

# A Cluster Analysis of Natural Beef Product Consumers by Shopping Behavior, Importance of Production Attributes, and Demographics

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The increasing complexity of consumer food-purchasing trends is an important factor guiding all agribusiness-marketing efforts (Kinsey and Senauer 1996). Retail sales trends indicate organic meats and poultry is the fastest growing segment of the \$23 billion organic food industry, with a growth of 77.8% from 2002 to 2003 (Organic Trade Association 2004). Sales of organic food through general supermarkets (rather than specialty natural markets) more than doubled from 1993 to 1995—an increase from \$98 million to \$210 million—and accounted for 45% of natural/organic food sales in 2001, up from 31% in 1998. These trends illustrate a growing mainstream appeal of natural foods and motivate the need for consumer profiles of those most likely to purchase natural meats.

This research analyzes consumer segments based on their interest and willingness-to-pay for various natural beef products (varied by production protocols and potential public goods) using cluster analysis. Such an analysis should facilitate producers' ability to effectively develop product concepts, labeling, and promotional strategies targeted at the most receptive consumer segments. The research hypothesis is that there are multiple segments of consumers who are likely to purchase natural beef, and that different segments are motivated by different factors.

Ziehl (2004) found that consumers who have previously purchased natural beef or occasionally buy meat at alternative markets (not supermarkets) are more willing to pay a premium for natural products.

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Consumer's stated importance and interest in attributes such as natural and/or grass-fed production practices, traceability, and tested for Mad Cow Disease also affect their decision to pay a premium for natural, regionally-produced beef. Ziehl's research motivated the need for market analysis methods to define specific consumer-segment groups. Using cluster analysis, a common market analysis technique, one could sort consumers with similarities into groups, enhancing producer and retail initiatives to target product development, promotional messages, and price points.

## Literature Review

There is a growing set of literature on consumer interest in beef with production assurances, such as locally raised designations and other quality claims (Wolf and Thulin 2000; Lusk and Fox 2002). However, only a small share of this existing literature focuses on the existence, size and characteristics of particular consumer segments.

Market-segmentation and consumer-profiling strategies have been used in agribusiness management analysis on issues as diverse as acceptance of genetically-modified foods, green consumerism, food safety, sustainable consumers, and supermarket preferences (Ganiere et al. 2004; Empacher, Gotz, and Schultz 2002; Mangaraj and Senauer 2001). Smith's (1956) seminal work on market segmentation is now a common method for strategically developing the marketing mix for a variety of products.

In a segmentation analysis of supermarket consumers, Mangaraj and Senauer found three distinct market segments: Middle Americans (motivated by price and value), sophisticates (concerned with quality and service), and time-pressed convenience seekers (with young children and little time). Carlson, Kinsey, and Nadau (2002) conducted a similar analysis of where consumers purchased foods (including away from home) and found nine segments that varied significantly by demographics, but that research did not consider food attitudes.

In a study measuring produce food-safety preferences, Baker and Crosbie (1993) found three segments, one concerned with pesticide use, one concerned with the level of damage to produce (the majority of respondents) and one primarily concerned with price and quality. Baker and Burnham (2001) conducted a similar study in 2000 considering genetically modified foods, and again found three segments. The three clusters—brand buyers, safety seekers and price pickers—were motivated by different concerns, attitudes toward risk, and knowledge of GMO's, but had demographics that were very similar to each other, illustrating that demographics are not effective market-segmentation factors.

Empacher, Gotz, and Schultz (2002) found four clusters of consumers: well-organized eco-families (open to civic agriculture), strugglers (price sensitive), rural traditionalists (rural areas with traditional agrarian values) and professionals without children (singles in urban areas with a focus on quality and image).

