2008

North Carolina Grass-fed Beef Demand Assessment

FoodLogiQ LLC

Lois G. Britt Agribusiness Center at Mount Olive College

NC Tobacco Trust Fund Commission

FoodLogiQ Sustainability Practice

FoodLogiQ's mission is to provide grower associations, food manufacturers, grocers and restaurants with systems and best practices to ensure food quality, safety, and defense. FoodLogiQ provides support and training to Food Industry Associations with a web-based software package that is the first of its kind. Products and services for food Quality, Safety and Defense are hallmarks of the FoodLogiQ brand. The Sustainability Practice leverages FoodLogiQ's on-demand software platform to provide local farmers with greater access to regional and national markets through enterprise resource and grower management solutions. Working with small farmer cooperatives and larger agribusiness corporations, the FoodLogiQ Sustainability Practice offers the latest food industry research and best practices for sustainable agriculture in the 21st century.

Lois G. Britt Agribusiness Center at Mount Olive College

The mission of the Lois G. Britt Agribusiness Center is to foster synergism between agricultural business, environmental stewardship policy, and Christian ethics by providing:

1) *Undergraduate education in Agribusiness and AgriScience Education;*
2) *Agribusiness technology transfer opportunities for Eastern North Carolina;*
3) *Applied agribusiness research and technologies; and*
4) *The development of sustainable partnerships.*

North Carolina Tobacco Trust Fund Commission

The Tobacco Trust Fund Commission was created to assist tobacco farmers, tobacco quota holders, persons engaged in tobacco-related businesses, individuals displaced from tobacco-related employment, and tobacco product component businesses in the State due to the adverse effects of the MSA. The Commission can disburse funds through compensatory programs and qualified agricultural programs.

Acknowledgements

Primary Authors

Jonathan Barnes, Food Systems Analyst, FoodLogiQ Sustainability Practice

Dr. Phil Hamilton, Director, Lois G. Britt Agribusiness Center, Mount Olive College

Judson Armentrout, Director, FoodLogiQ Sustainability Practice

Dr. Sandy Maddox, Associate Director, Lois G. Britt Agribusiness Center, Mount Olive College

Contributing Editors

Andrew Kennedy, President, FoodLogiQ

Belinda Cheung, Research Associate, FoodLogiQ Sustainability Practice

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Executive Summary

The beef industry in the United States is the single largest segment of US agriculture accounting for 31% of US farms in 2007. Unlike its poultry and pork counterparts, beef products have remained relatively undifferentiated in the US market amidst increasing consumer preferences for value-added and niche beef products such as Certified Angus, USDA Organic, or pre-packaged heat and serve products. Skyrocketing energy costs have resulted in higher feed prices and increased transportation costs, burdening farmers with an ever-narrowing profit margin. Producers in the beef industry hope to differentiate their products, emulating the success of the Certified Angus Brand by developing new niche markets for all natural and grass-fed beef that focus on consumers' lingering health concerns about consuming red meats,.

Available research on the health benefits associated with grass-fed beef suggests that grass-fed producers could market their beef products as a healthier alternative to conventional grain-fed beef. In a survey of 971 North Carolina consumers, 74% of participants reported that they would be willing to pay more for health benefits that have become increasingly associated with grass-fed beef, such as a reduced risk of heart attack and lower risk of developing cancer. When asked specifically about grass-fed beef, consumers were an average of 13% less likely to report a willingness to pay more for grass-fed when compared to the product offering the aforementioned health attributes.

Of the 61% of consumers who reported a willingness to pay more for grass-fed beef, participants with a graduate degree or higher were over 15% more likely to indicate a willingness to pay more for grass-fed beef, than participants who had only completed high school ($r=0.792$). Consumers surveyed at Natural Food Stores indicated that they were willing to pay a price premium for grass-fed beef by almost three-to-one, while less than half of participants surveyed at Grocery Stores indicated the same willingness to pay more for grass-fed beef ($p<0.0001$). It is important to note that 6 out of the 8 participating natural food stores were located in the three large Metropolitan areas of the State each containing more than 1

million people (by MSA), while all participating grocery stores were located in less-densely populated areas.

1 Introduction

Beef has long served humanity as an excellent source of protein and essential micronutrients such as vitamin B_{12}, Zinc and iron. The practice of domesticating cows dates back to early Neolithic communities in India, the Middle East and sub-Saharan Africa more than 10,000 years ago[1]. Today animal husbandry is common practice across the world, and has played a pivotal role in the development of modern civilizations from the Athenian city-state to today's skyscraping urban metropolis.

For the majority of human history, livestock such as cattle and sheep were raised either by nomadic peoples or in agrarian societies by individual farmers. Livestock were grazed in pastures of grass and other forages, and their meat provided families with a primary source of protein. Introduced to North America by European colonists in 1492, by the 16th century, domesticated cattle were being raised on every continent alongside human settlements[2].

The current method of cattle production is a relatively recent development in human history, with pasture-based systems being the dominate paradigm even into the early 20th century. After World War II, a surplus of wartime grain production in the United States was used by Midwestern farmers as an inexpensive feed for livestock. Artificial price supports of U.S. corn production gave corn a competitive advantage among feed-types. Relatively inexpensive feed costs combined with rising land rents and the ability of farmers to use prophylactic antibiotics in animal feed, cattle operations would intensify production into

[1] (Malville, Wendorf, Mazar, & Schild, 1998)
[2] (Ball, Borg, & Sidey, 1998)

smaller areas of land. The emergence of large industrial-scale farming equipment encouraged farmers to specialize in either grain or livestock production in order to warrant the capital investment in these high-tech machines. Concentrated animal feeding operations quickly became the industry standard in livestock production, as farmers utilized recent advances in farming technology to develop efficient and increasingly large-scale livestock operations.

Today 25% of the annual corn production in the United States is used to make ethanol.

2 Contemporary Challenges for the Beef Industry

2.1 Price of Corn

Today, a host of economic and environmental issues are reshaping the cattle industry as farmers cope with rising global demand for beef, higher feed prices and rising fuel costs. The skyrocketing price of oil has hit livestock farmers particularly hard, leaving many operations to cope with significant losses in 2008. Production of the primary animal feed, corn, requires growers to apply considerable amounts of fertilizers and insecticides, both of which are derived from petroleum and natural gas. The large machines used at harvest rely on diesel fuel for their operation, an energy source that has more than quadrupled in price over the last decade.

New investments in the production of corn-based ethanol have significantly increased the demand for corn, only compounding the recent increases in corn production costs. In only ten years, the use of corn for ethanol production has jumped from 5% of US corn production in 1997 to 25% in 2008[3]. In only five years the use of corn in ethanol production has more than

[3] (Wikinvest, 2008)

tripled to a quarter of the annual US harvest[4]. Thirty percent of the global growth in grain use between 2002/2003 and 2007/2008 is attributed to US ethanol production[5].

Feeding a burgeoning world population and seeking bio-fuel alternatives to petroleum-derived fuels are two significant interests that challenge the paradigm of corn as a readily available and inexpensive animal feed for livestock production in the 21st century.

