

Final Report for FSMIP Research Project
Determining Market Potential for Omega-3 Beef Products
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Principal Investigators

Ted C. Schroeder, Project Leader
University Distinguished Professor, Agricultural Economics
Kansas State University
Manhattan, KS 66506
(785)-532-4488; tcs@ksu.edu

John A. Fox, Principal Investigator
Professor, Agricultural Economics
Kansas State University

James Drouillard, Principal Investigator
Professor, Animal Sciences and Industry
Kansas State University

Kassie L. Curran, Principal Investigator
Graduate Research Assistant, Agricultural Economics
Kansas State University

Collaborator

Clay Mosely
President, La Vaca Meat Co.
Littleton, CO 80120

University Grants and Financial Office

Paul Lowe
Assistant Vice President for Research and Director PreAward Services
2 Fairchild Hall
Kansas State University
Manhattan, KS 66506
(785)-532-6804; plowe@ksu.edu

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Summary of Activities Performed by Objective

Summary statement

All activities for this project have been completed with a few modifications noted below to the project that were necessary as the project progressed.

Objective 1

To develop a net return budgeting tool that estimates added net cattle feeding costs including any costs to certify production practices and added finished cattle breakeven prices (given feeder cattle prices and feed grain prices) necessary to produce ground beef and steak cuts with various compositions of DHA and EPA omega-3 fatty acids.

Achievements for Objective 1

The cattle were finished on the special diet that included flax and algae necessary to produce the omega-3 beef products in late May 2015 and slaughtered and processed in early June 2015. The meat was transported to Kansas State University where product testing was completed and then shipped to retail outlets for market test selling. The budgeting tool associated with this objective was completed and is available from the investigators. We elected not to publish this on the web because the prices for the omega 3 feed ingredient are not published and are only available as special order and as such can vary a lot by source and availability. We are not comfortable publishing a general budget quote on this price as a result because it likely will vary depending on source.

Objective 2

To estimate incremental added net costs associated with processing cattle, fabricating beef products, and testing and labeling omega-3 fatty acid content on individual beef products.

Achievements for Objective 2

This objective has been completed as originally planned.

Objective 3

To determine in-store consumer demand elasticity and willingness-to-pay premiums for ground beef and beef steaks containing selected compositions of DHA and EPA Omega-3 fatty acids.

Achievements for Objective 3

Data associated with this objective was collected. The original plan for this objective was to sell all the omega 3 beef exclusively through LaVaca Meats. However, we decided to sell product through another retail outlet, in addition to offering product through LaVaca, to generate greater volume of data more rapidly. We applied for, and were granted USDA-AMS labeling approval for the omega 3 beef during the course of this project that we sold through a local outlet of a national retail grocer. A sample of the labeling approved and used for ribeye steak in the retail trial is illustrated in Figure 1 (similar labeling was designed and used for ground

beef and ribeye steaks, though they each have higher omega-3 fatty acid content than strips because they have higher overall fat content).

Figure 1. Sample of Retail Meat Label Associated with Omega-3 Beef Market Test.



The data from the retail sales were quite informative and they provided us with estimates of potential market share under various price premiums for ground beef, strip steaks, and ribeye steaks.

Initial expectations were that sales of the omega-3 enhanced beef products would sell well with LaVaca given the nature of their store (small, local, boutique meat store). We expected to see sales increase when prices decreased. Upon analysis, sales were actually the lowest during the period of the lowest prices – a 0% premium. We are unsure of an explanation for this, but it was during the holiday season in which LaVaca’s primary sales were Prime Rib, steak bundles, and filets. Out of the four time periods, the time period in which both omega-3 products had their highest share of sales within their category (e.g. all ground beef and all steak-excluding bundles), was during Period 3 (September 26, 2014-November 13, 2014), when there was a 15% premium: omega-3 ground beef at \$6.41/lb and omega-3 strip steak at \$24.53/lb. During this time period, the omega-3 ground beef had 23.7% of the sales volume and 23.96% of the sales dollars. In the same time period, the omega-3 strip steaks had 5.69% of the sales volume and 5.82% of the sales dollars. When looking at the data over all time periods, there was a great deal of variation and we did not find a pattern in sales.

