# Consumer-Preferred Attributes of a Fresh Ground Beef and Turkey Product: A Conjoint Analysis

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A random sample of 3,400 Louisiana households was surveyed by mail to determine their ratings for a number of product profiles involving a combined fresh ground beef and turkey product. The attributes and levels of the new product included form (fresh, frozen), identity of the packager (retailer, processor), percentage of beef in product (50,70,90), and price of the combined product as a percentage of ground beef (80,90,100). Based on 2,781 observations, the order of importance of the attributes were, in order of declining importance, content, form, price, and packager. Consumer utility was highly sensitive to the content of beef, with a higher content being preferred.

Food products can be offered to consumers in food stores in a number of different ways. Type and size of package, the product's form (such as fresh, frozen, or dried), the product's content, and other product attributes can be altered, which may increase or decrease consumer acceptability of the product from that of a known base product. Marketers of new or modified food products often obtain information on how various forms and presentations of a new or modified product will impact consumer acceptability prior to its introduction into the market. In recent years a number of new or modified beef products have come on the market, spawned by competition from a large number of new non-beef products that have been introduced, especially by the poultry industry.

Regular ground beef (hamburger) has been a popular meat in the United States for many years. However, the product's relatively high fat and cholesterol levels have discouraged many individuals from consuming hamburger, and many health-oriented consumers have switched to lower-fat poultry products or to higher-priced but lower-fat ground round or sirloin. Earlier attempts by a number of meat processors/distributors to lower the fat content of regular ground beef by substituting soybean concentrate for one-fourth of the beef produced a product which failed to win widespread consumer acceptability. An alternative lower-fat fresh ground meat product could consist of both ground beef and ground turkey. The combined fresh ground meat product would offer some of the flavor and taste of ground beef along with the reduced fat and cost of ground turkey.

Consumer acceptability of this composite fresh ground meat product is unknown. Proponents of regular ground beef are likely to question the impact of the inclusion of ground turkey on the composite product's taste, smell, texture, cooking properties, and shelf life. On the other hand, consumers of ground turkey could be less satisfied with the price, fat content, texture, and cooking properties of the combined ground meat product. To the authors' knowledge, no major processor or distributor has ever offered this combined product to the general public.

Mixtures of beef and poultry have been marketed successfully as processed meat products for a number of years. Typical of these products are frankfurters, bologna, and a number of canned products such as stews, chilies, and soups. These products, when compared to 100-percent processed beef products, have offered the consumer lower cost and reduced fat content. The processing procedures used and the accompanying flavor additives have effectively masked many of the characteristics of the individual species in the combined product, creating processed meat products with sensory properties differing from those of the separate species.

What is the approximate impact on the fat content of regular ground beef of substituting some turkey for beef? While the actual fat content in ground beef can be controlled from a *legal* maximum of 30 percent to a minimum of less than 5 percent, regular ground beef, as sold in most super-

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markets today, contains approximately 27 percent fat. Likewise, the fat content of ground turkey differs with the parts of the turkey carcass used to produce the product. The ground turkey sold in supermarkets today is obtained either from the breast or the dark-meat parts of the carcass, often including the skin. The fat content of ground turkey breast is very low but its cost would exceed that of regular ground beef. Therefore, the portions of the turkey carcass assumed to be used for the combined product in this study will be the thigh, leg, and wing, without the accompanying skin. The estimated fat content of this turkey product is approximately 10–15 percent (Wardlaw and Insel 1996). If the combined product were mixed on a 50/50 basis, the new ground meat product would contain 18–20 percent fat, very similar to the fat content of ground chuck.

The cholesterol content of ground turkey is nearly the same as that of ground beef, thus only minor changes in cholesterol content would occur by substituting turkey for regular ground beef. The fatty-acid profiles of ground beef and ground turkey differ, however, with turkey having a higher proportion of polyunsaturated fat to total fat and beef having a larger oleic acid content (Wardlaw and Insel 1996).