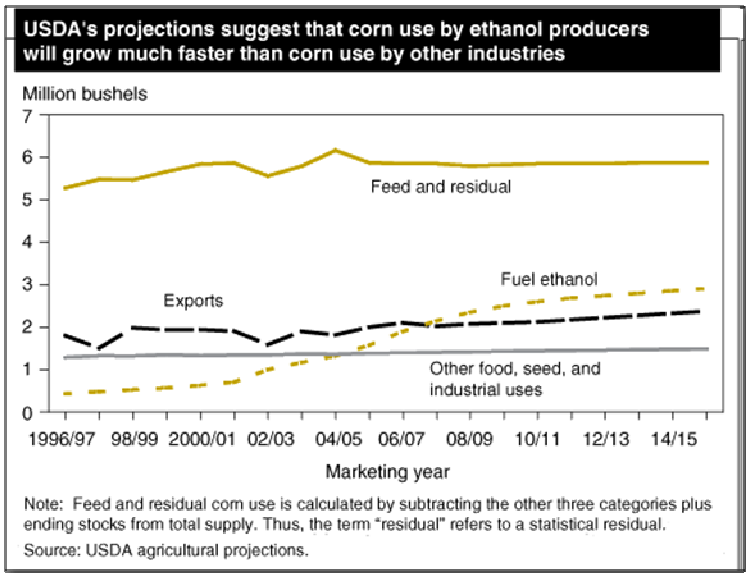


Figure 1 USDA projections for US corn production through 2016

2.2 Slow to React to Consumer Demand

Time has become a scarce commodity in the contemporary American lifestyle so consumers are spending less time preparing and eating meals as they once did. The family meal around the dinner table is no longer the ritual evening tradition that it once was in the 1950's and 1960's in American households. An increasing prominence of dual-income families mean there is less time for cooking and preparing meals in today's society. Consumers are increasingly looking for meal options that are both healthy and satisfying yet fast, easy, and 'ready-to-eat' requiring little or no preparation.

The poultry industry responded to this change in consumer preferences in the 1960's, embracing integrated production methods which allowed them to produce large quantities of

[4] (Trostle, 2008)
[5] (Trostle, 2008)

low-cost poultry products, including a variety of value-added products such as pre-seasoned and precooked meal options that could be "thrown in the microwave" for a quick and convenient meal[6].

In the 1980's the pork industry began to follow suit, coordinating activities along the supply chain to produce consistent quality meats in a variety of value-added products. Unlike its poultry and pork counterparts, the beef industry did not have the same characteristics that would promote economies of scale and consolidation within different production stages of the supply chain. Production costs for a cow-calf operation were not strongly correlated with herd size, meaning that producers had little incentive to consolidate into fewer and larger operations. Large fixed costs associated with negotiating production contracts makes contracting with a large number of small producers cost-prohibitive.[7] An uncoordinated production chain composed of numerous small ranching and feeder operations – often working part time –limited the beef industry's ability to convey changing consumer preferences to each link in the supply chain[8].

[6] (Ollinger, Nguyen, Blayney, Chambers, & Nelson, 2005)
[7] (Lamb & Beshear, 1998)
[8] (Lamb & Beshear, 1998)

2.3 Changing Consumer Preferences

Until the mid 1970's it appeared as if beef would only continue to strengthen its share of the market as the meat of choice for US consumers. In 1975 almost half of the meat purchased in the US was beef[9]. Although beef consumption remained relatively stable in the 1980's and 1990's, Americans increasingly purchased chicken and turkey products, more than tripling poultry consumption between 1975 and 2008 (*see figure 2*).

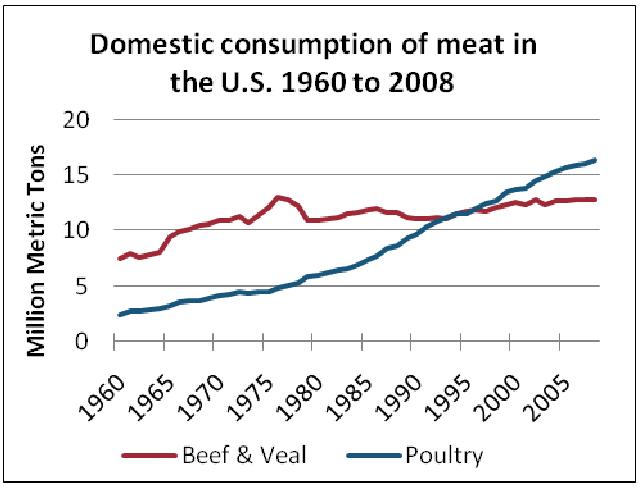


Figure 3 Trend in U.S. beef and poultry consumption since 1960 (USDA).

Although the total annual sales of beef continue to exceed those of poultry by almost two-to-one, in 1993 poultry had overtaken beef to become the number one meat of choice (by weight) for American consumers[10,11]. Industry analysts still debate over the reasons for beef's stagnation during the last 30 years with explanations ranging from a competitive advantage gained by the poultry industry in moving towards more value-added "ready-to-eat" products, to the targeted health campaigns of the American Heart Association

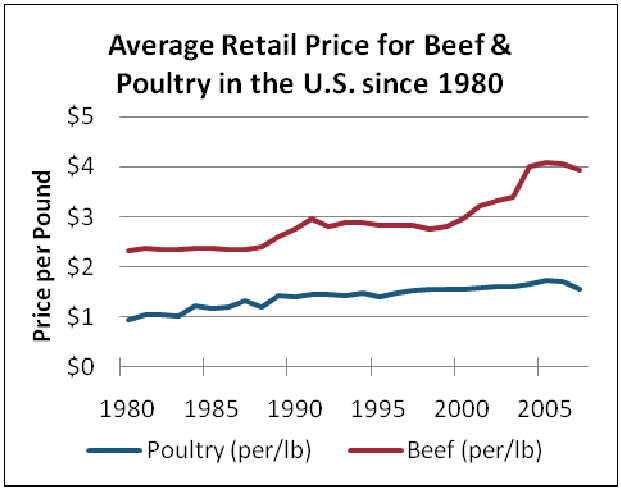


Figure 2 Historical trend in retail prices of beef and poultry.

[9] (Lamb & Beshear, 1998)
[10] (The Economic Research Service of the United States Department of Agriculture, 2008)
[11] (Trostle, 2008)

and medical establishment encouraging consumers to reduce their consumption of saturated and unhealthy fats[12]. In the last 25 years both beef and poultry have nearly doubled in retail price, but an increase in the price of beef from two to four dollars a pound may have had a greater impact on consumers buying decisions than poultry's increase from one to two dollars per pound (*see figure 3*).

2.4 Health Concerns

Consumers often cite health reasons, including concerns about fat and cholesterol, for curbing their beef consumption[13]. In a 2005 survey, consumers overwhelmingly agreed in a head-to-head matchup, that chicken is a healthier protein choice than beef (*see figure 4)*[14].