Table 1. Omega-3 vs. Total Sales Volumes, LaVaca

Volume (lbs)	May 23-Aug. 5 (15% premium)	Aug. 6-Sept. 25 (30% premium)	Sept. 26-Nov. 13 (15% premium)	Nov. 14-Jan. 5, 2015 (0% premium)
Omega-3 Ground Beef	11.22%	21.48%	23.70%	16.78%
LaVaca 80/20 Ground Beef	42.03%	41.60%	38.63%	58.16%
Other LaVaca Ground Beef	46.75%	36.91%	37.68%	25.05%
Omega-3 Strip Steak	2.72%	5.33%	5.69%	1.62%
LaVaca Choice Strip Steak	5.17%	11.30%	9.29%	7.20%
Other LaVaca Steak	92.11%	83.37%	85.02%	91.18%

Table 2. Omega-3 vs. Total Sales Dollars

Sales (\$)	May 23-Aug. 5 (15% premium)	Aug. 6-Sept. 25 (30% premium)	Sept. 26-Nov. 13 (15% premium)	Nov. 14-Jan. 5, 2015 (0% premium)
Omega-3 Ground Beef	11.91%	22.81%	23.96%	15.69%
LaVaca 80/20 Ground Beef	36.63%	35.08%	33.60%	53.49%
Other LaVaca Ground Beef	51.47%	42.11%	42.44%	30.82%
Omega-3 Strip Steak	2.70%	5.94%	5.82%	1.40%
LaVaca Choice Strip Steak	4.08%	9.44%	7.91%	5.56%
Other LaVaca Steak	93.22%	84.63%	86.27%	93.04%

Ultimately, the inconsistency in sales volumes and data management influenced this retail trial and led to results that contradict our initial expectation that sales would increase with lower prices. LaVaca Meats was selling products but determined that the meat product moved slowly when premiums were placed on the products – confirming what our retail trial above found. Based on analysis from both LaVaca sales and the local outlet of a large retail grocer it became apparent that consumers resisted paying significant premiums for the product if it was on the shelf next to lower-priced non-omega product. However, consumer reactions to the quality and eating experience was been immensely positive. This suggests omega-3 beef may need to launch with prices similar to competing products and then strive for premiums once the product gains consumer loyalty.

Objective 4

To estimate how consumer demographic and socioeconomic status, levels of health concerns, and price consciousness affect demand and willingness-to-pay premiums for ground beef and beef steaks containing selected compositions of DHA and EPA omega-3 fatty acids based on actual in-store consumer purchase decisions.

Achievements for Objective 4

From May 23, 2014 to July 27, 2015 a total of 115 online LaVaca customers completed the online survey. Of the 115 respondents, 18 did not purchase ground beef or steak (made purchase of other item (s)) so these responses were discarded, leaving 97 responses for analysis. 37 of the 97 respondents purchased ground beef while 89 purchased steak, which means 29 purchased both ground beef and steak. Of the 37 respondents who purchased ground beef, 8 purchased omega-3 enhanced ground beef, which represents 21.6% of those purchasing ground beef. However, 10 of the 37 respondents reported that they did not see the omega product available so when these customers are disregarded, 8 of 27 (29.6%) who purchased ground beef and knew omega product was available, purchased the omega enhanced ground beef. Of the 89 respondents who purchased steak, 34 reported not seeing omega product available, which leaves 55 customers who did purchase steak and saw that omega product was available. Of these 55, 7 customers purchased omega enhanced steak, which represents a share of 12.7%. Of the 8 customers who purchased omega ground beef, 7 cited “believe there are health benefits” as a reason for purchasing the omega-3 enhanced ground beef. Meanwhile, only 2 of the 7 customers who purchased omega-3 enhanced steak cited this same reason. The most frequently cited reason for not purchasing omega-3 ground beef or steak was “not interested/unsure about health benefits.” The composition of the sample included 52% male, an average age of 50 (ranges from 22 to 86), 56 of 115 are college graduates, 55/115 have a household size of 2 (including themselves), 10% of respondents have kids under 6 years old, while 30% have kids between 6 to 18. Most respondents (59 of 115) consume ground beef or steak 1 to 3 times per week. Additionally, of the purchase considerations surveyed, price had the lowest mean level of consideration, which is not surprising considering the type of customer that LaVaca targets (i.e. higher income consumers looking for specialty beef products).

