AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Functional Foods in the Marketplace:

Willingness to Pay for Apples Enriched with Antioxidants

Armenak Markosyan, Ph.D. Student, Graduate Research Assistant, School of Economic Science and International Marketing Program for Agricultural Commodities and Trade (IMPACT) Center, Washington State University, Pullman, WA 99164-6210; fax: 509-335-3958; email: armenak@mail.wsu.edu

Dr. Thomas I. Wahl, Professor and Director, IMPACT Center, Washington State University, Pullman, WA 99164-6210

Dr. Jill J. McCluskey, Associate Professor and Food Policy Fellow, School of Economic Sciences and IMPACT Center, Washington State University, Pullman, WA 99164-6210

Selected paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Portland, OR, July 29-August 1, 2007

Copyright 2007 by Armenak Markosyan, Thomas I. Wahl, and Jill J. McCluskey. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

Abstract:

The attention on so-called "functional foods" has been growing as consumers become more concerned with diet and nutrition. This article aims to measure consumers' response to apples with "naturally enriched antioxidant coatings." Surveys were conducted in grocery stores in Seattle, Washington and Spokane, Washington. The results suggest that consumers have a somewhat positive attitude towards functional foods in general and with apples enriched with antioxidants in particular. A contingent valuation technique was used to assess factors affecting consumers' willingness to pay for the apples with antioxidant coatings. Consumers in the Spokane grocery stores are more likely to pay a premium for the new type of apples than consumers in Seattle. Consumers who look for a wide variety of product in choosing where to shop for food are more likely to pay a premium for apples enriched with antioxidants. Also, it is estimated that consumers, on average, are willing to pay from 4% to 8% premium for these apples.

Keywords: functional food, willingness to pay, antioxidants

"How would you feel about apples with wax coatings enriched with antioxidants?" It was a question that had many consumers in the grocery stores raised an eyebrow in surprise when they read it in the questionnaire. *"Stop playing with natural food!"* – responded some. *"Sounds like a great idea!"* – responded others.

Background and Motivation

The attention directed towards so-called "functional foods" has been intensifying as consumers become increasingly concerned with diet and nutrition. Functional food is broadly defined as "any food or food components that provide health benefit beyond basic nutrition" (The Institute of Food Technologies). Food processors are increasingly using functional food claims as a marketing tool. Products such as high fiber breakfast cereals, orange juice with added calcium, and vitamin-fortified milk are now widely available in grocery stores.

The functional food industry has been growing rapidly over the last decade. According to *Nutritional Business Journal,* sales of functional foods in the U.S. grew from $11.3 billion in 1995 to $18.5 billion in 2001. This accounts for 3.7% of the total food sales. The sales are projected to reach $49 billion by 2010.

Despite the rapid growth, functional foods are not specifically defined under American law. Japan is the first country that has a legal definition for functional foods, and it has one of the most advanced markets in the world for such products (CSPIR, 1999). In the U.S., regulations on functional foods fall under the authority of the Food and Drug Administration (FDA) which regulates them under the same framework as conventional foods. The FDA has neither a definition nor a specific regulatory rubric for foods marketed as functional foods.

Food processors continuously try to apply health claims in marketing functional foods. This puts pressure on policymakers to develop appropriate tools to protect consumers from false and misleading health claims. Functional foods as credence goods face significant challenges in policy development arising from information asymmetry. Policies developed for functional foods to date are different in different countries. Issues considered in developing policies include factors influencing consumer preferences for these products and uncertainties in the markets for them. (Veeman, 2002) Therefore, it is critically important to shed more light on how consumers' perceive functional foods and whether there will be more demand seen for these products in the near future.

When talking about functional foods, most think of processed food products. However, soon we may be able to see fresh fruits and vegetables marketed as functional foods. An example is a new product, which is a coating to be applied on apples (and potentially other fruits). The coating is enhanced with specific flavonoids and stilbenes (antioxidants), which are believed to enhance the fruit's health benefits. This article focuses on one such product, apples "naturally enriched" with antioxidants. The objective is to measure consumers' response to apples with naturally enriched coatings. Specifically, we estimate confidence intervals for the possible premium consumers will pay for this product and analyze the factors that affect willingness to pay (WTP).