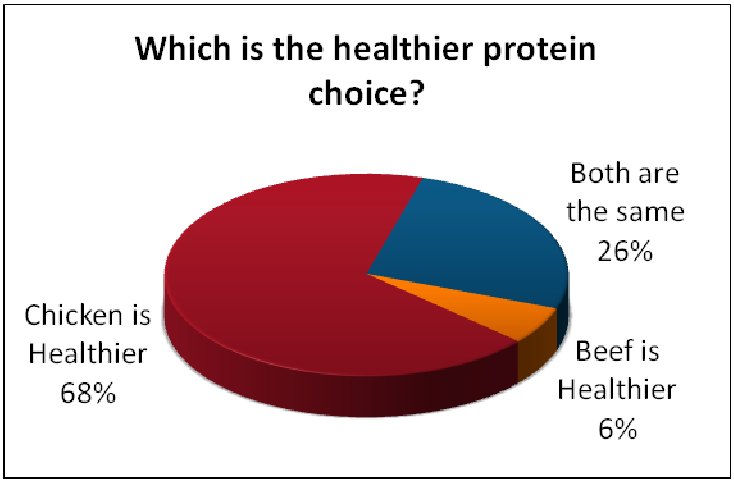


Figure 4 Consumer perceptions about beef and chicken (Husted, 2005).

Indeed, medical professionals, dieticians, and health and wellness advocacy groups became increasingly concerned by the growing epidemic of heart disease and stroke in America. For decades, organizations like the American Heart Association became active in the fight against heart disease, obesity and diabetes by encouraging lifestyle changes –including regular daily exercise—and healthy diet choices that would help reduce intake of saturated fats and cholesterol, the primary nutritional culprits of heart disease. As one of the most commonly enjoyed foods on America's dinner table, attention quickly turned to encouraging consumer to reduce their consumption of red-meat,

[12] (Lamb & Beshear, 1998)
[13] (Husted, 2005)
[14] (Husted, 2005)

which is often high in cholesterol and saturated fat. Apart from the well-grounded, but interminable suggestions to increase daily exercise, it seemed that America's number one killer had found its number one enemy: beef.

2.5 Developing a Market Niche: The Story of Certified Angus Beef

Figure 5 Certified Angus Beef is a successful niche market in the industry

Meat products fall along a continuum based on structural characteristics of the supply chain and more importantly, how products are marketed to consumers[15]. Increasingly differentiated products such as "USDA Organic" and "Certified Angus" capture specific preferences among a segment of consumers, creating a niche within a broader commodity market. The beef industry has responded to consumer demand by developing niche markets for beef that has certain attributes, and marketing the product based on these attributes. Arguably the most successful of these niche marketing efforts is the Certified Angus Beef brand, which has grown to annual sales of more than $2.5 billion since the program's inception in 1978[16].

3 Is Grass-fed the New Angus? Developing a Niche based on Health Attributes

3.1 USDA Grading System

The maxim "you are what you eat" holds truth even in the case of ruminant livestock, who for more than half a century, have been fed a high-energy diet of grains and concentrate. "Sweet

[15] (Rawls, Meyer, & Burdine, 2002)
[16] (Certified Angus Beef, 2008)

feed" as it is commonly known, provides the highly sought after marbling of intramuscular fat that makes a steak juicy, flavorful and tender.

The USDA grading system uses intramuscular fat content as one of its primary criteria for grading beef. Cuts with high levels of marbling receive the "prime" or "choice" designation indicating their premium quality. Paradoxically, leaner cuts of beef that medical professionals and health advocates have been recommending to their patients for the past few decades as a healthier choice receive a lower grade than their high-fat counterparts (*see figure 6).* The USDA grading system encourages farmers to use high-energy foods such as corn, grain and soy for feed in order to maximize the market value of the animal. Cattle farmers trying to capitalize on the emerging niche market for pasture-raised beef do not currently provide the needed volume for small packers to pay for USDA grading. Furthermore, the medium and large-scale packers that utilize USDA inspectors do not primarily process grass-fed beef, because of the small number of suppliers in the grass-fed market. Even if some grass-

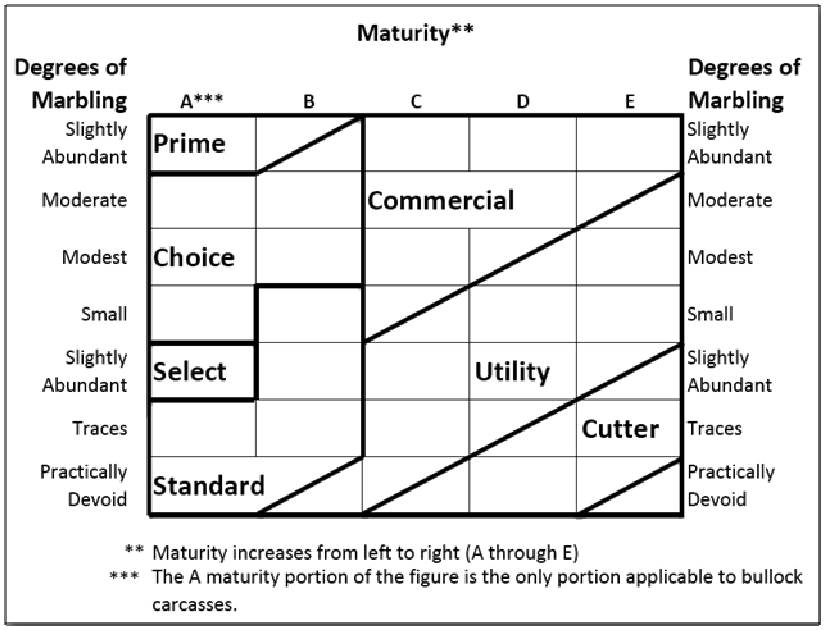


Figure 7 USDA Beef Grading Chart

Figure 6 Example of marbling in Japan's world-renowned Kobe beef.

fed producers had sufficient volume to afford a larger meat-packing facility that uses USDA grading, the lower fat content in the pasture-based diet could preclude grass-fed beef from obtaining higher grading[17,18,19].

Consumers have grown accustomed to the flavor of beef raised on a high energy and protein diet, but a growing segment of consumers is seeking out leaner beef products. According to a 2005 consumer poll, concerns about cholesterol and fat were cited as the top reasons consumers say they are eating less beef[20]. Grass-fed beef may become the healthy, lean alternative that allows consumers to avoid relegating the rib-eye steak or juicy hamburger to the status of guilt-laden comfort food. A growing collection of research has emerged in recent years suggesting that the malignant reputation given to this classic protein by doctors and dieticians alike may be ill-informed. Nutritionist and researcher Dr. Kate Clancy contends, "When you eat grass-fed meat, you're getting beef with benefits," and that the national conversation about the health implications of eating beef should be revisited.

[17] (Lamb & Beshear, 1998)
[18] (Daley, Harrison, Doyle, Abbott, Nader, & Larson)
[19] (Clancy, 2006)
[20] (Husted, 2005)

3.2 Emerging Science on the Importance of Essential Fatty Acids (EFAs)

Once demonized as the culprit of health woes such as heart disease, obesity, diabetes and other life-threatening diseases, fatty foods are getting a double take as health experts and scientists point to an increasing literature on the importance of fatty acids in regulating metabolism and enabling healthy organ and cell function[21].