The data collection associated with this objective was completed, however we did not get a lot of information from these surveys that we found immensely useful. We learned that most consumers will not completely fill out even a short survey during a shopping trip, whether on-line shopping or in store. Because we did not learn as much from this survey as we had hoped, we increased the intensity of the work we completed in objective 5. As such, this information was incorporated into objective 5.

Objective 5

To determine consumer relative preference rankings for enhanced DHA and EPA omega-3 ground beef and steak compared with other potentially important consumer preferences such as food safety, product quality (taste, tenderness), product price, sustainability, animal welfare, and related factors. Also determine consumer willingness-to-pay for omega-3 beef.

Achievements for Objective 5

This objective has been completed. A nation-wide survey was completed to assess consumer preferences for omega-3 beef. Much of the discussion below is based on an MS thesis completed for this project as referenced at the end of this report.

The following descriptions are for the complete data set – n=374 for ground beef and n=183 for steak survey respondents. Summary statistics for the sample of all responses are reported in Table 3. Both samples included more women than men: 55.6% for ground beef survey respondents and 58.5% for steak respondents. On a scale of 1 (some high school) to 5 (post college graduate), the average education was 3.8 for ground beef survey respondents and 3.65 for steak survey respondents (between some college and college graduate) with 38% indicating they were college graduates in both groups. Household size was measured by the number of adults, children under 6, and children between 6 and 18. The majority of respondents for both surveys indicated 2 adults and 0 children per household. Based on open ended questions where respondents could enter exact numbers, the averages for “adults” were 2.2 and 2.31 for ground beef and steak survey respondents, for “children under 6” they were 0.18 and 0.23, and 0.39 and 0.38 for “children between 6 and 18.” The age of respondents was dispersed between 18 and 60+ in both groups. On a scale of 1 (<18) to 5 (60+), the averages were 3.7 and 3.74 for ground beef and steak survey respondents, respectively.

Table 3. Demographic Summary Statistics of National Survey Respondents

Variable	Definition	Mean		Proportions	
		Ground Beef	Steak	Ground Beef	Steak
Gender male	1=male; 0=female	0.44 (0.497)*	0.42 (0.494)	44.4%	41.5%
Education edu	Level of education	3.8 (0.99)	3.65 (1.03)		
	1=Some high school			1.3%	1.6%
	2=High school graduate			9.9%	14.2%
	3=Some college			23.3%	24.0%
	4=College graduate			38.2%	37.7%
	5=Post college graduate			27.3%	22.4%
Adults adults	Number of adults in household	2.2 (0.94)	2.31 (1.63)		
Children Under 6 childu6	Number of children under 6 in household	0.18 (0.63)	0.23 (0.70)		
Children 6 to 18 child618	Number of children between 6 and 18 in household	0.39 (0.87)	0.38 (0.91)		
Age age	Age group of respondent	3.7 (1.06)	3.74 (0.98)		
	1=<18			0%	0%
	2=18-29			17.91%	12.02%
	3=30-44	50.1 (18.28)	50.44 (17.28)	22.46%	28.96%
	4=45-59			31.82%	32.24%
	5=60+			27.81%	26.78%
Income income	Income range of respondent	Without "11s" ¹			
	1=\$0-\$9999			5.88%	3.28%
	2=\$10,000-\$24,999	4.53 (2.23)	4.34 (2.05)	7.75%	7.65%
	3=\$25,000-\$49,999			14.44%	18.58%
	4=\$50,000-\$74,999			16.04%	15.85%
	5=\$75,000-\$99,999	\$79,501 (58,284)	\$73,722 (53,434)	13.10%	12.02%
	6=\$100,000-\$124,999			9.63%	8.74%
	7=\$125,000-\$149,999			5.61%	2.19%
	8=\$150,000-\$174,999			2.67%	2.19%
	9=\$175,000-\$199,999			1.34%	1.64%
	10=\$200,000+			4.01%	2.73%
	11= Prefer Not to Answer			19.52%	25.14%
Number of observations				374	183