The combined ground beef and turkey product could be marketed in a number of different forms, including prepared and/or packaged at several levels of the marketing chain, mixed in a number of different ratios of beef to turkey, priced at various percentages of the price of regular ground beef, packaged in different types and sizes of retail packages, and ground using a number of different sizes or types of grinds. These different forms or variations of the new combined product would likely influence the buyer's preference for the combined product relative to the individual species and to other competitive or complementary ground meat products. Potential sellers of the new combined-fresh-meat product would need to understand consumer reactions to the different ways of offering the product in the retail meat case.

This study was designed to estimate the consumer preferred means of presenting a combined ground beef and ground turkey product in the local supermarket. Conjoint analysis was used to ascertain consumer preferences for the combined product in the various ways in which it could be marketed.

## Objectives

The overall objective of this study is to estimate the best means of presenting a fresh ground beef and turkey product at the retail level based on consumer preferences. The specific sub-objectives are to identify the most important attributes associated with the consumer's preference for alternative ground meat products, determine consumer rankings of the alternative product presentations, and estimate the relative importance of the selected attributes for the combined meat product

## Previous Research

Only limited research has involved the relationship between ground beef and turkey products. The two located studies involved sensory rather than consumer ratings of the two species of ground meats. Holben and Holcomb (2000) used an untrained consumer panel to evaluate taco-type *seasoned* lean ground beef, ground turkey, and ground emu. Based on hedonic scoring of sensory traits and appearance, both beef and turkey were rated superior to emu; however, beef and turkey ratings were essentially equal.

When *fresh* lean ground beef, ground turkey breast, and ground emu were compared using an untrained consumer panel, panel members rated the lean ground beef superior to the ground turkey breast (Miller and Holben 1999). Both were rated superior to ground emu. The differences in familiarity of the panel members to the three meats were offered as an explanation for these different ratings among the three meats.

Stern et al. (1992) evaluated ground beef and ground turkey inoculated with two levels of two forms of microbial flora to determine whether the two meats differed as a media for growth of the flora under frozen storage. At the completion of ten days of storage, the inoculated beef and inoculated turkey were compared with uninoculated controls. No significant differences in spoilage rates (flora growth) were found between the two ground products.

Conjoint analysis has been used for a number of years to evaluate consumer perceptions of new or revised products for which demand data are limited or unknown. A few recent studies involving the use of conjoint analysis in analyzing preferences

for alternative meat products follow.

Gillespie et al. (1998) used conjoint analysis to determine the preferred ratite meat product for the retail and restaurant sectors. Results indicate that the most preferred product was a branded six-ounce ratite filet at the lowest quoted price. Price was the most important attribute among retail managers, while product form was the most important attribute for restaurant managers.

Harrison, Ozayan, and Meyers (1998) used conjoint analysis to investigate the market potential for minced meat products derived from underutilized small crawfish. The products evaluated were a soup/chowder base and a stuffing ingredient normally used by restaurants. The relevant attributes tested were price, form, and flavor. The most important attributes were form and price; however, the interaction effects were not significant. The most promising product was a high-quality fresh soup base or seafood stuffing, priced between 30–50 percent of the cost of fresh crawfish tail meat.

A mail survey was used by Halbrendt, Wirth, and Vaughn (1991) to examine buyer preferences toward farm-raised hybrid striped bass at the wholesale, retail, and restaurant levels. Four attributes were used: size (1, 2, 3 lbs), form (round, gutted, filleted), season (year-round, April–October) and price ($2, $4, $6 /lb). Each of the parameters for fish-attribute variables was significant at the 0.01 level. Low price and round form were the important attributes for the wholesale and retail markets. The filleted form contributed the most to restaurant preference ratings. Size was the second most important attribute for each of the market levels.

Manalo and Gempesaw (1997) surveyed shellfish consumers in the U.S. Northeast, asking them to rank oyster alternatives differing in source, price, and inspection. The most important attributes were, in order of declining importance, inspection, source, and price. As expected, the respondents preferred farm-raised oysters priced at the lowest level and inspected by the Food and Drug Administration, indicating the importance of product safety to the consumers.

## Methods, Data and Survey Procedures

Conjoint analysis is often used to determine the relative importance of product attributes among potential buyers as well as the consumer's most-preferred products. The analysis was developed as a measurement technique from the mathematical psychology and psychometric fields to establish the relative importance of a product's multidimensional attributes (Green and Wind 1975). Conjoint measurement refers to any decompositional method used to estimate the structure of consumers' evaluations of sets of predetermined combinations of product attributes or product profiles (Green and Srinivasan 1978).