Dietary Sources of Essential Fatty Acids	
Omega-3 Fatty Acids	
ALA	Grass Flaxseed, canola, soybean, walnut, wheat germ and walnut oils Tofu
CLA	Milk and dairy products Ruminant meats
EPA & DHA	Fish, fish oils, caviar
Omega-6 Fatty Acids	
	Corn, peanut, safflower, soy and other oils, nuts

Figure 8 Dietary sources of EFAs (MacLean et al. 2004; Fritsche & Steinhart 1998)

So-called Essential Fatty Acids (EFAs) include what are known as Omega-3 and Omega-6 fatty acids that cannot be synthesized by the body and are therefore an "essential" part of the diet. Foods rich in EFAs include fish, nuts, and pasture-raised meats (*see figure 8*). The American Heart Association recommends consuming foods rich in Omega-3 polyunsaturated fats (PUFAs) because of the imbalance in the ratio of Omega-6 to Omega-3 in the modern human diet[22].

Human Population	Ratio	Diet Features
Hunter Gatherers (400,000 to 45,000 years ago)	1:1	Wild plants, animals, and fish
Western cultures at onset of Industrial Revolution (150 years ago)	8.4:1	Greatly increased vegetable oils along with animals raised on cereal grains
Present-day Western cultures (70 years ago)	10.3:1	Increased fats, oils, vegetables and nuts

Courtesy of: Kris-Etherton et al. 2000.

Figure 9 Historical changes in the dietary ratio of Omega-6/Omega-3 fatty acids in humans

Early humans consumed a diet of meats and forages that provided a one-to-one dietary ratio of Omega-6 and Omega-3 fatty acids The contemporary American diet averages a ratio of 10:1,

[21] (Clancy, 2006)
[22] (Clancy, 2006)

which is almost five times the optimal ratio of two-to-one that is recommended by the National Institutes of Health *(see figure 9)*[23,24].

Specific fatty acids including DHA, CLA and EPA *(see appendix)* have received increased attention after a number of promising health benefits were observed in animal studies[25]. EPA has been shown to reduce the risk for coronary heart disease in Inuit populations who consume high amounts of fat from fish[26]. Both EPA and DHA have been shown to reduce triglyceride levels and better regulate blood pressure[27]. Health benefits of Conjugated Linoleic Acid (CLA) have also been well documented. Epidemiological studies in mice have shown that CLA has anti-carcinogenic properties[28]. In addition to its cancer-fighting properties, CLA fatty acids have been shown to reduce the formation of arterial plaque in rabbits, and decrease triglyceride and LDL cholesterol levels[29]. Unfortunately, most of these results have not been successfully reproduced in human studies.

3.3 Livestock Feed & EFAs in Beef

In ruminant animals, the type and concentration of fatty acids found in intramuscular fat is primarily influenced by the animal's diet[30]. The concentration of Omega-3 PUFAs in grass is approximately 30-times higher than that found in concentrate[31]. Higher proportions of fresh grass in a ruminant animal's diet are directly correlated with the concentration of CLA found in

[23] (Kris-Etherton, et al., 2000)
[24] (Simopoulos, 2000)
[25] (Clancy, 2006)
[26] (de Lorgeril, et al., 1994)
[27] (Harris, 1997)
[28] (Ha, Grimm, & Pariza, 1987)
[29] (Lee, Kritchevsky, & Pariza, 1994)
[30] (Moloney)
[31] (French, et al., 2000)

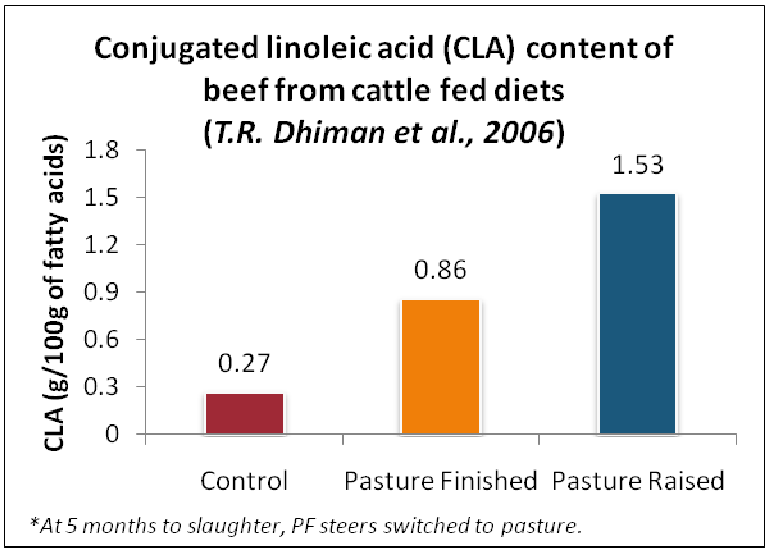


Figure 10 CLA levels in beef of grain-fed, grass-finished & grass-fed cattle

the meat[32,33]. Ruminant species fed on a diet of grass have been shown to produce 2 to 3 times more CLA than those fed in confinement on diets of concentrate.[34]

A 2006 report on the fatty acid composition of beef from animals with various diets of grain, grass, and concentrate analyzed the findings of thirteen scientific studies and concluded that the Omega-6/Omega-3 ratio of fatty acids is "consistently and significantly lower in steaks from grass-fed cattle" than grain or concentrate-fed animals[35,36].

The proportion of saturated fats in grass-fed beef is much lower per gram of total fat than that found in grain-fed beef[37]. Other nutrients found in grass-fed beef may be keys to the niche market's success with consumers. The National Research Council have determined that vitamin E is found in greater amounts in

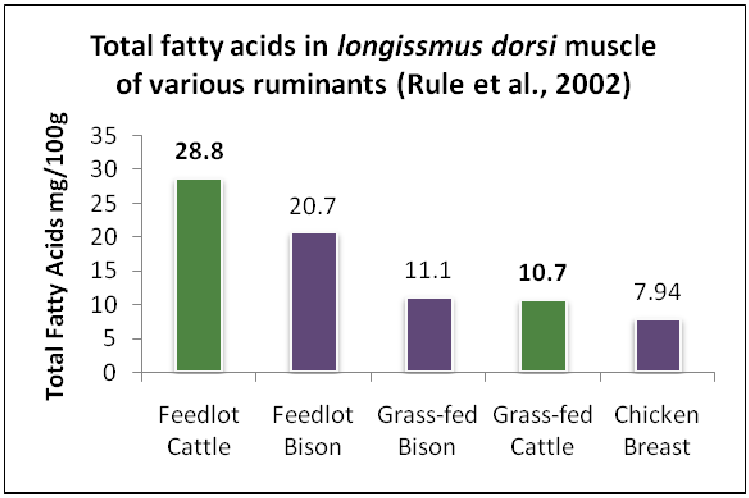


Figure 11 Fatty acid profiles of livestock on various feed diets

[32] (French, et al., 2000)
[33] (Dhiman, Poulson, Cornforth, & ZoBell, 2006)
[34] (French, et al., 2000) (Rule, Broughton, Shellito, & Maiorano, 2002)
[35] (Cordain, Watkins, Florant, Kelher, Rogers, & Li, 2002)
[36] (Clancy, 2006)
[37] (Clancy, 2006)

freshly cut forage or grass than exists in concentrate or other dried feeds. Even dried grasses or other forage such as hay or silage, quickly lose vitamin E after harvest. Kate Clancy's 2006 review of available research on grass-fed beef found that the meat of pasture-raised animals did indeed have significantly higher concentrations of vitamin E, with an average of three times more than is typically found in grain-fed meats[38,39]. Antioxidants such as vitamin E have been used as natural food preservatives for decades, and a recent study by Ohio State University found that vitamin E can extend shelf life and retard the growth of *E. Coli* and *Salmonella* populations in freshly ground beef, preserving the meat's red color[40,41].