*Standard deviations are in parentheses

Respondents were asked about their frequency of consumption for ground beef, steak, chicken, pork, and fish on a scale of 0 (never) to 4 (at least once a week). On average, the level of consumption for each category, respectively, was 3.09, 2.33, 3.56, 2.5, and 2.47 for ground beef survey respondents and 2.98, 2.32, 3.63, 2.64, 2.38 for steak survey respondents. For both survey groups, chicken was the most frequently consumed product, followed by ground beef. On a scale of 1 (less than \$60 per week) to 5 (more than \$150 per week) the average household food expenditure for ground beef survey respondents was 2.76 and 2.72 for steak survey respondents (between \$61-\$90 and \$91-\$120 per week). When asked where they most frequently purchase meat consumed at home, 75.9% and 77.6% of ground beef and steak survey respondents respectively, said supermarket/grocery store.

Respondents were asked about their experience with “grass-fed” beef and in both surveys, over 50% of respondents claimed that they have consumed “grass-fed” beef, but do not regularly consume it. The average responses, on a scale of 1 (never heard of it) to 4 (consume it regularly), were 2.74 for both surveys. Additionally, respondents were asked about impressions they had regarding “grass-fed” beef compared to conventional beef. The options were negative, neutral, positive, and no expectation for their impression of grass-fed beef’s impact on human health, environment, animal welfare, and taste compared to conventional beef. The responses for both ground beef and steak survey respondents were overwhelmingly positive with over 50% of respondents indicating positive impressions for all impacts.

Table 4 indicates the concern level of respondents regarding a series of food issues. On a scale of 1 (not at all concerned) to 5 (very concerned) average responses ranged from 3.19 to 4.03 for all issues. The lowest average for both groups was their concern about the use of irradiation to control foodborne pathogens (3.19 and 3.28), while the highest average for both groups was their concern about the use of chemicals/pesticides in food production (3.89 and 4.03). The correlations for these concern levels were all positive. In the ground beef survey, those correlations ranged from 0.54 for concern between foodborne pathogens and labeling of genetically modified food ingredients, to 0.865 between concern about chemicals/pesticides in food production and use of antibiotics in food animal production. For steak survey respondents the correlations range from 0.545 (between concern about Genetic Modification of food crops (GMOs) and welfare of animals used for food production) to 0.81 (between concern about chemicals/pesticides in food production and use of antibiotics in food animal production).

Table 4. Summary Statistics for Additional Variables

Variable	Definition	Mean	
		Ground Beef	Steak
Food Issue Concerns	How concerned respondents are about the issues 1=Not at all concerned 3=Somewhat concerned 5=Very concerned		
conhorm	Use of synthetic growth hormones in food	3.68 (1.39)	3.72 (1.40)
conpath	Foodborne pathogens that can cause illness	3.77 (1.30)	3.76 (1.23)
conirrad	Use of irradiation to control foodborne pathogens	3.19 (1.45)	3.28 (1.39)
congmm	Genetic Modification of food crops (GMOs)	3.33 (1.50)	3.43 (1.43)
conclone	Use of cloning in food animal production	3.36 (1.46)	3.58 (1.41)
conwelf	Welfare of animals used for food production	3.76 (1.30)	3.78 (1.30)
conchem	Use of chemicals/pesticides in food production	3.89 (1.32)	4.03 (1.21)
conlblgm	Labeling of genetically modified food ingredients	3.49 (1.47)	3.66 (1.40)
conantib	Use of antibiotics in food animal production	3.84 (1.35)	3.87 (1.27)
Omega-3 Agreements	Level of agreement with the statements 1=Strongly Disagree to 5=Strongly Agree		
agrheart	Omega-3 fatty acids can help reduce the risk of heart attacks.	3.78 (0.92)	3.75 (0.87)
agrsalm	Salmon is a good source of omega-3 fatty acids.	4.00 (0.94)	4.05 (0.85)
agrwheat	Wheat based foods are a good source of omega-3 fatty acids.	2.78 (0.84)	2.69 (0.87)
agrbeef	Beef is a good source of omega-3 fatty acids.	2.78 (0.90)	2.71 (0.90)
Confidence	Level of confidence respondents have 1=Not at all confident 3=Somewhat confident 5=Very confident		
choconf	Confidence in selections just made	3.37 (1.03)	3.62 (1.00)
o3bnconf	Confidence that there are health benefits from omega-3 fatty acids	3.58 (1.02)	3.63 (1.06)
Information Treatment	Whether respondents were given a high or low information treatment 1=High Info; 0=Low Info		
highinfo		0.54 (0.499)	0.51 (0.50)