Elicitation procedures involved in conjoint analysis allow for the determination of the combination of product attributes that a buyer prefers most, i.e., the combination of attributes that constitutes the most-preferred product. Other possible combinations of product attributes can also be preference-order ranked and the relative importance of the attributes estimated. Conjoint analysis is especially useful when examining new products that have not been or are only beginning to be introduced into a market. Survey respondents must, however, be familiar with the attributes of the product if they are to rank or rate various product profiles.

The attributes included in a conjoint analysis should be those that are the most important to buyers. Although price is not technically a product attribute, it is commonly included as an attribute in conjoint analysis since it is a major factor in determining which set of products to choose.

In conjoint analysis the buyer's utility from consuming a specific product is represented by his or her preference rating. This is the additive sum of the buyer's utility (part worths) for each individual product attribute. In regression analysis, a dummy functional form is often used. Results provide estimates which can be used to calculate the utility of each individual attribute level, where $Y_{jp}$ denotes the level of the pth attributes for the jth product. The preference $S_j$ is

$$(1) \qquad S_j = \sum_{p=1}^{t} f_p\left(Y_{jp}\right)$$

where $f_p$ is the function denoting the part worths for different levels of $Y_{jp}$. In practice, $f_p(Y_{jp})$ is estimated only for selected set levels. An alternative option to regression would be to use ANOVA analysis to determine the part worths. The product profiles selected must be carefully constructed so as to

be orthogonal, a mathematical constraint requiring the part-worth estimates of the attributes to be independent of each other. This allows for the measurement of the effects of changing attribute levels and separation of these effects from one another.

Traditionally, dummy variables are coded by assigning each of the (k-1) dummy variables as 1. The kth dummy variable is assigned a value of 0 and is referred to as the "base" since all comparisons are made to this level. The coefficients of the (k-1) dummy variables represent how much the value of the intercept terms of the (k-1) levels differ from the base level (Gujarati 1995). An alternative to this methodology, which is used in this study, is mean-deviation coding. In this process the base level is coded as -1 instead of 0. This technique is equivalent to traditional coding but has the additional benefit of allowing coefficients for all levels of attributes to be easily obtained. This coding system constrains the levels of each attribute to sum to 0. The base-level coefficient is calculated as the negative sum of the (k-1) attribute dummy coefficients. The intercept becomes the mean preference rating, and the dummy coefficients measure the deviation from the mean rating (Wirth, Halbrendt, and Vaughn 1990). The functional form of this preference is

$$(2) \qquad S_j = \sum_{p=1}^{t} w_p Y_{jp}$$

where $w_p$ are the weights for t attributes and Y represents the attributes. This functional form assumes a linear relationship between attribute utility and attribute value. Price and other qualitative attributes fit this form very well. A two-limit Tobit model was used in this study to obtain estimates.

Preliminary discussions with retailers (managers of supermarkets and specialized meat markets) and with a small focus group of consumers led to the selection of the following four attributes and their respective levels: form (frozen or fresh), identity of processing and packaging level (processor or retailer), proportion of beef (50, 70, or 90 percent), and price of the combined product relative to the price of ground beef (80, 90, or 100 percent). These attributes and associated levels were combined into hypothetical product profiles through use of orthogonal arrays in an Orthogonal Main-Effects Plan, creating a total of 36 distinct product profiles. This total resulted from the inclusion of two attributes with two levels and two attributes with three levels (2 x 2 x 3 x 3 = 36). This study used the Fractional Factorial Design, which allows for the estimation of all single-factor main effects without having to measure all possible attribute interactions (Greene 1997). Operationally, a reduction of profile numbers is desirable to entice consumers to participate in the evaluation process. With Fractional Factorial Design, a subset of nine profiles from the 36 total profiles was selected, which accurately represents the complete set of product profiles. The nine selected product profiles are listed in Table 1.

Consumer ratings of the nine sample product profiles can be obtained using a mail survey of households or through direct personal interviews.