Following Empacher, Gotz, and Schultz's (2002) focus on social concerns, this study seeks to extend past consumer profiling by considering more of the civic agriculture issues that may motivate natural beef consumers. Sunding (2003) asserts that, in addition to consumers' traditional concerns about nutritional content, purity, and freshness, there are also growing concerns about more publicly oriented characteristics of food, such as "free-range," "organic," and "locally-produced," to name a few. Sunding theorizes that consumers may value a product more because it has a positive externality or a public good, even though it may not necessarily be "more valuable" or "higher quality" than a conventional product. Ziehl (2004) found that concerns about private and social goods do influence consumer willingness-to-pay premiums for natural beef, but her analysis made no clear distinctions as to the socio-demographic profiles of consumers who value different social elements of a beef product.

## **Data and Methods**

The data were collected from a national online survey conducted by National Family Opinion (NFO) in April 2004. A total of 1840 members of NFO's online survey database were solicited to take the survey and a total of 1288 responses were returned, providing a 70% response rate. NFO was directed to

obtain a stratified sample, ( $n \geq 800$ ), representative of the United States Census; and another stratified sample, ( $n \geq 400$ ), representative of the Colorado Census, with thirty percent of the Colorado sample, or  $n \geq 120$ , respondents from the Western Slope of Colorado. This stratification served the applied purposes of the research: assisting Colorado Homestead Ranches. To obtain more robust and generalizable results, the research discussed in this paper focuses on the balanced U.S. sample with a total number of responses at  $N = 872$ .

In general, the survey elicited information on consumer shopping behavior, ratings for different production attributes (hormone and antibiotic use, grass-fed, traceable to source, open range), and attitudes about the perceived benefits (private, public environmental or public health benefits) of different attributes. In addition, a contingent-valuation method was used to elicit WTP for natural, regionally produced beef. The beef products considered were two relatively unprocessed products (ground beef and ribeye steaks) and two value-added products (chili verde and beef stroganoff), based on product lines carried by the natural meat producers who supported this study with a USDA Value-Added grant and our interest in whether different segments were interested in basic or convenience entrée choices. NFO also provided socio-demographic characteristics for each respondent, which they store in their database.

The summary statistics of the socio-demographic information and other responses are shown in Table 1. The sample is comparable to the U.S. Census (U.S. Census 2000) in terms of income, household size, and the percentage of households with children living at home. However, this sample also includes fewer minorities, more females, and the respondents are slightly older than the mean age reported by the U.S. Census. The fact that this sample is predominantly female is consistent with the results of several previous food-based surveys because females are generally the primary grocery shopper in a household (Kinsey and Senauer 1996). The online method for surveying may have led to fewer minority numbers.

Market segmentation is the process of grouping a market into smaller subgroups that are not arbitrarily imposed, but instead, are derived from the recognition that the total market is often made up of submarkets (called segments). Segments are homogeneous, i.e., people in the segment are

**Table 1. Summary Statistics for the Demographic Variables (n = 872).**

Variable	Description (Coding)	Mean	Std. dev.
Age	Years	46.587	13.917
Gender	1 if female, 0 if male	0.741	0.438
Grocery Bill	1 = < \$50 2 = \$50–\$99 3 = \$99–\$149 4 = \$149–\$199 5 = \$200–\$299 6 = \$300–\$399 7 = \$400–\$499	2.489	1.042
Citysize	1 = Rural (< 5,000) 2 = Small town (5,000–24,999) 3 = Small suburban (25,000–99,999) 4 = Large suburban (100,000–249,999) 5 = Metro area (+ 250,000)	3.243	1.311
New England	1 if resident, 0 otherwise	0.063	0.243
Atlantic	1 if resident, 0 otherwise	0.315	0.465
Central	1 if resident, 0 otherwise	0.369	0.483
Pacific	1 if resident, 0 otherwise	0.182	0.386
Mountain	1 if resident, 0 otherwise	0.070	0.255
Income	1 = <\$22,500 2 = \$22,500–\$39,999 3 = \$40,000–\$59,999 4 = \$60,000–\$89,999 5 = +\$90,000	3.175	1.475
Race	1 if Caucasian, 0 otherwise	0.823	0.382
Hispanic	1 if Hispanic, 0 otherwise	0.040	0.196
Household size	Actual number in household; range: 1–7 members	2.537	1.332
Life stage	1 if single, no children, 0 otherwise 1 if couple, no children, 0 otherwise 1 if children < 6 living in household, 0 otherwise 1 if children > 6 living in household, 0 otherwise	0.224 0.383 0.205 0.147	0.417 0.486 0.404 0.354