To better understand the respondents' knowledge of omega-3 fatty acids, a series of statements were provided to which respondents were asked to indicate their level of agreement ranging from 1 (strongly disagree) to 5 (strongly agree). For both survey groups, the highest level of agreement (4.0 and 4.05) was with the statement, "Salmon is a good source of omega-3 fatty acids." The second most agreed on statement, "Omega-3 fatty acids can help reduce the risk of heart attacks" had averages of 3.78 and 3.75 for ground beef and steak survey respondents respectively. The last two statements had much lower levels of agreement, which was expected. For "Beef is a good source of omega-3 fatty acids" the averages were 2.78 and 2.71, followed by "Wheat based foods are a good source of omega-3 fatty acids" with averages of 2.78 and 2.69. The agreement levels that respondents indicated (between disagree and neutral) for the statements about beef and wheat shows that consumers are not sure whether beef or wheat are good sources of omega-3 fatty acids.

Tables 5-7 provide data on the frequency with which steak products with various combinations of attributes were selected, and how additional information about Omega-3, whether the steak was from a locally raised animal or whether the steak was guaranteed to be tender affected the frequency of selection. Similar data are available for ground beef from the authors.

Additional information about Omega-3s provided to half of the survey respondents had little or no impact on the frequency with which steaks with varying levels of Omega-3 were chosen. The frequency with which the conventional steak was chosen fell from 16.4% to 15.4% while that for grass-fed and enhanced both increased – from 32.3% to 37.2% for grass-fed, and from 20.6% to 21.1% for enhanced. The pattern of change is in line with what would be expected since the additional information informs the respondent about recommended intake levels and the higher levels of beneficial omega-3s in animals fed with supplements derived from algae. In the ground beef data we again saw that the differences in selection frequency between the two information treatments are quite small, with a reduction in the frequency of selection for the conventional product (from 21% to 18%) and a slight increase for the enhanced product (from 25.1% to 25.7%).

In each table we observed that price appeared to have an important influence on the frequency with which an alternative is chosen. In almost all cases frequency of selection declined when price increases. Thus, for example, the frequency of selection for the conventional, non-local steak declined from 15.8% to 6% as price increased from \$10.99/lb to \$15.39/lb.

For both steak and ground beef, the response frequency data suggested a preference for the grass-fed product (Omega40) over the other two options (Conventional - Omega16 and Enhanced - Omega400). In the steak survey, the overall frequency of selection for the grass-fed product was 34.8% compared to 20.9% for enhanced and 15.9% for conventional. Similarly, in the ground beef survey, overall frequency of selection for grass-fed was 39.5% compared to 25.4% for enhanced and 19.3% for conventional. Thus, for both products, we observed a slight

preference for the enhanced omega-3 level product (Omega400) over the conventional product (Omega16).