In the last few years there has been a great increase in research and thus advertisement of the beneficial effects of antioxidants. Antioxidants are substances that may protect cells from the damage caused by unstable molecules known as free radicals. Free radical damage is believed lead to cancer. Antioxidants interact with and stabilize free radicals and may prevent some of the damage free radicals otherwise might cause. Examples of antioxidants include beta-carotene, lycopene, vitamins C, E, and A, and

other substances. (National Cancer Institute, 2004) These compounds, often called phytonutrients, are present in most fruits and vegetables naturally. The consumption of pills providing these compounds has greatly increased in recent years. Indeed, this would seem to indicate that consumers are much more aware of the health benefits. There is also information indicating that maximum benefits are achieved when these phytonutrients are consumed in natural products (e.g. fruits, wine) rather than in pills. Significant evidence have been found that fruits and vegetables in combination have synergistic effects on antioxidant activities leading to greater reduction in risk of chronic disease, specifically for cancer and heart disease. (International Food Information Council, 2006)

Literature

Functional foods have captured some researchers' attention in the last few years. However, existing literature on functional foods is still scarce. Hu, et al. (2006) study consumers' perception of and willingness to pay for credence attributes associated with canola oil in Japan. The results indicate that consumers are willing to pay more for "organic" or "functional" attributes, but are willing to pay less for genetically modified (GM) attributes.

Maynard and Franklin (2003) employed a sensory evaluation, willingness-to-pay survey, and feasibility analysis to assess the commercial potential of "cancer-fighting" dairy products. Their results suggest that profit potential exists for producers serving niche markets via small-scale processing ventures. Households with children and health-conscious consumers were, it appeared, most willing to pay premiums for "cancer-fighting" dairy products. The authors argue that consumer demand and the legality of health claims hinge on pending medical research outcomes.

West, et al. (2002) tried to assess consumers' valuation of functional foods in Canada. The results from a Canada-wide survey suggest that Canadian consumers in general have positive attitudes towards functional foods and may be willing to pay a premium for them. However, they indicate that a large proportion of respondents negatively perceived GM and organic foods relative to conventional foods, after controlling for price and health properties.

In the U.S., the International Food Information Council (IFIC) has been tracking consumer perceptions of functional foods since 1996. In 2000 IFIC conducted a phone survey of 1000 individuals representing ethnic diversity and gender ratio of the U.S. population. They indicate that people are incorporating more foods with functional benefits into their diet. Several important findings resulted from the survey. Consumers are aware of and convinced of the effects of nutrition and diet on health. Top health concerns among the respondents were heart health (45%) and cancer (31%). There may exist a trend toward adding healthful ingredients in the diet rather than avoiding harmful ones. The report mentions the several demographic factors – including age, gender, ethnicity, and marital status – contribute to choices about functional foods. The majority (82%) of the respondents were able to identify a functional food and its associated health benefit.

Survey

Our research is based on a face-to-face survey that was conducted in September and October of 2006 at two grocery stores in Seattle, Washington and one grocery store in Spokane, Washington. All the stores had a variety of fresh produce including both

conventional and organic items. A total of 730 questionnaires were completed and used in the analysis.

A questionnaire was developed to elicit consumer's response to "naturally enriched apple coatings." The first section of the questionnaire included questions about consumers' awareness of antioxidants, attitudes toward nutritionally enriched food and toward apples naturally enriched with antioxidants, factors influencing their choice of apples and choice of places to shop. Dichotomous choice contingent valuation questions (with follow-up) were included as well to elicit consumers' WTP for apples with naturally enriched coatings. The second section of the questionnaire included questions about the demographic characteristics of the respondents, such as age, income, education, and presence of children in the household.

The questionnaire was randomly presented to the respondents in two different formats. One type of the questionnaire contained the following statement informing about potential health benefits of antioxidants:

"*Fruit enhanced with natural antioxidants will improve its health benefits by helping to prevent cancer, cardiovascular and other diseases.*"

The other type of questionnaires contained no such information. This allows us to test the effect of positive information on consumers' attitudes toward naturally enriched apples and WTP for the product. In addition, the respondents were randomly presented with four different price premiums (discounts) associated with naturally enriched apples: 5%, 10%, 20%, and 30%. Randomly presenting multiple bids (i.e. premiums and discounts) improves statistical efficiency of our analysis.

