (A) and AU Lean (C) in terms of desirable cooking qualities. AU Lean (C) outperformed both the market and the other lean product on shrinkage and appearance, as well as being rated far more desirable than the market product (A) on the amount of fat produced.

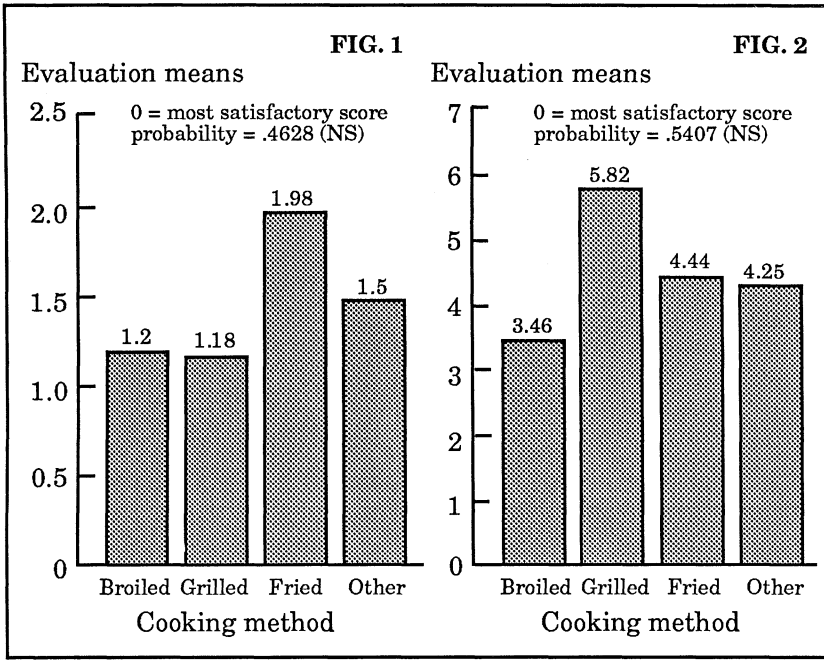


FIG. 1. Meal preparers' cooking evaluations of AU Lean according to cooking method. FIG. 2. Meal preparers' eating evaluations of AU Lean according to cooking method.

When grilling was used in cooking, differences among the three products were less distinct. Only the small amount of fat produced by AU Lean (C) significantly distinguished it from the market product (A). Nevertheless, the ratings for AU Lean (C) were more desirable (lower) than were those for the market product (A) and about the same as those for the lean product (B) on shrinkage and appearance.

Figure 1 shows the meal preparer composite evaluation ratings for AU Lean (C) using different cooking methods. Caution should be used in generalizing from these results because of the small number of households that reported using methods other than frying. Nevertheless, the findings are interesting. At the cooking stage, meal preparers who grilled or broiled gave AU Lean (C) similarly favorable ratings, almost twice as good as the ratings for those who fried.

EATING STAGE RATINGS. Taste-test evaluations failed to reveal any marked preferences among the three ground

beef products when rated by the meal preparers using different cooking methods, table 12. Nevertheless, when frying was the cooking method, AU Lean (C) received the most desirable ratings for all four traits tested. The same finding held true when broiling was the cooking method; that is, AU Lean (C) was consistently rated more desirable than the market product (A). The ratings for liking and flavor were

TABLE 12. MEAL PREPARER EATING EVALUATIONS OF PATTIES OF THREE GROUND BEEF PRODUCTS ACCORDING TO COOKING METHOD, WEEKS 1 THROUGH 3

Cooking method	Evaluation, by ground beef product		
	Product A (market)	Product B (lean)	Product C (AU Lean)
Fried	(n=44)	(n=44)	(n=43)
Like very much			
Percent rating	39	34	44
Mean rating	1.32	1.20	0.98
Very tender			
Percent rating	36	39	47
Mean rating	1.23	1.02	0.98
Very good flavor			
Percent rating	36	39	40
Mean rating	1.30	1.20	1.02
Very juicy			
Percent rating	21	27	30
Mean rating	1.61	1.57	1.47
Broiled	(n=12)	(n=15)	(n=15)
Like very much			
Percent rating	33	53	47
Mean rating	1.75[1]	0.87	0.67
Very tender			
Percent rating	50	53	53
Mean rating	1.33	0.80	0.67
Very good flavor			
Percent rating	33	47	47
Mean rating	1.75[2]	0.80	0.67
Very juicy			
Percent rating	25	40	33
Mean rating	1.75	1.13	1.47
Grilled	(n=14)	(n=12)	(n=11)
Like very much			
Percent rating	36	42	27
Mean rating	1.29	1.17	1.27
Very tender			
Percent rating	43	42	46
Mean rating	0.93	1.33	1.18
Very good flavor			
Percent rating	36	25	36
Mean rating	1.14	1.92	1.09
Very juicy			
Percent rating	14	25	18
Mean rating	1.57	2.17	2.27

[1]Product A is significantly different from product C at the .05 level.
[2]Product A is significantly different from products B and C at the .05 level.

TABLE 13. HOUSEHOLD MEMBER EATING EVALUATIONS (OTHER THAN MEAL PREPARER) OF PATTIES OF THREE GROUND BEEF PRODUCTS ACCORDING TO COOKING METHOD, WEEKS 1 THROUGH 3

Cooking method	Evaluation, by ground beef products		
	Product A (market)	Product B (lean)	Product C (AU Lean)
Fried	(n=30)	(n=39)	(n=36)
Like very much			
Percent rating	10	26	28
Mean rating	1.93	1.44	1.28
Very tender			
Percent rating	20	28	28
Mean rating	1.77	1.28	1.31
Very good flavor			
Percent rating	20	28	31
Mean rating	1.93	1.41	1.17
Very juicy			
Percent rating	3	21	19
Mean rating	2.07	1.90	1.75
Broiled	(n=8)	(n=10)	(n=15)
Like very much			
Percent rating	25	50	27
Mean rating	2.13[1]	1.00	0.87
Very tender			
Percent rating	25	40	47
Mean rating	2.00[1]	1.10	0.80
Very good flavor			
Percent rating	25	40	40
Mean rating	2.13[1]	1.00	0.73
Very juicy			
Percent rating	25	30	7
Mean rating	2.00	1.50	2.20
Grilled	(n=13)	(n=11)	(n=10)
Like very much			
Percent rating	23	18	0
Mean rating	1.54	1.45	1.80
Very tender			
Percent rating	31	18	20
Mean rating	1.31	1.91	1.70
Very good flavor			
Percent rating	23	0	10
Mean rating	1.46[2]	2.72[3]	1.50
Very juicy			
Percent rating	8	0	0
Mean rating	1.85[3]	3.00	3.10

[1]Product A is significantly different from products B and C at the .05 level.
[2]Product A is significantly different from product B at the .05 level.
[3]Product B is significantly different from product C at the .05 level.

both statistically significant. The one weak trait was juiciness, where the lean product (B) was rated more desirable than AU Lean (C). Grilled patties resulted in the most varied set of ratings. Although none of these ratings differences were statistically significant, preferability of AU Lean (C) over the market product (A) occurred only for the tenderness

and flavor traits, while ratings for the remaining traits showed the market product (A) as being more desirable.

Meal preparer ratings for AU Lean (C) according to the cooking method used are shown in figure 2. The best rating is represented by the lowest score. Broiled patties received the better of the taste-test ratings. Conversely, AU Lean (C) ratings were least favorable when the patties were grilled. Ratings for fried patties were about midway between those for broiling and grilling.

When the taste ratings of household members other than the meal preparers are considered, the rating patterns paralleled those previously observed among the preparer ratings for the various cooking methods, table 13. AU Lean (C) was generally rated more desirable than the market product (A) by household members who ate the product either fried or broiled. Rating differences for broiled patties were statistically significant for the traits of liking, tenderness, and flavor. Conversely, when grilling was the cooking method, the market product (A) was rated more desirable than AU Lean (C) on all four traits.