For consumers of grass-fed beef, the value of a locally-raised designation would exceed the value of a tenderness guarantee. In Table 7 we see that non-tender, enhanced omega steak offered at \$13.19/lb is selected with a frequency of 16.7%. Reducing the price of that product to \$10.99/lb increases the frequency of selection to 24.9%, while adding a tenderness guarantee but maintaining the \$13.19/lb price increases the frequency of selection to 25.7%. Since the effect of either change is quite similar, we can say that the effect of adding a tenderness guarantee is roughly similar to the effect of reducing price by \$2.20/lb.

Table 5 Steak: Effect of Information on Choice Frequency.

Omega Level	Price	Percent Choosing	
		Low Info	High Info
NONE		30.5%	26.2%
Omega 16 (Conventional)		16.4%	15.4%
	10.99	21.6%	22.0%
	13.19	18.5%	17.3%
	15.39	8.9%	6.3%
Omega 40 (Grass-Fed)		32.3%	37.2%
	10.99	51.8%	56.4%
	13.19	28.9%	30.8%
	15.39	15.9%	23.8%
Omega 400 (Enhanced)		20.6%	21.1%
	10.99	31.2%	33.8%
	13.19	20.7%	20.9%
	15.39	10.7%	10.5%

Table 6. Steak: Effect of “Local” on Choice Frequency.

Omega Level	Price	Percent Choosing	
		Not Local	Local
NONE		28.3%	28.3%
Omega 16 (Conventional)		10.4%	21.0%
	10.99	15.8%	28.5%
	13.19	7.3%	27.6%
	15.39	6.0%	8.9%
Omega 40 (GrassFed)		26.4%	43.4%
	10.99	49.2%	59.2%
	13.19	14.6%	44.8%
	15.39	15.3%	25.1%
Omega 400 (Enhanced)		17.7%	23.7%
	10.99	25.1%	39.7%
	13.19	17.1%	24.9%
	15.39	10.5%	10.7%

Table 7. Steak: Effect of “Tender” on Choice Frequency.

Omega Level	Price	Percent Choosing	
		Not Tender	Tender
NONE		28.3%	28.3%
Omega 16 (Conventional)		9.7%	23.7%
	10.99	11.6%	35.0%
	13.19	13.0%	24.0%
	15.39	4.8%	11.2%
Omega 40 (GrassFed)		29.7%	38.9%
	10.99	42.8%	63.1%
	13.19	24.2%	33.9%
	15.39	22.1%	18.2%
Omega 400 (Enhanced)		15.8%	25.4%
	10.99	24.9%	38.9%
	13.19	16.7%	25.7%
	15.39	5.6%	14.1%

WTP estimates were derived from random parameter logit models estimated using Choice Experiment results from the consumer survey. Results are summarized in Tables 8 and 9 for the corresponding attribute compared to the baseline product, as well as the upper and lower 95% confidence intervals. In the case of steak, the baseline product is a conventionally raised, not guaranteed tender, not locally raised steak. For ground beef, the baseline product is conventionally raised, 80/20 lean-to-fat-ratio, regularly inspected, not locally raised ground beef.

The estimated premium that females are WTP for grass-fed steak is \$4.06/lb compared to a baseline beef steak product. Males are willing to pay less for this same product (\$3.33/lb). The premium for the enhanced beef with 400 mg/serving of omega-3 fatty acids is \$1.93/lb with low information compared to the baseline product, but with high-information it is only \$1.79/lb. Respondents were willing to pay a premium of \$1.65/lb for steak that is guaranteed tender and \$1.93/lb for steak that is locally raised. More discussion on the distribution of WTP values follows the ground beef WTP estimates.