similar to each other in their attitudes about certain variables. Because of this intra-group similarity, consumers within a certain segment are likely to respond somewhat similarly to a given marketing strategy (Smith 1956).

When enough information is combined to create a clear picture of a typical member of a segment, this is referred to as a "buyer profile." Cluster analysis, a class of statistical techniques commonly used in determining a profile, can be applied to data that exhibits "natural" groupings with relatively homogeneous characteristics but with heterogeneous characteristics relative to objects outside the cluster. Cluster analysis, like factor analysis and multi-dimensional scaling, is an interdependence technique: it makes no distinction between dependent and independent variables. The requirements for successful segmentation are: homogeneity within the segment, heterogeneity between segments, segments that are measurable and identifiable, segments that are accessible and actionable, and segments that are large enough to be profitable. Initial analysis of data would suggest that all of these factors are present in this data (Ziehl 2004). For this analysis, we used a k-means clustering technique embedded in STATA 7.0 (Stata Press 2001).

## Results and Discussion

Table 2 presents the findings of the cluster analysis, with all factors but societal and private concerns included. Descriptions of the non-demographic variables are given, together with the ranges for potential responses. Those variables in each cluster with means significantly different from the average for the full sample are bolded, and superscripts are used to signify the means that were above and below the average. There are five distinct clusters of fairly significant size, and some significant differences in concerns about production attributes, willingness-to-pay values, and rankings of product characteristics.

The first cluster (19% of all respondents), akin to Baker and Burnham's price pickers, are concerned with price above all else, showed a below average willingness-to-pay any premium for natural beef products, and rated their concern for production attributes relatively low. This segment of consumers is more likely to reside in larger urban areas, to be Caucasian and to have young children in the household; unexpectedly, these consumers tend

to have higher-than-average incomes (although not significantly different than the average for the sample). This consumer profile is named the Value Seekers.

The second cluster (27%) is more akin to Empacher, Gotz, and Schultz's (2002) strugglers, as this segment of consumers tends to exhibit greater concern for many of the production attributes (although insignificant), but they are not willing to pay a premium for natural beef products. These consumers are located in smaller cities, and unlike the price pickers, have below-average incomes. This consumer profile is named the Empathetic Value Seekers.

The third cluster (22%) is akin to the brand buyers and urban professionals found in other studies. These consumers exhibit the least price sensitivity, the highest incomes, have fewer children, and are from larger cities. They are interested in some beef production qualities, including open-range grazing, no hormone use, and BSE testing of meat, but they are only willing to pay a premium more commonly (and insignificantly) than the average on basic meat products that are not processed, such as ground beef and steaks. This consumer profile is named the Casual Sophisticate.

The fourth cluster (19%) is also a potential consumer of the natural beef described in the study, but unconcerned about production protocols and more price sensitive, even though they are more commonly willing to pay a premium. These are urban households with higher incomes and with young children at home, but this segment appears to have little interest in production-based beef quality differences. This consumer profile is named the Uninterested Urban Professional.

The final cluster (13%) is the most attractive consumer segment for those marketing natural, regionally-produced beef, with a significantly higher premium they are willing to pay, great interest in many production issues, little price sensitivity, and a revealed propensity to purchase given past natural meat purchases. They are more commonly female and in larger cities, but with fewer children and smaller incomes. This consumer profile is akin to Empacher, Gotz, and Schultz's (2002) well-organized eco-families. This consumer profile is named the Committed Natural Meat Consumer.