Price Comparisons

How much would household meal preparers pay for the various ground beef products eaten and tested? Table 14 shows the price that meal preparers estimated they would be willing to pay in the market place for each of the three

TABLE 14. MEAL PREPARER EVALUATIONS OF THE PRICE PER POUND WILLING TO PAY FOR EACH GROUND BEEF PRODUCT, WEEKS 1 THROUGH 3

Willingness to pay $1.80 or more	Product A (market)	Product B (lean)	Product C (AU Lean)
Panel I	(n=22)	(n=24)	(n=18)
Percent rating	50	46	45
Mean rating ($)	1.80	1.82	1.77
Panel II	(n=14)	(n=24)	(n=20)
Percent rating	36	33	45
Mean rating ($)	1.77	1.75	1.75
Panel III	(n=24)	(n=27)	(n=31)
Percent rating	42	48	65
Mean rating ($)	1.76	1.82	1.82
Overall (not accounting for panel)	(n=60)	(n=75)	(n=69)
Percent rating	44	43	54
Mean rating ($)	1.78	1.80	1.79
Percentage giving price	75	96	96
	60/80=75	75/78=96	69/72=96

ground beef products. Note that the preparers did not know that the tests involved a "developed" lean ground beef product. The only information they had for assigning an estimated price was the observed product traits. Also, there was a 1-week lapse between their use of the three products so they did not have immediate product comparability when making this estimate. These factors taken together may partially explain the minor pricing differences obtained for the three products.

Meal preparers in their weekly product evaluations were asked "What price would you be willing to pay for this ground beef product?" The introduction to the question stated that "Ground beef products at local supermarkets usually sell at prices ranging from $1.49 to $2.29 per pound." A set of five categories involving 20-cent price intervals ranging from a low price of $1.40 to a high price of $2.39 per pound was provided. Here, as for most of the traits tested, the market product (A) received the lowest average price, but the difference was a single penny. Because of this lack of price discrimination, more work needs to be done on the willingness of consumers to pay the premium price that will be required to make a lean ground beef product available in the supermarket for household consumption.

Attitudes and AU Lean (C) Evaluations

A separate research activity undertaken in conjunction with the consumer testing of AU Lean (C) was to determine household meal preparer attitudes relative to a variety of concerns potentially associated with the purchase and consumption of red meat products. To measure these attitudes, a battery of 49 attitudinal items (statements) was presented to each of the household meal preparers in a separate questionnaire completed 2 weeks after the fourth and last week of product testing. Questionnaires were mailed or hand-delivered to the home with instructions to complete and return in the pre-addressed and stamped envelope provided. Personal interviews were used with selected preparers who the researchers anticipated might need assistance in completing the questionnaire because of age or lack of reading skills. This procedure provided 75 completed questionnaires from

81 household meal preparers who participated throughout the study (a 93 percent response rate).

Meal preparers were asked to indicate their agreement or disagreement with each of the attitude items on a 5-point Likert scale. Item scoring ranged from 0 for strongly disagree to 4 for strongly agree. Mean scores of 2.0 indicate a neutral position neither favorable nor unfavorable toward an item. A number of attitudes were stated in negative terms, in which case a disagree response indicated a positive attitude.

Of these 49 attitude items, 41 were categorized into 9 logically homogeneous factors. Tables 15 through 23 summarize household meal preparer responses and mean scores for each of these nine attitude dimensions. These were labeled: (1) meat and meat consumption, (2) nutrition, (3) health, (4) food purchasing, (5) price consciousness, (6) meal planning, (7) meal preparation aesthetics, (8) meal preparation time, and (9) food eating. These attitude dimensions were created by combining selected, relatively similar items into distinct composite measures involving a range of scores reflecting each meal preparer's attitude across all items in the particular dimensional set.

The procedure used was to determine the positive or negative connotation of each item and to score all items as positive statements. Where the wording of the item was stated in negative terms so that a response of disagree was required to convey a favorable attitude, the scoring for the item was reversed so that high scores of 3 and 4 always indicated a positive attitude. All items were scored from 0 to 4, with a score of 4 always indicating a very favorable or positive response.

Each attitude scale consists of a different number of items. This results in scales of different score ranges. However, all 9 attitude scales begin with a zero value representing a very unfavorable or negative attitude. Scale scores toward the middle of the particular scale range indicate a weak or uncrystallized attitude, while high scores reflect increasingly more favorable attitudinal orientations. For example, the meat and meat consumption scale had an actual range extending from 0 to 24, with a mid-range of 12 as the point at which an uncrystallized attitude existed.

In this section, each of the nine attitudes identified above are described in terms of the individual items used to mea-

sure each attitude. This is followed by a discussion of the relationship between the various meal preparer attitudes and their AU Lean (C) evaluations for each of the three test stages. Figures 3 through 11 report these relationships using bar graphs to show meal preparers' mean composite evaluation scores for AU Lean (C) in terms of their attitude on each of the nine factors measured. Each figure represents a different attitude and its relationship to preparers' AU Lean (C) evaluations.

Meat and Meat Consumption

What attitudes do meal preparers hold about meat as a part of their households' food consumption? Six items focus on this question, table 15. The first observation is the strong cultural value surrounding a meat dish as an essential component of a household's main meal each day (item 1). A high mean score of 3.2 was recorded for this attitude, with 78 percent of the preparers responding favorably. Item 2 contrasts meat with alternative main dishes and reveals a strong taste preference for meat. Here 55 percent of the meal preparers were of this opinion with a mean score of 2.6.

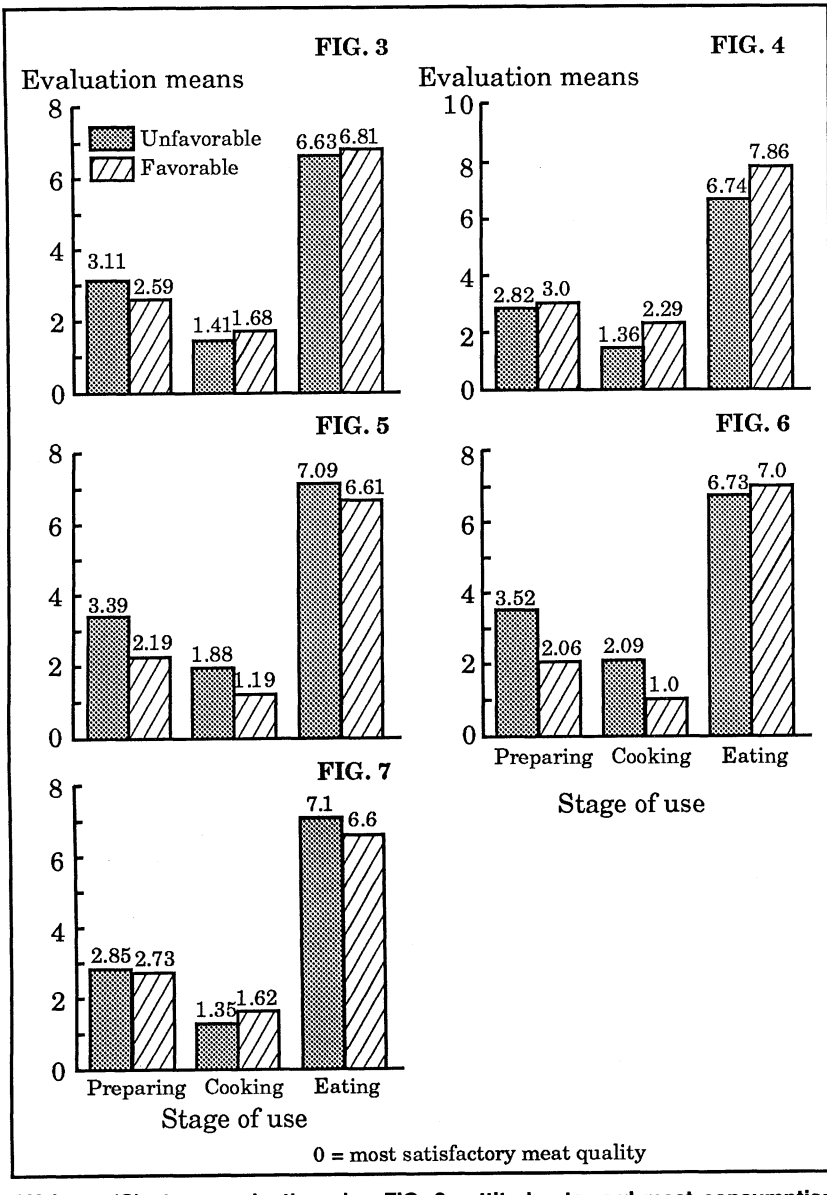
Two items were presented as negative items for which disagreement represented a favorable response toward meat. Three quarters of the preparers disagreed with the contention that the consumption of meat by their household was curtailed because of high cost (item 3). Also, the majority of preparers (52 percent) indicated that their household had not and was not considering any cutbacks in the amount of meat consumed because of health concerns (item 4). The respective mean scores were 0.9 and 1.6 for these two negatively worded items. A positively worded statement (item 5) reflecting the belief that meat is a healthier food than other things we eat was supported by more than one-third of these meal preparers (37 percent), while the largest proportion had no clear attitude (43 percent).