For grass-fed ground beef with 40 mg/serving of omega-3 fatty acids is \$1.48/lb for females and \$1.06/lb for males compared to a baseline ground beef product. Similar to the steak WTP estimates, males are willing to pay less for the grass-fed product. The premium for the enhanced ground beef with 400 mg/serving of 61 omega-3 fatty acids is \$0.53/lb with low information compared to the baseline product, but with high information it is \$1.06/lb. Respondents were willing to pay a premium of \$0.62/lb for steak that is 90/10 lean-to-fat, \$0.35/lb for steam pasteurized ground beef, and \$0.69/lb for ground beef that is locally raised. Meanwhile, respondents of this survey had an average WTP discount of \$0.31/lb for irradiated ground beef, which is expected given the results from previous analysis

Table 8. WTP for Steak

Attribute/Variable	Level	Willingness-to-Pay Estimate ^a	
Omega	Grass-fed (Omega40)	Upper 95% Confidence Interval	\$5.23
		Point Estimate	\$4.06 ^{***b} (0.597) ^c
		Lower 95% Confidence Interval	\$2.89
	Male – Grass-fed	Upper 95% Confidence Interval	\$4.76
		Point Estimate	\$3.33 ^{***} (0.729)
		Lower 95% Confidence Interval	\$1.90
	Enhanced (Omega400)	Upper 95% Confidence Interval	\$3.18
		Point Estimate	\$1.93 ^{***} (0.639)
		Lower 95% Confidence Interval	\$0.68
	HighInfo – Enhanced	Upper 95% Confidence Interval	\$3.04
		Point Estimate	\$1.79 ^{***} (0.642)
		Lower 95% Confidence Interval	\$0.53
Steak Guaranteed Tender Yes	Upper 95% Confidence Interval	\$2.17	
	Point Estimate	\$1.65 ^{***} (0.268)	
	Lower 95% Confidence Interval	\$1.12	
Animal Locally Raised Yes	Upper 95% Confidence Interval	\$2.38	
	Point Estimate	\$1.93 ^{***} (0.229)	
	Lower 95% Confidence Interval	\$1.48	

^aWillingness-to-pay estimates in dollars per pound.

^bOne asterisk indicates statistical significance at the 10% level, two at the 5% level, three at the 1% level.

^cValues in parentheses are standard errors.

Table 9. WTP Ground Beef.

Attribute/Variable	Level	Willingness-to-Pay Estimate ^a	
Omega	Grass-fed (<i>Omega40</i>)	Upper 95% Confidence Interval	\$1.87
		Point Estimate	\$1.48 ^{***b} (0.199) ^c
		Lower 95% Confidence Interval	\$1.09
	Male – Grass-fed	Upper 95% Confidence Interval	\$1.48
		Point Estimate	\$1.06 ^{***} (0.214)
		Lower 95% Confidence Interval	\$0.64
	Enhanced (<i>Omega400</i>)	Upper 95% Confidence Interval	\$0.91
		Point Estimate	\$0.53 ^{***} (0.194)
		Lower 95% Confidence Interval	\$0.15
	HighInfo – Enhanced	Upper 95% Confidence Interval	\$1.43
		Point Estimate	\$1.06 ^{***} (0.189)
		Lower 95% Confidence Interval	\$0.68
Lean-to-fat Ratio	90/10 (<i>fat9010</i>)	Upper 95% Confidence Interval	\$0.85
		Point Estimate	\$0.62 ^{***} (0.12)
		Lower 95% Confidence Interval	\$0.39
Food Safety Intervention	Regular Inspection plus Steam Pasteurization (<i>Steam</i>)	Upper 95% Confidence Interval	\$0.63
		Point Estimate	\$0.35 ^{**} (0.145)
		Lower 95% Confidence Interval	\$0.07
	Regular Inspection plus Irradiation (<i>Irrad</i>)	Upper 95% Confidence Interval	-\$0.0006
		Point Estimate	-\$0.31 ^{**} (0.157)
		Lower 95% Confidence Interval	-\$0.62
Animal Locally Raised	Yes (<i>yeslocal</i>)	Upper 95% Confidence Interval	\$0.87
		Point Estimate	\$0.69 ^{***} (0.088)
		Lower 95% Confidence Interval	\$0.52

^aWillingness-to-pay estimates in dollars per pound.

^bOne asterisk indicates statistical significance at the 10% level, two at the 5% level, three at the 1% level.

^cValues in parentheses are standard errors.

Objective 6

Based upon all the information gained from objectives 1 through 5, synthesize how the beef industry can successfully design a roadmap for producing and marketing omega-3 beef enriched with DHA and EPA profitably to consumers.