In addition to higher levels of vitamin E, grass-fed beef has markedly higher amounts of beta carotene and vitamin A than conventionally raised beef[42]. Though its higher vitamin E content helps to maintain grass-fed beef's red color, the increase in beta carotene can cause some yellow discoloration of the intramuscular fat, potentially detracting from the beef's marketability[43].

[38] (Clancy, 2006)
[39] (Dhiman, Poulson, Cornforth, & ZoBell, 2006)
[40] (Geay, Bauchart, Hocquette, & Colioli, 2001)
[41] (Ahn, Grün, & Mustapha, 2006)
[42] (Dhiman, Poulson, Cornforth, & ZoBell, 2006)
[43] (Maricich, Neilsen, Owens, & Vedo, 1997)

4 Methodology

4.1 Survey Design

A set of 14 questions was developed to evaluate North Carolina consumers' willingness to pay for various attributes of grass-fed beef. Designed as a face-to-face survey, consumers were given an incentive for completing the one-page questionnaire, ranging from gift cards to generic consumable goods such as soda and bathroom tissue. Survey incentives were priced between $1 and $5, and the type of incentive varied by participating retail establishment. The survey was designed to be completed in two to three minutes, after which participants were offered an additional incentive to participate in an on camera interview discussing their beef purchasing preferences and evaluating their knowledge of grass-fed beef.

Eight areas across the state were identified as survey regions. These areas included the three large metropolitan areas of Charlotte, the Triangle and the Piedmont-Triad, as well as more rural areas including Wilmington, Asheville, Fayetteville, Greenville and Morehead City. The three metropolitan areas had populations of more than 1,000,000 people, whereas the more rural areas contained less than 500,000 people by Metropolitan Statistical Area.[44]

Type of Retail Establishment	SIC Code	Example
Farmers' Market (FM)	5431	*State Farmers' Market* (Raleigh)
Grocery Store (GRO)	5411	*Carlie C's IGA* (Fayetteville)
Natural Food Store (NFS)	5499	*Whole Foods Market* (Winston-Salem)

Figure 12 Classification of the survey's participating retail establishments

[44] Census 2000

Participating retail establishments were classified into one of three Standard Industry Classification (SIC) categories including supermarkets and grocery stores (5411), specialty food stores (5499) and fruit and vegetable markets (5431). In the results and subsequent discussion sections these categories are hereby referred to as Grocery (GRO), Natural Food Stores (NFS), and Farmers' Markets (FM), respectively.

Though we contacted a number of large regional and national grocery chains seeking their participation in the study, our efforts were met with limited success. The few traditional grocery stores that were willing to participate were independent grocers in the Eastern North Carolina region including the cities of Fayetteville and Morehead City.

4.2 Survey Demographics

More than 75% of survey responses were gathered at Natural Food Stores (NFS) or Farmers' Markets (FM). The remaining 25% were obtained at IGA supermarkets in the Fayetteville and Morehead City areas.

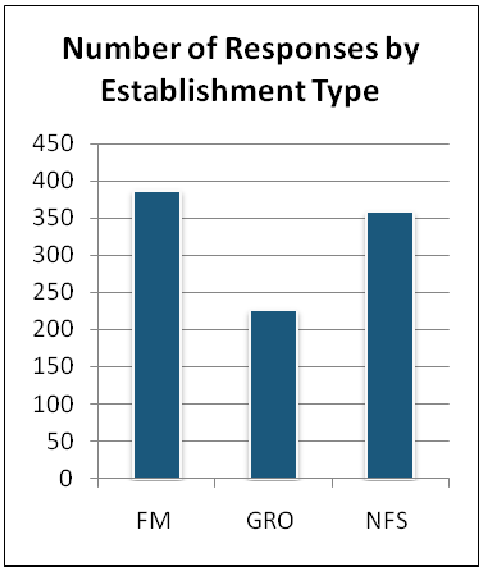


Figure 13 Survey responses by SIC classification of participating establishments

It is important to note that Natural Food Stores were located primarily in the three urban areas, with Asheville being a notable exception. None of the participating grocery stores were located in urban areas and therefore the conclusions made by establishment type cannot be generalized across the rural/urban dichotomy.

Figure 14 Response density by 3-digit Zip Code Tabulation Area (ZCTA)

A total of 971 North Carolina consumers were surveyed across the eight study regions. A distribution of responses by three-digit zip code can be seen in *figure 13.* The age groups sampled were determined to be fairly representative when compared to 2006 state demographic data. The sample distribution was skewed slightly to the left overwhelmingly favoring the 55 – 69 age group but moderately disfavoring the Over 69 age group (*see figure 14).*

Of the 971 respondents, 956 indicated a gender in their response. Although North Carolina's population is 51% female and 49% male, in our survey female