The last statement (item 6) again shows the strong attitudinal commitment to meat as a preferred product in the diets of these households. A mean score of 3.3 was recorded in support of a good tasting, low fat meat product even at a little higher price. A very large percentage (87 percent) of these meal preparers indicated a positive attitude, with almost

TABLE 15. MEAT AND MEAT CONSUMPTION ATTITUDES OF HOUSEHOLD MEAL PREPARERS (FACTOR 1)

Attitudinal items	Scale categories					
	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree	Score (mean)
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	
(1) To really satisfy households' appetite, a main meal must include meat	5.5	5.5	11.0	23.3	54.8	3.16
(2) Compared to other foods that might be served as the main part of a meal, my household considers meat the best tasting	6.8	5.5	32.9	31.5	23.3	2.59
(3) My household doesn't eat much meat because it is too expensive	54.2	20.8	15.3	1.4	8.3	0.89
(4) For health reasons, members of my household are considering or have already cut down on the amount of meat we eat	22.9	30.0	20.0	17.1	10.0	1.61
(5) Meat is definitely healthier than other foods we might eat	6.8	13.7	42.5	23.3	13.7	2.23
(6) I would gladly pay a little more for meat that had less fat and tasted good	1.4	2.7	9.5	39.2	47.3	3.28

Note: Mean scores are based on a rating of 0 for strongly disagree to 4 for strongly agree. A score of 2.00 shows balance between unfavorable and favorable attitudes.



AU Lean (C) stage evaluations by: FIG. 3—attitudes toward meat consumption; FIG. 4—attitudes toward nutrition; FIG. 5—attitudes toward health; FIG. 6—attitudes toward food purchasing; and FIG. 7—attitudes toward price.

half (47 percent) showing a strong commitment. This orientation to a good tasting, low-fat meat product fits into current values for a healthy life style and indicates that leaner meats should be positively received by many consumers, even at some differential in cost.

The scores of 0 to 4 for each item included in the attitudinal set were summed to provide a single measure. This particular measure consists of six items resulting in a meat and meat consumption score with a possible range from 0 to 24. Low scores indicate an unfavorable attitude contrasted to high scores that indicate a favorable attitude. A mid-range score of 12 reflects an inconsistent or uncertain attitude. Table 24 describes the distribution of meal preparer scores for all nine attitudinal measures identified above.

Figure 3 shows the relationship between the composite measure for the meat and meat consumption attitude and the meal preparer's AU Lean (C) evaluations for the preparing, cooking, and eating stages. The lower the bars for the two attitude groups, the better is the mean evaluation score for AU Lean (C) at a particular utilization stage. It is observed that meal preparer attitudes toward meat and meat consumption do not appear to have any consistent or patterned impact on how preparers evaluate AU Lean (C) at either of the three test stages. Both preparers with unfavorable and those with favorable attitudes toward meat and meat consumption gave similar ratings to AU Lean (C) at each of the three evaluation stages. The ratings provided by those meal preparers with favorable attitudes rated AU Lean (C) somewhat better in the preparing stage than did those with unfavorable attitudes. However, the reverse was true at both the cooking and eating stages. None of the observed relationships between the attitude toward meat and meat consumption and the evaluation of AU Lean (C) was significant.

Nutrition

Five attitudinal items address concerns relating to nutrition, table 16. High mean scores above 3.0 are recorded for two of these items. Item 1 has a mean score of 3.3, with almost 82 percent of the meal preparers agreeing and 59 percent doing so with a high degree of intensity. This indi-

TABLE 16. NUTRITION ATTITUDES OF HOUSEHOLD MEAL PREPARERS (FACTOR 2)

Attitudinal items	Scale categories					
	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree	Score (mean)
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	
(1) Nutrition is an important health concern and no one should be careless about it	2.9	2.9	12.9	22.9	58.6	3.31
(2) I am concerned that the foods I serve are nutritious	.0	1.4	21.9	30.1	46.6	3.22
(3) I avoid buying foods that are *not* nutritious or not good for members of my household	2.7	13.5	32.4	23.0	28.4	2.61
(4) In my household, it doesn't matter to me when we eat or what we eat, as long as our intake of food is balanced at the end of the day	19.4	26.4	19.4	29.2	5.6	1.75
(5) In my household, as long as our doctor doesn't say anything about nutrition, we will not worry about it	40.3	15.3	20.8	11.1	12.5	1.40

Note: Mean scores are based on a rating of 0 for strongly disagree to 4 for strongly agree. A score of 2.00 shows balance between unfavorable and favorable attitudes.

cates that nutrition is an important health concern for the vast majority of these preparers. The mean score for item 2 was 3.2, revealing the high intensity at which meal preparers perceived that the meals they serve in their households are nutritious. About 77 percent of the preparers reflected positively on this attitude, with almost half (47 percent) holding a strong attitude.

In a similar vein, more than half (51.4 percent) agreed with the idea expressed in item 3, that they refrain from buying foods that are not nutritious or not good for household members. In contrast, there seems to be far less concern for having a balanced diet every day (item 4). Only slightly more than one-third (35 percent) of the preparers responded positively to the need for household members to eat a balanced diet regardless of where or when meals are eaten. Item 5 represents a negatively expressed item about a person's concern for nutrition. A mean score below 2.0 in this instance indicates a favorable attitude toward the need for good nutrition practices. More than half (55.6 percent) of these meal preparers disagreed with the contention that they would not worry about the household's nutrition until their doctor tells them to do so. Nevertheless, a consciousness of nutrition is a part of the value structure within most of these households.

How does this attitude relate to the way the meal preparer evaluates AU Lean (C) under test? Figure 4 shows a negative relationship between the attitude toward good nutrition and ratings for AU Lean (C) at all rating stages. Meal preparers who held unconcerned (unfavorable) attitudes toward nutrition consistently rated the developed product less positively (i.e., had higher average scores) than those who were nutritionally concerned. This difference was not statistically significant for either of the three stages, but it was a consistent pattern.

Health

Attitudes relating to health issues surrounding the foods people eat are reported in table 17. Seven health-related items are included here, with attention focusing on concerns about calories, cholesterol, salt, fat, and food additives, each of which has relevance to the consumption of red meat.