**Table 1. Hypothetical Composite Ground Beef and Turkey Product Profiles Used in the Conjoint Analysis, Louisiana Consumer Survey, 2000.**

| Profile | Form | Packager | Percent beef | Price as % of beef price |
|---|---|---|---|---|
| 1 | Fresh | Retailer | 50 | 80 |
| 2 | Frozen | Processor | 50 | 100 |
| 3 | Fresh | Retailer | 50 | 90 |
| 4 | Frozen | Retailer | 70 | 90 |
| 5 | Fresh | Processor | 70 | 80 |
| 6 | Fresh | Retailer | 70 | 100 |
| 7 | Fresh | Retailer | 90 | 100 |
| 8 | Fresh | Processor | 90 | 90 |
| 9 | Frozen | Retailer | 90 | 80 |

The former method was chosen for this study and a questionnaire was developed, reviewed, and revised (with Dillman 1978 as a guide). The respondents were asked to rate each of nine product profiles on a 0-to-10 scale based on their preferences for purchasing the ten product variations, where 0 represented the least-preferred and 10 the most-preferred product profile. Respondents were allowed to give duplicate ratings and reminded that only 9 of the 36 possible product combinations were being evaluated in the survey. Each of the respondents also was asked to provide selected socioeconomic data about their household.

A random sample of 3,400 Louisiana households was obtained from the Louisiana Department of Public Safety—Motor Vehicle Registration Division. Given that over 86 percent of Louisiana households have at least one motor vehicle, this method of selection was considered to yield a representative sample of the state's population. The questionnaire, an explanatory cover letter, and a postage-paid envelope were mailed to each of these households in April, 2000. A follow-up questionnaire, cover letter, and postage-paid envelope were mailed two weeks later to all households which had not responded previously. As a result of the two mailings, 704 responses were returned, approximately 20.6 percent of the total mail out. This rate of return was considered satisfactory given that the questionnaire was unsolicited, somewhat complex, and sent by bulk mail. When compared to the actual Louisiana population, the respondents were somewhat biased toward the more-affluent, more-educated, older, or white segments of the total population.

## Results

While a total of 704 responses were received, 82 respondents (11.6 % of the total respondents) did not consume beef on a regular basis, so they did not complete the questionnaire. An even larger number of respondents (314) did not respond to the conjoint portion of the survey or their responses indicated that they did not understand the profile-rating process. While the survey for the product-profile responses was considered reader-friendly, the form required the respondent to make rating distinctions among product profiles that involved considerable personal attention and time. The number of returns that could be used for the conjoint analysis (309) was therefore reduced to less than half of the total respondents.

The means, standard deviations and ranges of consumer responses to the nine product profiles are given in Table 2. These means ranged from 3.14 for frozen, processor-packaged, 50% turkey priced at 100% of the price of regular ground beef to 6.83 for fresh, processor-packaged, 90% turkey priced at 90% of the price of regular ground beef.

Given 309 useful responses and nine product profiles, there were 2,781 total observations used in the conjoint analysis (Table 3). Three of the six variables used in the analysis were significant at

**Table 2. Means, Standard Deviations, and Ranges of Consumer Responses for the Nine Product Profiles, Louisiana Consumer Survey, 2000.**

| Profile[a] | Mean | Standard deviation | Range |
|---|---|---|---|
| 1. Fresh, Retailer, 50 and 80 | 5.66 | 2.919 | 0-10 |
| 2. Frozen, Processor, 50 and 100 | 3.14 | 2.753 | 0-10 |
| 3. Fresh, Retailer, 50 and 90 | 4.93 | 2.573 | 0-10 |
| 4. Frozen, Retailer, 70 and 90 | 4.73 | 2.308 | 0-10 |
| 5. Fresh, Processor, 70 and 80 | 6.40 | 2.311 | 0-10 |
| 6. Fresh, Retailer, 70 and 100 | 5.38 | 2.656 | 0-10 |
| 7. Fresh, Retailer, 90 and 100 | 6.19 | 2.758 | 0-10 |
| 8. Fresh, Processor, 90 and 90 | 6.83 | 2.615 | 0-10 |
| 9. Frozen, Retailer, 90 and 80 | 5.91 | 2.800 | 0-10 |