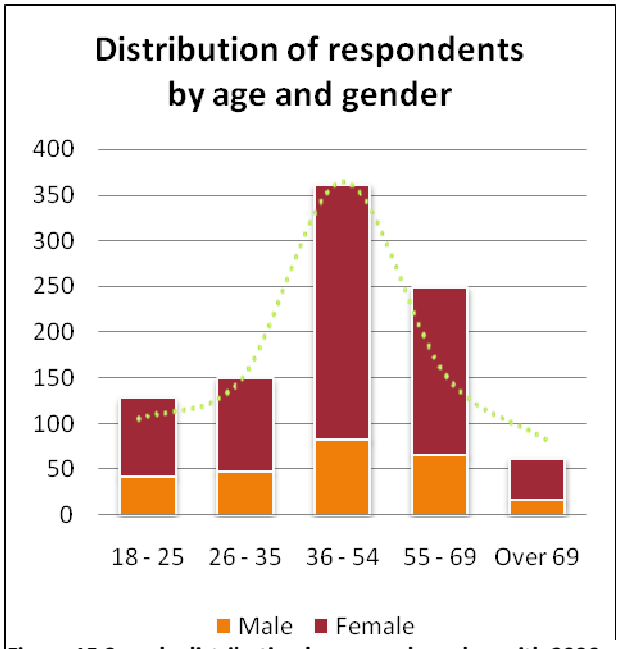
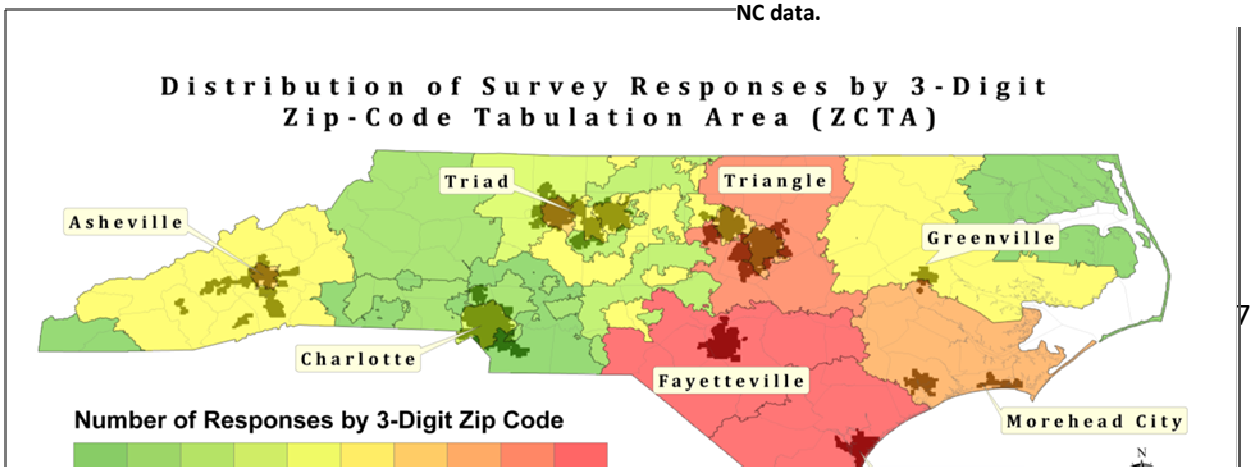
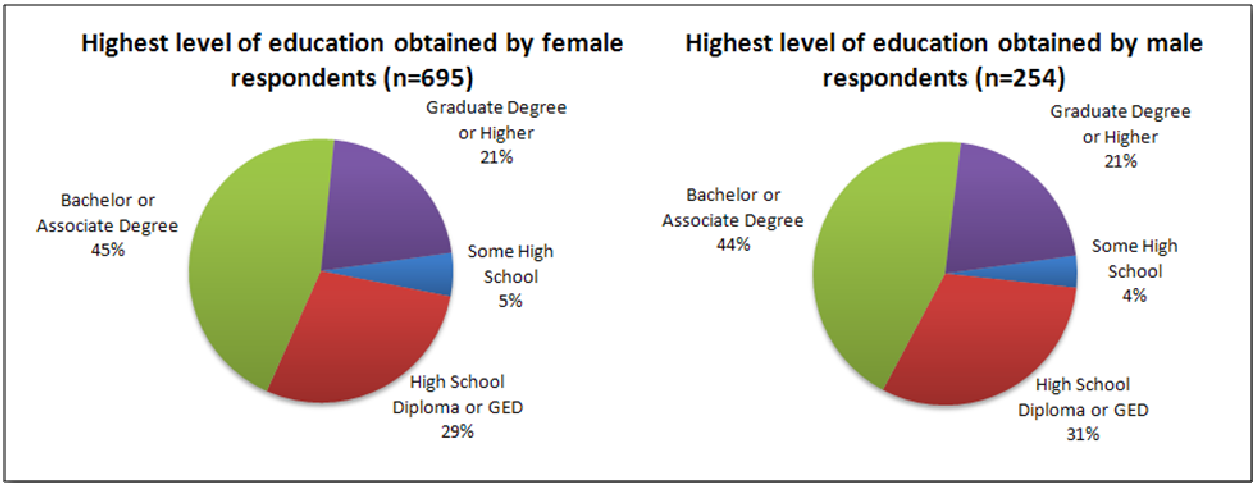


Figure 15 Sample distribution by age and gender, with 2006 NC data.





respondents outnumbered male respondents almost 3:1.[45]

Figure 16 Breakdown of education level of survey respondents by gender

The distribution of the "highest level of education obtained" by survey respondents was fairly consistent across the gender demographic (*see figure 15*). Two-thirds of both gender groups indicated having obtained some form of higher education, while less than 5% of respondents in both groups had not completed high school.

[45] (Census2000)

5 Survey Results & Analysis

5.1 How much do you currently pay?

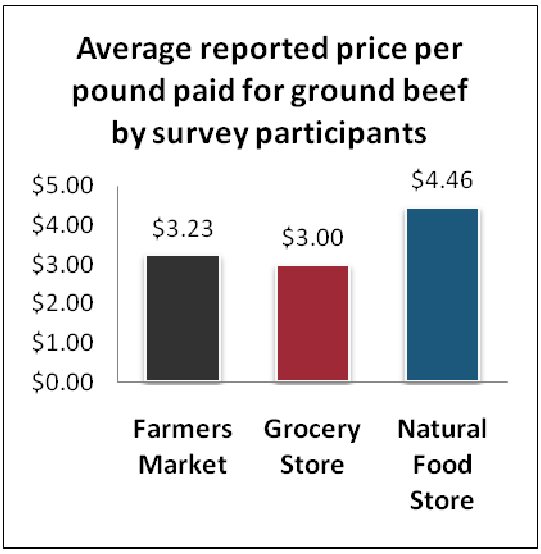


Figure 17 Average reported price paid for ground beef by establishment type (p< 0.0001).

When respondents were asked how much they typically pay for ground beef, less than half of them (46%) gave some indication of price with an average of $3.58 per pound. There was no significant difference in the price that respondents reported to pay for ground beef between gender groups; however, the average price differed significantly based on the type of retail establishment in which participants were surveyed. On average, participants at Natural Food Stores reported paying almost 50% more than respondents at grocery stores (regardless of where they claimed to purchase beef).

When looking at the price participants reported that they pay for ground beef and the differences in response by education level, a distinct trend emerged as persons who had obtained higher levels of education reported paying a higher price than their less-educated counterparts (p = 0.0143). Participants who had obtained a graduate degree or higher reported paying on average $4.02 per pound for ground beef,

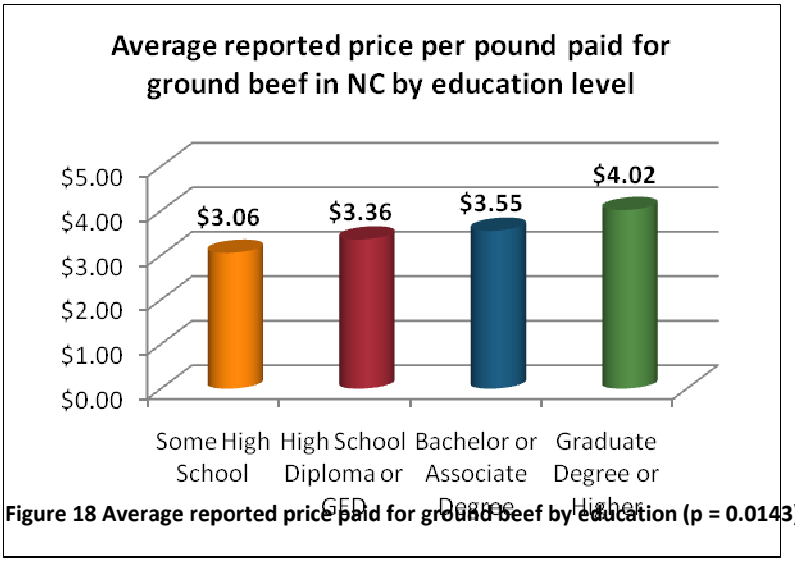


Figure 18 Average reported price paid for ground beef by education (p = 0.0143)

whereas those who had not completed high school reported paying on average $3.06 per pound, a price difference of almost 25%.