TABLE 17. HEALTH ATTITUDES OF HOUSEHOLD MEAL PREPARERS (FACTOR 3)

Attitudinal items	Scale categories					
	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree	Score (mean)
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	
(1) In my household, I feel that we should be more concerned about the calories in the foods we eat	6.9	4.2	30.6	22.2	36.1	2.76
(2) In my household, there are certain foods we really enjoy but I rarely buy anymore because they contain additives	14.3	28.6	20.0	25.7	11.4	1.91
(3) I make a real effort to avoid foods that are high in cholesterol	2.8	8.5	21.1	28.2	39.4	2.93
(4) Concern about weight control has a big influence on the kinds of foods I buy	8.5	14.1	21.1	25.4	31.0	2.56
(5) I think the recent interest in health diets is just a fad that will soon disappear	39.4	21.1	26.8	5.6	7.0	1.20
(6) In my household, we are extremely concerned about reducing the amount of salt in our diet	12.5	8.3	27.8	20.8	30.6	2.49
(7) It's important to limit the amount of fat in one's diet, even if one is not concerned about weight control	1.4	5.5	6.8	32.9	53.4	3.32

Note: Mean scores are based on a rating of 0 for strongly disagree to 4 for strongly agree. A score of 2.00 shows balance between unfavorable and favorable attitudes.

Among these varied health concerns, the one addressing the importance of limiting the amount of fat in the diet (item 7) recorded the highest mean score (3.3) on a scale of 0 to 4. Some 86 percent of these meal preparers reflected a positive attitude toward the need to limit fat intake even when weight control was not the motivating factor. More than half of the preparers indicated a rather intense value for limiting one's fat intake.

Weight control itself is an important consideration for many preparers (item 4). More than half of the preparers (56.4 percent) indicated that weight control has a big influence on the kinds of foods they buy. The mean score for this attitude was also high, at the 2.6 level.

A statement focusing on cholesterol (item 3) recorded a relatively high mean score of 2.9. More than two-thirds of these meal preparers (67.6 percent) reported a favorable attitude toward the need to avoid foods high in cholesterol. Only marginally less emphasis was shown for concern about calories (item 1). A mean score of 2.8 was recorded for the idea that one needs to be more concerned about the calories in the foods eaten. Some 58 percent of preparers expressed an awareness and need to watch the caloric intake of household members. Similarly, the amount of salt intake (item 6) was revealed to be of considerable concern as shown by a mean score at the 2.5 level. More than half (51.4 percent) of the preparers indicated a need to reduce the amount of salt consumed.

Attitudes toward food additives have direct relevance to the lean ground beef product being evaluated here, because lecithin, a minute amount of carrageenan, and beef flavor enhancers have been added to develop AU Lean (C). Meal preparers exhibited attitudes on both sides of the additives issue (item 2). The largest proportion (42.9 percent) indicated that they were not concerned about additives in the foods they eat, but 37 percent responded that food additives were a concern to them. The remaining 20 percent reported no attitudinal position either way. In this test of a developed lean ground beef product, households did not know that food additives had been incorporated into one of the products provided them.

As a last item pertaining to health, these meal preparers were asked about the current popularity of dieting (item 5).

Again, this idea was negatively presented so that a low score indicated that dieting for health purposes was not just a fad. The low mean score of 1.2, with 61 percent of the preparers indicating that the current interest in health diets was the wave of the future, reveals something about the extent to which this behavior prevails throughout American society.

Composite attitudes toward health scores are presented in table 24. Inclusion of seven items produced a scale with a potential range of scores from 0 through 28 and a mid-range point of 14. Figure 5 reports the relationship between different health attitudes of the meal preparers and their ratings of AU Lean (C) at each stage of use. Most observable is the lack of association between preparers with poor versus good attitudes toward health and their taste ratings of AU Lean (C) at the eating stage. However, preparers who were more health conscious did rate the developed product somewhat better (i.e., lower scores) than those with poor health attitudes at all three stages. None of the observed ratings differences associated with health attitudes was statistically significant.

Food Purchasing

Several attitudes were surveyed relating to food purchasing behaviors, table 18. Two thirds of the meal preparers perceived themselves as being interested in trying new foods (item 2), with few uninterested in experimenting. Also, the largest proportion (42 percent) indicated that ease of preparation was important in deciding the foods to buy (item 4). Only about one-third said that they buy new foods when they first see them in the grocery store (item 3).

How did these meal preparers view the task of grocery shopping? They were evenly divided between enjoying and not enjoying it (item 1), with an equal proportion having no preference either way. These findings reveal that the food purchasing attitudes of meal preparers are quite varied. No one pattern distinctly characterizes their food shopping practices.

A composite food purchasing attitude scale was created by summing the preparers' scores for the four items. This provided a scale with a potential score range of 0 through 16. A mid-range score of 8 reflects an indefinite attitude. Figure 6

TABLE 18. FOOD PURCHASING ATTITUDES OF HOUSEHOLD MEAL PREPARERS (FACTOR 4)

Attitudinal items	Scale categories					
	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree	Score (mean)
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	
(1) I enjoy grocery shopping	20.5	12.3	32.9	19.2	15.1	1.96
(2) I like to try new foods	2.8	6.9	23.6	34.7	31.9	2.86
(3) I like to try new foods when I first see them in the supermarket	9.6	16.4	42.5	17.8	13.7	2.10
(4) Ease of preparation is one of my most important considerations in deciding what foods to buy	12.7	12.7	32.4	25.4	16.9	2.21

Note: Mean scores are based on a rating of 0 for strongly disagree to 4 for strongly agree. A score of 2.00 shows balance between unfavorable and favorable attitudes.

TABLE 19. PRICE CONSCIOUSNESS ATTITUDES OF HOUSEHOLD MEAL PREPARERS (FACTOR 5)

Attitudinal items	Scale categories					
	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree	Score (mean)
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	
(1) I choose food products on the basis of low prices	16.4	16.4	38.4	15.1	13.7	1.93
(2) I choose food products based on quality rather than prices	1.4	7.0	31.0	28.2	32.4	2.83
(3) I don't let price govern my purchase decisions when it comes to food	11.0	19.2	38.4	15.1	16.4	2.07

Note: Mean scores are based on a rating of 0 for strongly disagree to 4 for strongly agree. A score of 2.00 shows balance between unfavorable and favorable attitudes.

shows that food purchasing attitudes are associated to some degree with AU Lean (C) ratings in the preparing and cooking stages, but not in the eating stage. Ratings of the developed product (C) at the eating stage were comparable for both those with unfavorable and favorable attitudes toward food purchasing.

Food Price

Since AU Lean requires special processing to achieve the low-fat, good taste desired by consumers, there is considerable likelihood that such a product will carry with it a higher price. The three attitudinal statements presented here relate to the perceived concern of household meal preparers for price when choosing and purchasing foods to be served to household members, table 19.

A large proportion of these meal preparers indicated that food quality rather than price is the key motivator in their purchasing behavior. About 61 percent were quality conscious (item 2). Conversely, only one-third (33 percent) indicated that low price is a major consideration in the choice of foods they buy (item 1). Item 3 expresses the price attitude in a different fashion and provides a better idea of the consumer dilemma. When the attitude is stated in terms of price governing the preparer's food purchasing decisions, equal proportions said no (32 percent) and yes (30 percent), with the largest proportion (38 percent) holding an uncertain or undecided attitude. These data suggest that, although price is a consideration for most food purchasers, it is not the only one. Other factors are considered by many consumers. It is likely that two of these factors are represented by the nutrition and health attitudes already discussed.

A food price consciousness attitude score was obtained by summing the scores for each of the three items described above after converting the scores on item 1 to indicate a negative rather than positive attitude about food prices. High attitude scores reflect lack of concern for price when making food purchases. The scale has a range of 0 through 12, with a mid-range point of 6.

Figure 7 presents the relationship between the household meal preparers' consciousness of price when selecting food products and their evaluation of AU Lean (C). Again the

TABLE 20. MEAL PLANNING ATTITUDES OF HOUSEHOLD MEAL PREPARERS (FACTOR 6)

Attitudinal items	Scale categories					
	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree	Score (mean)
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	
(1) The time I spend planning meals is time well spent	2.7	2.5	32.4	21.6	40.5	2.95
(2) Planning meals for several days at a time makes it possible to buy foods more efficiently	5.6	12.5	16.7	26.4	38.9	2.81
(3) Planning meals several days in advance helps me serve better meals	20.8	13.9	20.8	18.1	26.4	2.15
(4) Sometimes I go for days without planning meals in advance	13.9	25.0	11.1	26.4	23.6	2.21

Note: Mean scores are based on a rating of 0 for strongly disagree to 4 for strongly agree. A score of 2.00 shows balance between unfavorable and favorable attitudes.