As mentioned previously, we were also interested in considering consumer attitudes toward the private and social benefits of the natural beef

products that were described, and we elicited this information with the following question:

*There may be various reasons you prefer the natural beef products previously described above. Please estimate what share or percentage of your premium is based on the following: (Your answers must add up to 100 percent)*

\_\_\_\_\_ *Nutrition, quality, safety (Personal Benefits)*

\_\_\_\_\_ *Support local agriculture, environmental benefits (Societal Benefits)*

\_\_\_\_\_ *Potential antibiotic resistance, unknown hormonal effects (Societal Health Concerns)*

\_\_\_\_\_ *Other, Please Specify: \_\_\_\_\_*

On average, the sample reported that 49% of their premium was based on personal benefits. Societal health concerns accounted for an average of 24%, societal benefits made up 20%, while other beliefs were attributable to 7% of the premium a consumer was willing to pay. The sample of respondents who stated that a share of their premium was based on other potential benefits specified these other benefits as including, but not limited to, cost or price, product appearance, taste of the product, desire not to purchase natural beef, and preference for convenience.

Another cluster analysis was performed that included all of these variables, in addition to those listed in the first analysis. Table 3 presents the results from that analysis. There are still five clusters, but the inclusion of these variables made the distribution across segments far less uniform, with two clusters dominating the sample.

The first cluster (2%) is unconcerned with potential personal benefits relative to other concerns (price), and is generally an urban household with lower income. The second cluster (3%) is similar, and even more unwilling to pay a premium, and represents the most extreme of the value seekers in the sample. The fourth cluster is also small (6%), with similar concerns about price, but with more females, with children in the household, and living in smaller cities. There is little potential in these segments, as they are driven by prices.

The third cluster (35%) is also value-seeking, but these consumers tend to be more motivated by

personal health benefits from natural meat, which explains their higher rank for BSE testing. These consumers appear to be from more-urban, higher-income households with fewer children. Again, there is little market potential to garner premiums for natural beef in this profile unless specific health claims can be made about the natural and/or local production of the beef.

The fifth cluster is large (54%), willing to pay more for natural beef, and motivated by civic agricultural issues in the public domain. Consumers in this segment are equally concerned with the social benefits that natural beef may provide them beyond their personal benefits. Additionally, they have an interest in alternative production practices and are not as price-sensitive as other segments. These consumers have higher incomes, have older children, and live in smaller cities. They are likely a combination of the Committed Natural Meat Consumers, Uninterested Urban Professionals, and Casual Sophisticates from the first analysis. Still, further analysis of how concerns about different ratings of social issues could further differentiate this large cluster is warranted.

## Conclusions

Ziehl's (2004) previous findings suggested that past supermarket objectives to target the "average" consumer led to attrition of some segments. We found that consumer's stated importance and interest in attributes such as natural production practices, grass-fed, traceability, and tested for Mad Cow Disease not only influence their willingness to pay a premium for natural beef, but that there are different segments that are significant in size, identifiable and with distinct interests in the production practices of natural beef.

Further analysis of these consumer segments could also help different meat-market participants (supermarkets, meat shops, and producers who directly market their natural beef products) differentiate themselves by the type of consumer segment they hope to attract with their product offerings and their own market image. This information can inform emerging producer initiatives, helping them to differentiate their beef products through adoption of new production protocols, certification processes, and labeling of such attributes to inform and attract customers.





Table 2. Demographic, Rating, and Characteristic Means for Natural Beef Consumer Profiles (Continued).