5.2 Characterizing the Market – What do Consumers Buy?

Some participants reported that they buy "North Carolina beef" because they shop at their local supermarket

Survey participants were asked a series of four questions about their buying habits. When asked if they buy natural beef consumers overwhelmingly said yes (57%) while sixteen percent of consumers "don't know" if they buy natural beef. Almost half of respondents (46%) indicated that they did not buy organic beef, while roughly one third stated that they do and fourteen percent of consumers surveyed "don't know" whether or not they buy organic beef. When asked about their purchasing habits regarding local North Carolina Beef, 44% of participants indicated that they purchased local beef products, however more than one third of respondents were unsure, and 15% stated definitively that they did not purchase North Carolina beef.

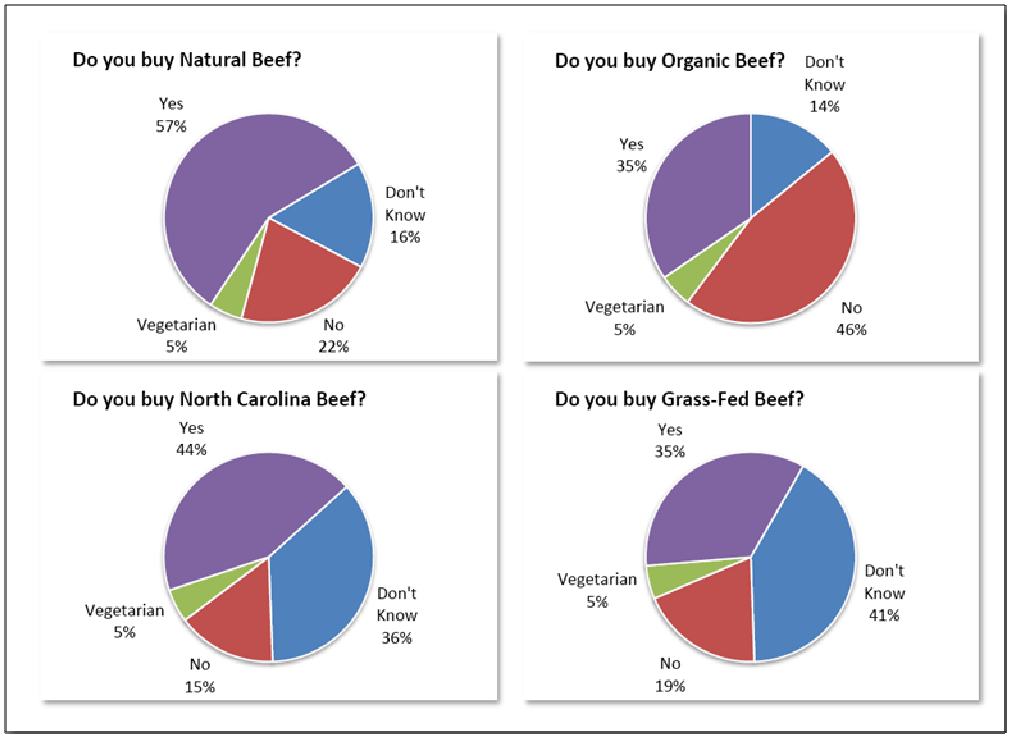


Figure 19 Characterizing survey participants' current purchasing habits.

When participants were asked about their buying habits as they relate to grass-fed beef,

most respondents (41%) indicated that they "don't know" whether or not they buy it, while slightly more than a third (35%) indicated that they do purchase grass-fed beef products.

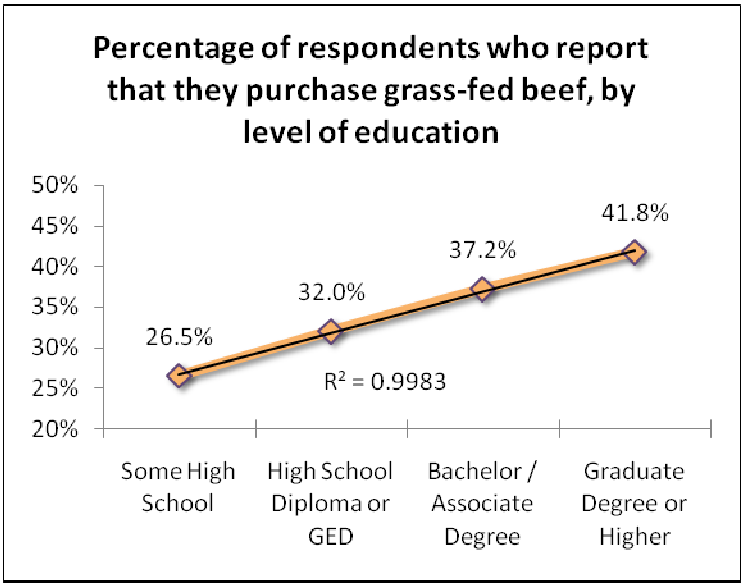


Figure 20 Correlation between education and those who indicated they already buy grass-fed beef

Most notable however, is the correlation between a participant's level of education and their likeliness to report buying grass-fed beef. More than 4 in 10 respondents with at least a graduate degree indicated that they buy grass-fed beef, while slightly more than 25% of respondents with only some high school education agreed that they purchase grass-fed. More than half (52.3%) of those surveyed at Natural Food Stores indicated that they already purchase grass-fed beef, compared to only 27% of Grocery Store respondents who make the same claim. It is important to note that at the time of this survey only the Natural Food Stores and some of the Farmers Markets offered grass-fed beef product for sale.

Consumers are generally more familiar with the term "organic" as it relates to their purchasing habits than they are with indications of an animal's diet or origin ("grass-fed beef" and "North Carolina beef"). In fact, 86% of respondents were able to readily indicate whether or not they purchase organic beef, while only 59% could discern if they buy grass-fed beef. The greater familiarity consumers have with the term "organic" may be attributed to the marketing efforts of a multi-billion dollar organic foods industry. The ambiguity of what it means to purchase "North Carolina beef" was noted anecdotally by the survey administrators when some

participants indicated that they purchase “local beef” because they shop at their local grocery store, or because they buy beef raised in the United States.

Almost 6 out of 10 survey respondents stated that they purchase “natural” beef. The ambiguity of the term “natural” was observed when many participants inquired about the intended use and meaning of the term “natural beef.” The USDA classifies “natural” as a meat that is minimally processed, an ambiguous claim that provides little information to consumers at the point of sale. In non-meat food products, the “natural” claim is unregulated and is used to describe millions of food products on the market today leaving consumers to guess about the merits of a food manufacturer’s labeling claims.

5.3 Evaluating Willingness to Pay

Participants were asked about their willingness to pay more for ground beef with certain attributes, including the animal’s diet, certain health benefits of the meat, and the location of origin of the beef. Almost three-quarters of respondents (74%) indicated that they were willing to pay at least $0.50 more per pound for a beef that “contained a nutrient that has been shown to reduce the risk of cancer”. Slightly lower was the number (73%) of participants willing to pay $0.50 more per pound for a beef that “contained a nutrient that could significantly reduce your risk of heart attack.” Only 61% of respondents were willing to pay $0.50 more for beef that was grass-fed, while almost two-thirds would pay more for locally raised beef from North Carolina. The difference in willingness to pay between attributes was not statistically significant.