TABLE 21. AESTHETIC MEAL PREPARATION ATTITUDES OF HOUSEHOLD MEAL PREPARERS (FACTOR 7)

Attitudinal items	Scale categories					
	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree	Score (mean)
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	
(1) Cooking helps satisfy my need to express myself	27.4	12.3	32.9	12.3	15.1	1.75
(2) I try to fix unusual meals for my household	23.3	15.1	39.7	13.7	8.2	1.69
(3) Experimenting with new foods gives me a sense of creativity	15.3	13.9	18.1	37.5	15.3	2.24

Note: Mean scores are based on a rating of 0 for strongly disagree to 4 for strongly agree. A score of 2.00 shows balance between unfavorable and favorable attitudes.

lower the bar in the graph the more positive the evaluation of the meat. None of the relationships shown between price consciousness and ratings of AU Lean (C) were statistically significant. At both the preparing and cooking stages, more price conscious meal preparers rated the developed product (C) better than did those preparers who were not as price conscious. The association was reversed at the eating stage, however, where the nonprice conscious gave the developed product (C) the better ratings.

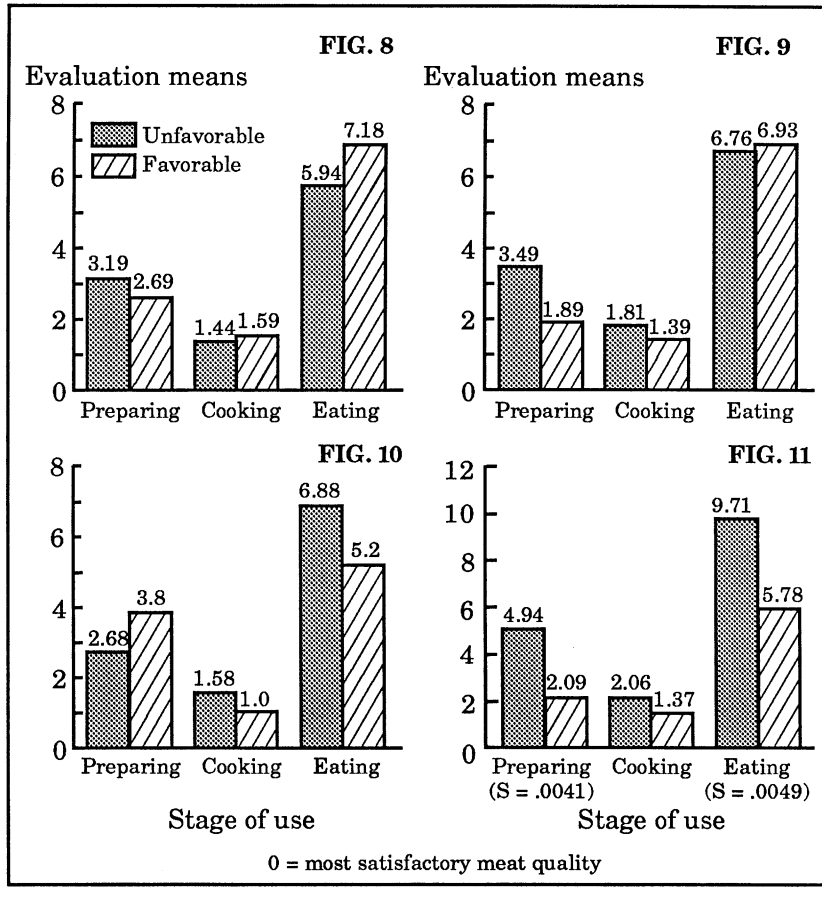
Meal Planning

Four attitude items focus on meal planning, table 20. The majority of meal preparers (62 percent) held the idea that meal planning is a good household practice (item 1). This is clearly shown by the mean score of 2.9 for the widely held belief that time spent planning meals is worthwhile. Also, almost two-thirds (65 percent) indicate that efficient purchasing of food results when meals are planned several days ahead (item 2). Similarly, 45 percent believe that meal planning results in the serving of better meals (item 3). Conversely, one-half of these preparers identify themselves as sometimes going days without planning meals in advance (item 4). Although most meal preparers hold a favorable attitude toward meal planning as a valuable behavior, many fail to do so on a regular basis.

A composite measure of the attitude toward meal planning was constructed by summing the scores of each meal preparer across the four items, figure 8. Preparers with low scores on this attitude are unfavorable to meal planning, in contrast to those with high scores who have a positive orientation toward this activity. No significant relationships were found between these different attitudes toward meal planning and ratings of AU Lean (C) for any of the three observation stages. The greatest difference was seen at the eating stage where preparers with unfavorable attitudes toward meal planning gave the developed product (C) better ratings than did those with a planning orientation.

Meal Preparation Aesthetics

This set of three attitudes relates specifically to the emotional dimension of meal preparation, table 21. It is observed



AU Lean (C) stage evaluations by: FIG. 8—attitudes toward meal planning; FIG. 9—attitudes toward meal aesthetics; FIG. 10—attitudes toward time and convenience; and FIG. 11—attitudes toward food eating.

that meal preparation is not viewed as a particularly valued activity by most of these respondents. Only 22 percent indicate they sometimes prepare unusual meals (item 2). Slightly more preparers said that cooking serves as a means of self expression (item 1), and more than half had a positive attitude toward the sense of creativity derived from experimenting with new foods (item 3). With more women working outside the home and with some men assuming responsibility for meal preparation, attitudes have become quite varied about meal preparation as a subjective, emotional experience.

To capture the subjective dimension in food preparation, a measure of a composite attitude toward meal aesthetics was constructed by summing the item scores for each meal preparer to these three items. By 'aesthetics' is meant the sense of satisfaction that some people receive from working with foods and preparing a good meal for themselves and others. Persons with favorable attitudes toward food preparation are anticipated to rate a new lean ground beef product better than persons who are not aesthetically oriented to meal preparation. This relationship was observed only at the cooking stage, figure 9. Here, meal preparers with favorable attitudes toward food preparation rated AU Lean (C) better (1.89) than did preparers with unfavorable attitudes toward food preparation (3.49). The observed difference was not statistically significant, however. Differences in the product ratings were small at both the cooking and eating stages.

Meal Preparation Time

Cooking is a highly routine household activity in the sense that three meal times occur every day, year after year. A considerable amount of time by one or more household members can be consumed by this task. Nevertheless, the majority of these meal preparers (56 percent) responded negatively to item 3 which conveyed the attitude that cooking requires too much of one's time, table 22. Conversely, less than 20 percent indicated that meal preparation is too time consuming. In a similar fashion, 61 percent reflected a negative attitude (item 1) toward the rationalization that a busy schedule prevents them from having enough time to prepare meals that require much time. Here, the low mean score of 1.4 reflects further the lack of identification with this belief. Nonetheless, only 40 percent of these meal preparers held a positive attitude toward preparing meals as an enjoyable activity (item 2).

Two items focus on attitudes relating to the use of convenience foods to conserve the meal preparer's time. These data show wide attitudinal variability regarding the use of such foods. Items 4 and 5 have low mean scores below 2.0 and reflect the generally negative attitude that the term "convenience foods" elicits. Half of these meal preparers responded negatively to the contention that they use conve-

TABLE 22. MEAL PREPARATION TIME ATTITUDES OF HOUSEHOLD MEAL PREPARERS (FACTOR 8)

Attitudinal items	Scale categories					
	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree	Score (mean)
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	
(1) With my busy schedule, I rarely have time to fix meals that take more than half an hour to prepare	33.3	27.8	18.1	9.7	11.1	1.38
(2) I really enjoy spending time on meal preparation	11.3	18.3	31.0	25.4	14.1	2.13
(3) Cooking usually requires too much time	22.2	33.3	25.0	9.7	9.7	1.51
(4) I use convenience foods whenever I can to save time	16.9	23.9	32.4	19.7	7.0	1.76
(5) I can use my time most efficiently by using convenience foods	19.4	30.6	26.4	16.7	6.9	1.61

Note: Mean scores are based on a rating of 0 for strongly disagree to 4 for strongly agree. A score of 2.00 shows balance between unfavorable and favorable attitudes.