Variable (Definition)	Cluster 1 (n = 167)		Cluster 2 (n = 233)		Cluster 3 (n = 193)		Cluster 4 (n = 162)		Cluster 5 (n = 117)		Total (N = 872)	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Attribute Ranking (5 =Most Important)												
Price Rank	4.56	0.77	4.19	1.11	3.44	1.31	4.17	1.21	<b>2.46<sup>a</sup></b>	<b>1.34</b>	3.86	1.33
Natural Rank	2.49	1.12	2.85	1.18	2.88	1.29	2.88	1.13	3.76	1.22	2.92	1.24
Traceability Rank	2.18	1.02	2.21	1.16	2.44	1.22	2.25	1.16	2.33	1.27	2.28	1.16
Grass-fed Rank	2.29	1.02	2.30	1.08	2.24	1.13	2.20	1.04	2.84	1.11	2.34	1.09
BSE Tested Rank	3.49	1.41	3.45	1.46	4.01	1.34	3.50	1.43	3.61	1.50	3.61	1.44
Gender	0.72	0.45	0.78	0.42	0.79	0.41	0.64	0.48	0.76	0.43	0.74	0.44
Citysize	3.28	1.35	2.79	1.36	3.42	1.24	3.44	1.20	3.53	1.20	3.24	1.31
Income	3.21	1.48	3.05	1.50	3.41	1.44	3.19	1.50	2.97	1.40	3.18	1.48
Non-caucasian	0.16	0.37	0.18	0.39	0.19	0.39	0.18	0.38	0.16	0.37	0.18	0.38
No Children	0.59	0.49	0.61	0.49	0.65	0.48	0.57	0.50	0.62	0.49	0.61	0.49
Parent with Young Children	0.23	0.42	0.19	0.39	0.18	0.38	0.25	0.44	0.19	0.39	0.21	0.40
Parent with Older Children	0.13	0.33	0.12	0.33	0.21	0.41	0.14	0.35	0.12	0.33	0.15	0.35

\*Cluster means and standard deviations in bold represent significance at  $\alpha = 0.10$ . <sup>a</sup>Mean of segment is statistically lower than the total mean ( $\alpha = 0.10$ ). <sup>b</sup>Mean of segment is statistically higher than the total mean ( $\alpha = 0.10$ ).

**Table 3. Demographic, Rating and Characteristic Means for Natural Beef Consumer Profiles Including Share of Price Premium Due to Private and Societal Concerns.**