Achievements for Objective 6

Ultimately, the overall acceptance and willingness to pay towards an omega-3 enhanced beef product was evaluated in this project. Consumers who purchased and consumed the product from LaVaca reported very desirable eating experiences. When we sold the omega-3 product in stores though, we found it difficult to sell the product if it was priced at a premium. This contrasts the survey results we found and suggests before a premium price for omega-3 beef is going to be sustained, it may take gaining consumer loyalty to the product first.

In surveys, consumers showed a preference for the enhanced omega-3 beef option over conventionally raised beef, but a much higher preference for grass-fed beef. This research contributed to the limited availability of published literature on this topic and provides as well as the meat marketing industry, a better understanding of the potential opportunity to expand product offerings for consumers. The overall acceptance and willingness to pay for an omega-3 enhanced beef product, which has levels of DHA and EPA higher than traditional beef and is an alternative to fish, was less than a grass-fed beef option with 90% less omega-3 fatty acids per serving. Even with a high-information treatment, consumers more frequently preferred the grass-fed option. As expected, higher prices are associated with lower utility. The average premium, for this survey sample, for the omega-3 enhanced steak is \$1.93/lb compared to the baseline steak product. The top 25% of consumers are WTP \$2.36/lb, and the top 10% of consumers are willing-to-pay \$2.75/lb for the enhanced omega steak. Meanwhile, the premium for the omega-3 enhanced ground beef is \$0.53/lb with low-information and \$1.06/lb with high-information. With high-information, the top 25% of consumers were WTP \$1.19/lb, and the top 10% of consumers are willing-to-pay \$1.30/lb for the enhanced omega ground beef. Therefore, if it costs less than these willingness-to-pay estimates to produce and market the omega-3 enhanced beef product, then this could be a viable production option for the beef industry.

Publications/Press Releases to Date

Press Articles/ Press Releases

Associated Press. "Research beefing up steaks, hamburgers with healthy omega-3s" Prepared by Roxana Hegeman, AP. October 2015.

<http://bigstory.ap.org/article/f7388db6e4c742528d44c9511a7e0d3d/research-beefing-steaks-hamburgers-healthy-omega-3s> (Picked up by Huffington Post, FarmForum.net, SciFeeds.com, several others nationwide).

K-State Research & Extension News. "Give me more of the good fat: New research from K-State suggests consumers may prefer beef enhanced by important omega-3 fatty acids." Prepared by Connor Orrock. September 2015.

<http://www.ksre.k-state.edu/news/news-stories/2015-news-releases/september/good-fat092315.html> (Picked up by Western Livestock Journal, Midwest Producer, Morning Ag Clips, High Plains Journal, etc).

Radio Interviews

KRVN/Rural Radio Network, Nebraska with Jesse Harding. "Demand for Omega-3 Enhanced Beef." October 16, 2015.

CBS Radio News with Stephen Kaufman. "Demand for Omega-3 Enhanced Beef." October 15, 2015.

Agriculture Today with Eric Atkinson. "Consumer Demand for Omega-3 Enhanced Beef." August 20, 2015.

Thesis

Kassie Curran. "Consumer Acceptance of Omega-3 Enhanced Beef in Surveys and Retail Trials." MS Thesis, August 2015.

Selected as the outstanding MS Thesis for 2015, Department of Agricultural Economics. Nominated for outstanding thesis awards to the Agricultural and Applied Economics Association (AAEA), and the Western Agricultural Economics Association (WAEA). Link to the thesis: <http://krex.k-state.edu/dspace/handle/2097/20413>

Journal Manuscripts

Lister, G., G.T. Tonsor, M. Brix, T.C. Schroeder & C. Yang (2017) Food Values Applied to Livestock Products, *Journal of Food Products Marketing*, 23:3, 326-341, DOI: 10.1080/10454446.2014.1000436

"U.S. Consumer Preferences for Omega-3 Enhanced Beef." In preparation for submission to peer reviewed journal