TABLE 23. FOOD EATING ATTITUDES OF HOUSEHOLD MEAL PREPARERS (FACTOR 9)

Attitudinal items	Scale categories					
	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree	Score (mean)
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	
(1) Members of my household eat more meals away from home than at home	58.3	13.9	12.5	11.1	4.2	0.89
(2) Members of my household eat out a lot to make more efficient use of my time	55.1	18.8	18.8	4.3	2.9	0.81
(3) In my household, we usually eat snacks between meals or at bedtime	15.1	27.4	24.7	21.9	11.0	1.86
(4) Food is to be savored as part of the good life	1.4	2.8	25.0	29.2	41.7	3.07

Note: Mean scores are based on a rating of 0 for strongly disagree to 4 for strongly agree. A score of 2.00 shows balance between unfavorable and favorable attitudes.

nience foods to make more efficient use of their time (item 5), compared to one-fourth who actually did. However, when the same attitude was worded somewhat more positively, only 40 percent were negative to the idea that convenience foods are often used to save the preparer's time (item 4). This item elicited more uncertainty, with one-third expressing no opinion. The conclusion may be drawn that some stigma currently exists among many meal preparers about serving convenience foods, particularly on a regular basis.

These attitudes were combined to form an attitude toward time and convenience measure having a score range of 0 to 20 with a mid-range of 10. Meal preparers with unfavorable versus favorable attitudes toward time and convenience in meal preparation are compared according to their ratings of AU Lean (C), figure 10. None of the observed ratings differences between the two attitudinal groups was significant at any of the three evaluation stages. Meal preparers who placed a premium on their time were less likely to rate the developed product (C) as good (3.8) than were those who were less concerned about time spent in food preparation. Conversely, at both the cooking and eating stages, time-conscious preparers gave the developed AU Lean product (C) better ratings. At the eating stage, the comparable scores were 6.88 for those with unfavorable time attitudes versus 5.2 (low score indicating a better rating) for those with favorable attitudes toward time and convenience.

Food Eating

Attitudes toward food eating or consumption were addressed by four statements presented in table 23. Item 4 indicated a widely held attitude with a mean score at the 3.1 level. More than two-thirds of these meal preparers (71 percent) identified with the idea that living a good life is reflected in the savoring of food.

Items 1 and 2 involve attitudes toward household members eating meals away from home. Both items revealed a negative orientation as observed from the low mean scores of 0.9 and 0.8, respectively. A large majority of preparers (74 percent) rejected the view presented in item 2 that eating out often was something the household did to make better use of the preparer's time. Also, a similarly large majority (72 per-

cent) denied the contention expressed in item 1 that household members eat more meals out than they do at home. Few households (only 5 and 15 percent, respectively) identified with either of these household practices.

The third attitude deals with eating between-meal snacks. Item 3 revealed wide variability among the households. While 43 percent indicated their household refrained from snacking, one-third (33 percent) identified with the behavior. Certainly, the meal preparers participating in this study held strong attitudes with regard to food eating. Two points are clear. Food is highly associated with notions of the "good life," and eating major meals at home is the cultural value to which most of these meal preparers adhered.

The final attitude measure constructed reflects meal preparers' attitudes toward food eating by combining their responses to these four items. Scores ranged from 0 to 16, with a mid-range score of 8. Low scores indicated unfavorable meal consumption habits relative to eating at home and eating snacks. Meal preparers with more favorable attitudes toward food eating for the household were found to be significantly more likely to rate AU Lean (C) better at both the preparing and eating evaluation stages, figure 11. The mean ratings for preparing the ground beef were very good at the 2.09 level for those with favorable food eating attitudes, compared to 4.94 for those with unfavorable food eating attitudes. Similarly, at the eating stage with the much broader range of scores, the comparable mean ratings showed a good score of 5.78 for those with favorable attitudes toward food eating compared to 9.71 for those with unfavorable attitudes. Little difference in ratings between the two attitude groups was observed at the cooking stage.

A description is given in table 24 for each of the nine attitude measures constructed and reported here. Several of the attitudes did provide skewed distributions for the meal preparers participating in this study. Thus, the distinction between a low (unfavorable) and high (favorable) attitude was not always at the mid-point, but was adjusted upward or downward to assure a sufficient number of meal preparers in each attitude group.

TABLE 24. HOUSEHOLD MEAL PREPARERS' CLASSIFICATIONS FOR NINE ATTITUDES RELATING TO GOOD HEALTH AND TO THE PURCHASE, PREPARATION, AND EATING OF FOODS

Scores	Attitude scale classification								
	Meat consumption	Nutrition	Health	Food purchasing	Price	Meal planning	Meal aesthetics	Time	Food eating
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
27-28			7.2						
25-26			10.0						
23-24	7.2		5.8						
21-22	10.0		15.7						
19-20	20.0	.0	11.4					.0	
17-18	22.9	.0	12.9					1.4	
15-16	11.4	7.1	20.0	1.4		8.4		2.8	14.8
13-14	11.5	18.6	5.7	5.7		14.1		5.6	23.6
11-12	11.4	44.3	5.7	22.8	11.2	21.2	7.0	24.0	29.4
9-10	2.9	22.8	4.3	24.3	15.5	16.9	9.9	25.4	17.7
7-8	.0	1.4	1.4	27.1	26.8	21.2	24.0	19.7	7.3
5-6	.0	.0	.0	10.0	28.2	9.8	25.4	15.5	5.9
3-4	1.4	.0	.0	7.2	12.6	7.0	19.8	5.6	1.5
1-2	.0	.0	.0	.0	5.6	1.4	9.8	.0	.0
0	.0	.0	.0	1.4	.0	.0	4.2	.0	.0
Preparers	(70)	(70)	(70)	(70)	(71)	(71)	(71)	(71)	(68)
Scale range	0-24	0-20	0-28	0-16	0-12	0-16	0-12	0-20	0-16
Mid-range	12	10	14	8	6	8	6	10	8
Mean score	16.9	11.6	18.7	8.8	6.9	9.6	5.7	9.1	11.5

Note: Dotted line indicates score differentiation dichotomizing low versus high (favorable) attitudes.

SUMMARY

This report describes the findings of a consumer taste test of a newly developed lean ground beef product (AU Lean). The research purpose was to provide consumer evaluations of the product under home-use conditions in contrast to a narrow focus laboratory taste-test alternative. To accomplish this task, a procedure was designed to identify a random sample of 90 households in a small city with a varied population of about 20,000 residents. The design of the study involved home delivery of three distinct ground beef products: (1) product A (market with 20% fat), (2) product B (lean beef with no additives), and (3) product C (AU Lean, developed with meat enhancers). Households volunteering to participate in the study were randomly assigned to one of three test groups. Each week a sufficient quantity of fresh ground beef for the family's meal needs was delivered directly to the home. The product was to be prepared in pattie form. A different product was tested each week with a different order of receipt for each group, to control for any order of receipt bias. With the weekly delivery of a new ground beef product, the test evaluations for the previous week were collected from each household.

Design of the taste test involved evaluations by the household meal preparer at three stages of consumer use — the preparing, cooking, and eating stages. At each stage, several product traits were rated on 6-point scales ranging from best to worst for each trait. Traits rated at each stage included: preparing — appearance, color, leanness, smell, and workability; cooking — amount of fat, shrinkage, and overall appearance; and eating — liking, tenderness, flavor, and juiciness. A composite measure summing the individual trait scores at each stage was constructed to provide a single rating score across stage traits.