5.3.1 Education & Willingness to Pay

5.3.1.a Grass-fed Beef

Evaluating respondents' willingness to pay more for grass-fed beef by their level of education we find a moderately strong correlation between participants' reported willingness to pay more for grass-fed beef and their level of education. This supports the earlier finding that individuals indicating a higher level of education are significantly more likely to report that they already purchase grass-fed beef than their less-educated counterparts.

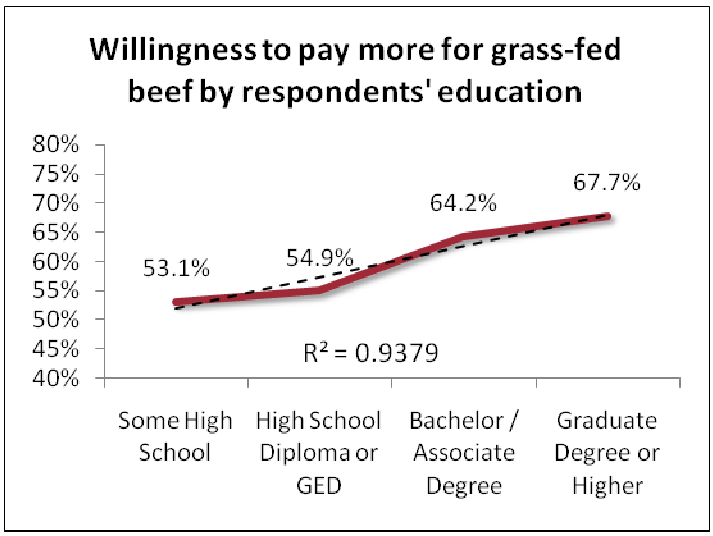


Figure 21 Willingness to pay more for grass-fed beef by education

Survey participants at natural foods stores reported that they were willing to pay more for grass-fed beef by almost three to one when compared to those who were not willing to pay a price premium. Of those participants surveyed at farmers' markets, twice as many indicated that they were willing to pay the price premium for grass-fed over those who were not. Although grass-fed beef received overwhelming support at natural food stores and farmers' markets, participants at grocery store establishments were split almost evenly, with slightly less than half indicating a willingness to pay more for grass-fed product ($p<0.0001$).

5.3.1.b Beef with Health Benefits

Survey participants with a graduate degree or higher were an average of 13-15 percentage points *less* likely to indicate a willingness to pay for either of the two health benefits, than were

respondents who had not completed high school. This correlation indicates that consumers who are more educated are likely to be less compelled by a product's health claims than those who are less educated. Perhaps most important to the grass-fed beef industry is that the current consumer base that purchases grass-fed beef is 13% to 15% *less* likely to be convinced by marketing health claims for beef products.

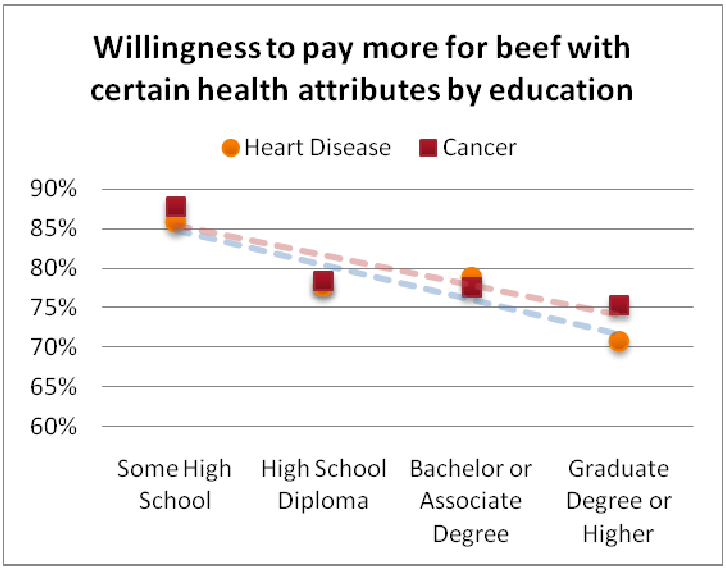


Figure 22 Willingness to pay more for health attributes by education

6 Discussion

It is apparent that a consistent market opportunity exists for grass-fed beef in North Carolina. Suppliers of grass-fed beef face numerous challenges to gain increased market share and preference among consumers. Targeting potential grass-fed buyers by highlighting the health benefits of grass-fed beef that are becoming increasingly evident is likely the most effective way for grass-fed suppliers to further grow the emerging niche market. Recent consumer studies indicate that labeling claims surrounding a food's health benefits provide the most added value and consumers are increasingly willing to pay more for products with these benefits as highlighted by our survey results. The highly educated and urban-dwelling consumer is arguably the primary customer base for grass-fed beef in NC. Differentiating grass-fed beef by its reported health benefits –particularly the emerging science on the importance of Omega 3 EFAs- could be a primary focus of any marketing efforts to promote grass-fed beef in the state.

Due to widely varying perceptions surrounding the flavor and palatability of grass-fed beef, producers may choose to address product quality issues by coordinating production efforts through a cooperative. Existing retail markets for grass-fed beef were found to be located primarily in larger urban areas and may continue to serve as the principal marketing channel for niche protein products such as grass-fed and organic meats in the near future.

Appendix A

6.1 Acronyms and Abbreviations

CAFO	Concentrated Animal Feeding Operation
CLA	Conjugated Linoleic Acid
DHA	Docosahexaenoic Acid
EFA	Essential Fatty Acid
EPA	Eicosapentaenoic Acid
FM	Farmers' Market
GRO	Grocery Store
NFS	Natural Foods Store
PUFA	Polyunsaturated Fatty Acid
SFA	Saturated Fatty Acid
SIC	Standard Industry Classification
USDA	United States Department of Agriculture
ZCTA	Zip-Code Tabulation Area

6.2 Glossary of Terms

Concentrate – Livestock feed that is high in energy (grain), low in fiber content, and highly digestible.

Concentrated Animal Feeding Operation (CAFO) is a category of operations originated by the Environmental Protection Agency's Clean Water Act. CAFOs are operations with a capacity of 2,500 head or more, or operations with 750-2,500 head that discharge pollutants directly into navigable waters.

Consolidation – refers to the horizontal integration of smaller firms within larger firms.

Contracts – often called livestock production contracts, are legally binding agreements between independent farmers and processors.

Feedlot - Enterprise in which cattle are fed grain and other concentrates for usually 90-120 days. Feedlots range in size from less than 100-head capacity to many thousands.

Finished Cattle - Fed cattle whose time in the feedlot is completed and are now ready for slaughter.

Forage - Feedstuffs composed primarily of the whole plant, including stems and leaves that are utilized by cattle.

Vertical Integration means that a small number of companies are involved in more than one facet of the supply chain. Large farming companies ("integrators") coordinate company-owned farms, contract farms, and farming-related businesses (feed mills, transportation, etc.) often under a single company banner[46].

[46] (Environmental Defense Fund, 2002)

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