Variable	Cluster 1 (n = 21)		Cluster 2 (n = 24)		Cluster 3 (n = 302)		Cluster 4 (n = 51)		Cluster 5 (n = 474)		Total	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Max WTP Ground Beef	1.95	2.27	<b>0.33<sup>a</sup></b>	<b>0.70</b>	2.70	2.31	2.41	2.11	3.11	2.31	2.82	2.32
Max WTP Ribeye Steak	1.43	1.33	<b>0.29<sup>a</sup></b>	<b>0.69</b>	1.70	1.78	2.02	2.08	2.27	2.00	1.98	1.93
Max WTP Beef Stroganoff	0.86	0.96	<b>0.21<sup>a</sup></b>	<b>0.41</b>	0.97	1.34	1.18	1.58	1.38	1.64	1.18	1.52
Max WTP Chili Verde	0.62	0.67	<b>0.17<sup>a</sup></b>	<b>0.38</b>	0.96	1.38	1.14	1.59	1.37	1.72	1.16	1.58
Personal Benefits	<b>13.57<sup>a</sup></b>	<b>8.39</b>	<b>0.54<sup>a</sup></b>	<b>2.04</b>	<b>79.61<sup>b</sup></b>	<b>13.66</b>	<b>31.47<sup>a</sup></b>	<b>11.43</b>	34.96	14.29	48.76	27.01
Societal Benefits	<b>6.71</b>	<b>5.72</b>	<b>0.08<sup>a</sup></b>	<b>0.28</b>	<b>8.41<sup>a</sup></b>	<b>7.95</b>	17.47	10.99	30.53	20.97	20.69	19.75
Societal Health	<b>8.62</b>	<b>10.35</b>	<b>0.50<sup>a</sup></b>	<b>2.04</b>	<b>11.36<sup>a</sup></b>	<b>9.81</b>	17.63	9.85	34.03	18.59	23.68	19.04
Other	<b>71.10<sup>b</sup></b>	<b>6.34</b>	<b>98.88<sup>b</sup></b>	<b>2.86</b>	<b>0.62<sup>a</sup></b>	<b>2.86</b>	<b>33.43<sup>b</sup></b>	<b>11.81</b>	<b>0.49<sup>a</sup></b>	<b>2.55<sup>a</sup></b>	6.87	20.62
Have Purchased Natural	0.19	0.40	0.08	0.28	0.11	0.31	0.20	0.40	0.27	0.45	0.20	0.40
Open Range	<b>1.86<sup>a</sup></b>	<b>0.85</b>	1.83	1.13	2.68	1.26	2.73	1.30	3.08	1.25	2.86	1.28
No Antibiotics	2.52	1.08	<b>1.88<sup>a</sup></b>	<b>1.36</b>	3.06	1.27	3.20	1.27	3.52	1.25	3.27	1.30
No Hormones	2.57	1.40	<b>1.92<sup>a</sup></b>	<b>1.41</b>	3.19	1.32	3.14	1.25	3.75	1.24	3.44	1.34
Natural	2.43	1.12	2.08	1.28	2.97	1.18	3.08	1.29	3.41	1.24	3.18	1.26
Organic	<b>1.67<sup>a</sup></b>	<b>0.73</b>	1.79	1.22	2.26	1.13	2.33	1.23	2.73	1.26	2.50	1.23
Grass-fed	2.10	1.22	1.83	1.17	2.54	1.16	2.59	1.25	3.11	1.23	2.82	1.25
Traceable	2.71	1.35	2.04	1.33	3.04	1.27	3.14	1.39	3.51	1.22	3.26	1.29
Price Rank	4.48	1.03	4.38	1.35	4.11	1.18	3.88	1.39	3.64	1.38	3.86	1.33
Natural Rank	2.90	1.22	2.54	1.14	2.79	1.15	2.96	1.17	3.01	1.31	2.92	1.24
Traceability Rank	2.38	1.02	2.38	1.17	2.18	1.13	2.10	1.19	2.35	1.19	2.28	1.16
Grass-fed Rank	1.90	0.94	2.38	1.06	2.23	1.03	2.55	1.10	2.40	1.13	2.34	1.09
BSE Tested Rank	3.33	1.39	3.33	1.31	3.68	1.41	3.51	1.47	3.61	1.47	3.61	1.44
Gender	0.57	0.51	0.63	0.49	0.72	0.45	0.76	0.43	0.77	0.42	0.74	0.44
City Size	3.62	1.32	2.83	1.31	3.28	1.26	3.20	1.22	3.23	1.35	3.24	1.31
Income	3.10	1.34	2.88	1.73	3.18	1.48	3.18	1.41	3.19	1.47	3.18	1.48
Non-Caucasian	0.10	0.30	0.04	0.20	0.16	0.37	0.18	0.39	0.20	0.40	0.18	0.38
No Children	0.76	0.44	0.58	0.50	0.56	0.50	0.55	0.50	0.64	0.48	0.61	0.49
Parent w/ Young Children	0.24	0.44	0.25	0.44	0.20	0.40	0.27	0.45	0.20	0.40	0.21	0.40
Parent w/ Older Children	0.19	0.40	0.13	0.34	0.13	0.34	0.16	0.37	0.16	0.36	0.15	0.35

\*Cluster means and standard deviations in bold represent significance at  $\alpha = 0.10$ . <sup>a</sup>Mean of segment is statistically lower than the total mean ( $\alpha = 0.10$ ). <sup>b</sup>Mean of segment is statistically higher than the total mean ( $\alpha = 0.10$ ).



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