On the fourth and last delivery, all households received AU Lean (C) and were instructed to use it in any way they wished. Evaluations for this test were to be mailed to the researchers. A supplemental questionnaire was mailed or delivered to the meal preparer in each household 2 weeks later to obtain preparer attitudes and additional information about the household for analysis purposes.

Taste-test results revealed that household food preparers

consistently rated the market product (A) less acceptable than either the lean product (B) or AU Lean (C) on all traits. Ratings differences for the various traits were most distinct at the preparing and cooking stages. At the eating stage, all three products received similar ratings, although AU Lean (C) consistently received a slightly better rating than the market product (A) on each of the four traits tested, figure 14. Compared with the lean product (B), i.e., the control product, the trait differences were small, with both lean products B and C being rated more like each other than like the market product (A). However, the lean product (B) was consistently rated slightly better than AU Lean (C) at both the preparing and cooking stages, figures 12 and 13. At the eating stage, AU Lean (C) was rated slightly better than the lean product (B) on all eating traits except juiciness, where the ratings were similar among products. The composite scores for each of the three test stages revealed the overall evaluation in which the market product (A) was rated significantly less desirable than the lean products (B and C) at both the preparing and cooking stages. No difference was noted at the eating stage. Moreover, the lean product (B) was rated less desirable than the market product (A), which was less desirable than AU Lean (C), though neither difference was significant.

Taste-test results for household members other than the meal preparer revealed parallel ratings, but generally less favorable or more critical toward all three test products. Here again, AU Lean (C) received the better ratings on each eating stage trait except juiciness. Following completion of this consumer test and based on these results, the production process for AU Lean was reformulated and adjusted to accommodate this result.

Personal characteristics of the meal preparers and household members were analyzed in association with the market product (A) and AU Lean (C). Consistent patterned relationships were found to exist among the factors of sex, race, age, education, occupation, and household income. Meal preparers who were male, black, and older and with lower education, occupational status, and income gave the better ratings to both lean products. Reasons for this association are not readily clear.

The findings relating to the willingness of meal preparers

FIG. 12

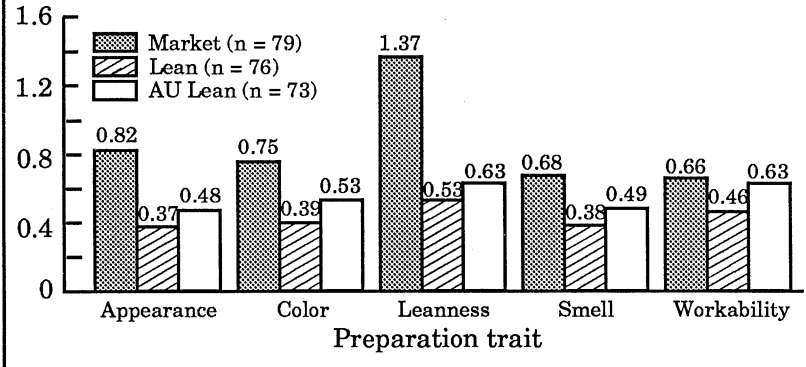


FIG. 13

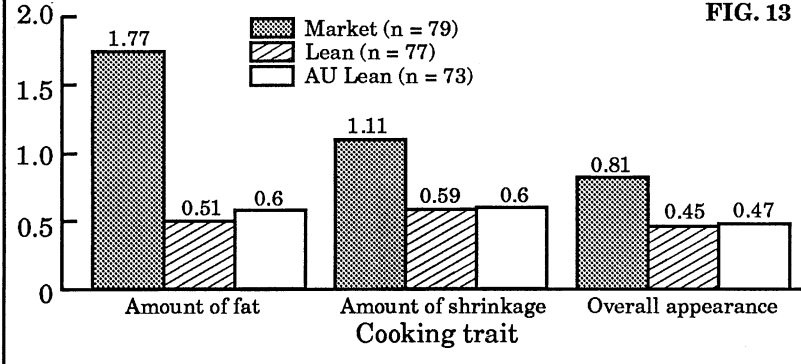
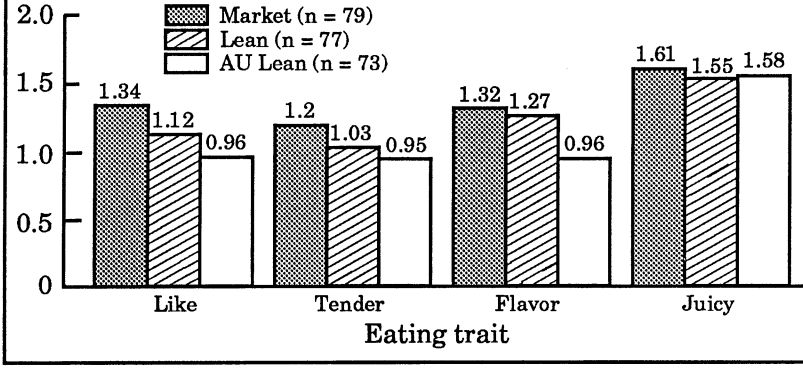


FIG. 14



Meal preparers' evaluations of three ground beef products: FIG. 12—by five preparation traits (A significantly different from B and C for appearance and leanness); FIG. 13—by three cooking traits (A significantly different from B and C for all traits); and FIG. 14—by four eating habits (no significant differences). In the text, the market product is identified as A, the lean product as B, and AU Lean as C.

to pay differentially for the three products failed to provide any meaningful result. Only minor differences of a few pennies were observed. It must be noted, however, that the meal preparers evaluated the three ground beef products without knowing the products being rated. Also, since a week elapsed between tests of the products, there was no opportunity for direct comparison among the three products at a single point in time. Future research is needed to determine consumer willingness to pay for a developed lean ground beef product.

Attitudes of meal preparers were measured and analyzed for their association with how AU Lean (C) was rated. From a battery of 49 attitude items, 9 composite attitudinal measures were constructed. These nine attitudes were then dichotomized to identify unfavorable or favorable groupings of meal preparers relative to each attitude. Mean AU Lean (C) ratings were compared for the two groups on each of the nine attitudes. Few associations between attitudes and AU Lean (C) ratings were observed. Although attitudes toward such things as (1) meat and meat consumption, (2) nutrition, (3) health, (4) food purchasing, (5) price consciousness, (6) meal planning, (7) meal preparation aesthetics, (8) meal preparation time, and (9) food eating differed widely among the study participants, there existed little relationship between these attitudes and ratings of AU Lean (C). Attitudes toward meat consumption, price, or nutrition were not found to be associated with the ratings given AU Lean (C) at any of the three test stages. Only the attitudes toward health and food eating showed any significant differences.

The purpose of this study was to test consumer responses to a new lean ground beef product, "AU Lean" (C), compared to a market control product (A) and a lean product (B). Results reported indicate a very positive evaluation of the new product (AU Lean) and suggest a strong potential for consumer acceptance if introduced into the market as a supermarket ground beef alternative.

ACKNOWLEDGEMENT

This study was funded in part by a research grant from the Beef Industry Council of the National Live Stock and Meat Board, Chicago, Illinois. The authors greatly appreci-

ate this organization's continuing support of lean ground beef product development (AU Lean) and consumer acceptance research.

Also, conduct of the household consumer testing of AU Lean would not have been possible without the assistance of 91 households in Opelika, Alabama, whose members volunteered to test ground beef products in their homes. Household meal preparers' efforts and dedication are especially deserving of our thanks.

Recognition and thanks are also extended to the authors' coworkers and graduate students in the Departments of Animal and Dairy Sciences and Agricultural Economics and Rural Sociology who assisted in delivering the fresh ground beef products to the participating households each week: Dennis L. Seman, Carla Kasabach, Chiao-Min Chen, Rebecca S. Myrick, J. Mark Clayton, Vivian Amy Warren, Litchi S. Wu, and Mary Ann Carter.