[a] See Table 1 for a description of profiles.

the one-percent level. Since the base values chosen were frozen, processor, 50% beef, and priced at 100% of the price of ground beef, each variable was expected to have a positive sign. Each was positive. Each of the variable coefficients represents the change in probability associated with a one-unit increase in an explanatory variable, controlling for the effects of the other variables in the equation. The intercept is the expected value of the probability of occurrence if all of the explanatory variables are set equal to zero. The marginal coefficients given in Table 3 represent the increase in the respondents ratings as a result of moving from the base level to the specified levels in the equation. For example, the marginal coefficient associated with Content 70 indicates the impact on the respondent's rating of the product profile of increasing the product's beef content from 50% to 70% (by 0.315).

The least-preferred product profile contained the four base-attribute levels: frozen form, processor packaged, 50% beef content, and priced at 100 percent of the price of regular ground beef. The most-preferred product profile was fresh form, retailer packaged, 90% beef content and priced at 70 % of the price of regular ground beef.

The relative importance of the product attributes (i.e., part worths) are presented in Table 4. Product form claimed 31.8 percent, product packager held less than one percent, percentage of mixed product that is beef took 40.5 percent, and product price as a percentage of the price of regular ground beef had 26.9 percent. The most important factors explaining consumer utility were the amount of beef in the combined product and the product being fresh. The price of the combined product relative to ground beef was less important and identity of the packager was of no importance.

## Conclusions and Implications

The study was undertaken to determine from consumers their preferred combination of ground beef and ground turkey in a new blended ground product and how this new product should be presented in the retail store. Results of this study provide guidance to sellers in choosing the characteristics of a mixed ground beef and turkey product that would lead to successful presentation in the meat counter. The four product attributes selected offered consumers broad differences in product which they

**Table 3. Estimated Tobit Coefficients, Standard Errors, Probabilities, and Marginal Effects, Conjoint Analysis, Louisiana Consumer Survey, 2000.**

| Variable | Coefficient | Std. error | Probability | Marginal effects |
|---|---|---|---|---|
| Constant | 5.2396* | 0.0645 | 0.0000 | 4.7363 |
| Form (fresh) | 0.7621* | 0.0610 | 0.0000 | 0.6889 |
| Packager (retailer) | 0.0197 | 0.0611 | 0.7476 | 0.0178 |
| Content 70 | 0.0349 | 0.0811 | 0.6667 | 0.0315 |
| Content 90 | 0.9516* | 0.0813 | 0.0000 | 0.8602 |
| Price 80 | 0.6168* | 0.0812 | 0.0000 | 0.5575 |
| Price 90 | 0.0549 | 0.0811 | 0.4982 | 0.0497 |

Log-Likelihood Function = -6498.859.

**Table 4. Part Worths of Attributes in Preference Ratings, Louisiana Consumer Survey, 2000.**

| Attributes | Percentage |
|---|---|
| Form | 31.8 |
| Packager | 0.8 |
| Percentage of product that is beef | 40.5 |
| Product price as percentage of price of ground beef | 26.9 |

could use in selecting the particular product profiles that would maximize their utility.

Three of the variables used in the conjoint analysis were significant, indicating that they were important in assessing the consumer's preferences with respect to the combined meat product: form, content, and price. The most important attribute was the percentage of beef in the final product. Increasing the proportion of beef in the final product greatly increased the consumer's utility obtained from the product. These consumer results show the difficulty sellers of this new product will encounter in using higher proportions of turkey in the combined product to reduce its overall fat content and price. Consumers appear to want a high percentage of beef in the combined product because of the desirable qualities it adds to the fresh ground product.

As expected, consumers preferred a fresh combined product relative to a frozen product and a lower product price relative to a higher price. Sales of ground beef or ground turkey in frozen form are largely limited to sale of preformed patties or in chub packs which can be cut into patties prior to defrosting.

The respondents made almost no distinction in their preferences among product profiles between packaging of the product at the processor or retailer levels. This was unexpected, as consumers were expected to prefer see-through or transparent packaging. Transparent or see-through packaging is more likely if the local retail outlet grinds and packages the product.

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