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APPENDIX

APPENDIX TABLE 1. HOUSEHOLD MEAL PREPARER EVALUATIONS OF PATTIES OF THREE GROUND BEEF PRODUCTS FOR FIVE TRAITS OBSERVABLE DURING MEAL PREPARING STAGE, HOLDING TEST PANEL CONSTANT, WEEKS 1 THROUGH 3

Preparing traits	Evaluation, by ground beef product		
	Product A (market)	Product B (lean)	Product C (AU Lean)
Appearance			
Panel I (A,B,C)	(n=25)	(n=23)	(n=19)
Percent rating 0=good	60	64	58
Mean rating	0.56	0.57	0.79
Panel II (B,C,A)	(n=24)	(n=24)	(n=23)
Percent rating 0=good	50	83	78
Mean rating	1.00[1]	0.21	0.30
Panel III (C,A,B)	(n=30)	(n=29)	(n=31)
Percent rating 0=good	43	72	58
Mean rating	0.90[1]	0.34	0.42
Color			
Panel I (A,B,C)	(n=25)	(n=23)	(n=19)
Percent rating 0=good	68	64	63
Mean rating	0.52	0.48	0.68
Panel II (B,C,A)	(n=24)	(n=24)	(n=23)
Percent rating 0=good	58	83	78
Mean rating	1.00[1]	0.29	0.39
Panel III (C,A,B)	(n=30)	(n=29)	(n=31)
Percent rating good	43	69	61
Mean rating	0.73	0.41	0.55
Leanness			
Panel I (A,B,C,)	(n=25)	(n=23)	(n=19)
Percent rating 0=lean	48	71	63
Mean rating	1.04	0.43	0.68
Panel II (B,C,A)	(n=24)	(n=24)	(n=23)
Percent rating 0=lean	38	79	57
Mean rating	1.63[1]	0.29	0.65
Panel III (C,A,B)	(n=30)	(n=29)	(n=31)
Percent rating 0=lean	30	52	58
Mean rating	1.43[1]	0.79	0.58
Smell			
Panel I (A,B,C)	(n=25)	(n=23)	(n=19)
Percent rating 0=good	72	54	58
Mean rating	0.44	0.48	0.58
Panel II (B,C,A)	(n=24)	(n=24)	(n=23)
Percent rating 0=good	58	83	65
Mean rating	0.88	0.29	0.52
Panel III (C,A,B)	(n=30)	(n=29)	(n=31)
Percent rating 0=good	50	72	65
Mean rating	0.73	0.38	0.42

Continued

APPENDIX TABLE 1 (CONTINUED). HOUSEHOLD MEAL PREPARER EVALUATIONS OF PATTIES OF THREE GROUND BEEF PRODUCTS FOR FIVE TRAITS OBSERVABLE DURING MEAL PREPARING STAGE, HOLDING TEST PANEL CONSTANT, WEEKS 1 THROUGH 3

Preparing traits	Evaluation, by ground beef product		
	Product A (market)	Product B (lean)	Product C (AU Lean)
Workability			
Panel I (A,B,C)	(n=25)	(n=23)	(n=19)
Percent rating 0=good	60	58	63
Mean rating	0.60	0.48	0.89
Panel II (B,C,A)	(n=24)	(n=24)	(n=23)
Percent rating 0=good	50	75	61
Mean rating	0.71	0.33	0.48
Panel III (C,A,B)	(n=30)	(n=29)	(n=31)
Percent rating 0=good	53	66	65
Mean rating	0.67	0.55	0.58

[1]Product A is significantly different from products B and C at the .05 level.

APPENDIX TABLE 2. HOUSEHOLD MEAT PREPARER EVALUATIONS OF PATTIES OF THREE GROUND BEEF PRODUCTS FOR THREE TRAITS OBSERVED DURING COOKING STAGE, HOLDING TEST PANEL CONSTANT, WEEKS 1 THROUGH 3

Cooking traits	Evaluation, by ground beef product		
	Product A (market)	Product B (lean)	Product C (AU Lean)
Amount of fat			
Panel I (A,B,C)	(n=25)	(n=24)	(n=19)
Percent rating 0=small amount	28	54	58
Mean rating	1.48[1]	0.50	0.63
Panel II (B,C,A)	(n=24)	(n=24)	(n=23)
Percent rating 0=small amount	29	80	52
Mean rating	1.88[1]	0.42	0.65
Panel III (C,A,B)	(n=30)	(n=29)	(n=31)
Percent rating 0=small amount	23	62	60
Mean rating	1.93[1]	0.62	0.55
Amount of shrinkage			
Panel I (A,B,C,)	(n=25)	(n=24)	(n=19)
Percent rating 0=small amount	40	46	68
Mean rating	0.80	0.75	0.53
Panel II (B,C,A)	(n=24)	(n=24)	(n=23)
Percent rating 0=small amount	33	67	39
Mean rating	1.33[1]	0.40	0.74
Panel III (C,A,B)	(n=30)	(n=29)	(n=31)
Percent rating 0=small amount	32	52	53
Mean rating	1.20[1]	0.66	0.55
Overall appearance			
Panel I (A,B,C)	(n=25)	(n=24)	(n=19)
Percent rating 0=good	72	58	58
Mean rating	0.40	0.54	0.58
Panel II (B,C,A)	(n=24)	(n=24)	(n=23)
Percent rating 0=good	50	75	65
Mean rating	1.08[1]	0.29	0.48
Panel III (C,A,B)	(n=30)	(n=29)	(n=31)
Percent rating 0=good	39	66	63
Mean rating	0.93[1]	0.52	0.39

[1]Product A is significantly different than products B and C at the .05 level.

APPENDIX TABLE 3. HOUSEHOLD MEAL PREPARER EVALUATIONS OF PATTIES OF THREE GROUND BEEF PRODUCTS DURING EATING STAGE, HOLDING TEST PANEL CONSTANT, WEEKS 1 THROUGH 3

Eating traits	Evaluation, by ground beef product		
	Product A (market)	Product B (lean)	Product C (AU Lean)
Like			
Panel I (A,B,C)	(n=25)	(n=24)	(n=19)
Percent rating 0=like very much	48	42	42
Mean rating	1.12	1.13	1.16
Panel II (B,C,A)	(n=24)	(n=24)	(n=23)
Percent rating 0=like very much	42	42	52
Mean rating	1.75	1.08	0.96
Panel III (C,A,B)	(n=30)	(n=29)	(n=31)
Percent rating 0=like very much	33	38	36
Mean rating	1.20	1.14	0.84
Tenderness			
Panel I (A,B,C,)	(n=25)	(n=24)	(n=19)
Percent rating 0=very tender	40	46	58
Mean rating	1.08	1.08	0.84
Panel II (B,C,A)	(n=24)	(n=24)	(n=23)
Percent rating 0=very tender	42	50	44
Mean rating	1.42	1.00	0.96
Panel III (C,A,B)	(n=30)	(n=29)	(n=31)
Percent rating 0=very tender	43	35	45
Mean rating	1.13	1.00	1.00
Flavorfulness			
Panel I (A,B,C)	(n=25)	(n=24)	(n=19)
Percent rating 0=very good	44	42	53
Mean rating	1.32	1.29	0.95
Panel II (B,C,A)	(n=24)	(n=24)	(n=23)
Percent rating 0=very good	42	46	39
Mean rating	1.38	1.00	0.96
Panel III (C,A,B)	(n=30)	(n=29)	(n=31)
Percent rating 0=very good	30	28	36
Mean rating	1.27	1.48	0.97
Juiciness			
Panel I (A,B,C)	(n=25)	(n=24)	(n=19)
Percent rating 0=very juicy	20	42	37
Mean rating	1.56	1.29	1.47
Panel II (B,C,A)	(n=24)	(n=24)	(n=23)
Percent rating 0=very juicy	25	24	30
Mean rating	1.67	1.96	1.43
Panel III (C,A,B)	(n=30)	(n=29)	(n=31)
Percent rating 0=very juicy	27	28	26
Mean rating	1.60	1.41	1.74