Demographics of the sample are shown in table 1. The average age of the respondents was 45 years old. Sixty-one percent of the respondents were female. The

average size of household was 3 members and 35% of the respondents had children under 18 in the household. Most of the respondents claimed to have higher education degrees. Thirty one percent of the respondents had bachelor's degree, 27% had advanced or graduate degree, 28% claimed to have attended some college, 12% said they had a high school diploma, and only 2% said they have had some school. Mean and median annual household income appeared to be within $40,000 and $79,999. Also, the majority of the respondents were employed at the time of the survey. Sixty-two percent and 16% said they were formally employed and self employed respectively, 11% claimed to be retired, 5% were students, 4% - housewives, and 3% claimed to be unemployed.

Survey responses suggest that consumers in general are aware of antioxidants and their health benefits. One question asked the respondents to express their feelings about nutritionally enriched food (e.g. orange juice with added calcium, high fiber cereal). (See Q.3 in the Appendix) The respondents were given 6 choices: very positive, somewhat positive, neutral, somewhat negative, very negative, and don't know. Overall, the feeling tended to be positive. Twenty-five percent and 38% of the respondents said they felt very positive or somewhat positive respectively. Only 2% of the consumers surveyed felt very negative about nutritionally enriched food. These responses are also shown in table 2.

If respondents expressed that they were somewhat negative or very negative, they were asked to explain why they felt negatively. The most popular explanations were:

"it is unnatural," "it is better to get necessary nutrients naturally," "additives are not good for health," and "organic food is more preferable."

Another question asked the respondents to rate their feelings about apples "naturally wax coated with antioxidants." (See Q.8 in the Appendix) Here the percentage of positive responses was significantly lower and negative responses significantly higher. Fifteen percent and 27% of the overall customers surveyed said they had very positive and somewhat positive feelings respectively. Nineteen percent felt somewhat negative and only 6% felt very negative about apples enriched with antioxidants. Finally, 28% were neutral and 5% said they didn't know. These responses are shown in Table 2 as well.

Again, customers who felt negatively about apples enriched with antioxidants were asked to explain why they felt that way. Several reasons were provided by the respondents. The most popular explanations were:

"don't want to eat wax," "it is unnatural," "additives to fruit are not necessary," "washing apples removes the wax," "prefer food with no additives," "don't have enough information," "it is better to get nutrients naturally," "don't know," "prefer organic," "it changes the taste."

Several questions were asked about the consumers' shopping behavior. (See table 3) Eighty five percent of the respondents were primary shoppers in their household. The majority, 58%, of the respondents claimed to shop 2 to 5 times a week. Twenty eight percent said they shopped once a week, 8% said they shopped daily, 5% and 1% said they shopped once every 2 weeks and once a month respectively. Another question asked the respondents what is the most important factor to them in their choice of where to shop for food. The options given were price, quality, variety, location, and other. Quality was the most popular choice of the respondents with 65%. Price, variety, and location appeared to be roughly equally important to the consumers with 16%, 12%, 12% and 17% respectively. Four percent of the respondents listed other factors, out of which 98%

percent said availability of organic food was the most important factor influencing their choice of grocery stores. A question was asked to understand the relevant importance of high nutrition versus lower prices. The respondents were asked to evaluate this tradeoff on a Likert scale of 1 to 10, where 1 means high nutrient content is the most important and 10 means buying food at the lowest prices is the most important. The average response appeared at 5.4.

Contingent Valuation

Contingent Valuation (CV) has been widely used to elicit individuals' WTP for product quality and environmental benefits (e.g. McCluskey et. al., 2003; Donovan and Hesseln, 2004; Loureiro et. al., 2006). There are two main approaches to the CV Method: single-bounded and double-bounded. The single-bounded method is a conventional method of analyzing WTP. The respondent is asked only one dichotomous choice question, i.e. offered a single amount for a particular good to which the respondent should answer "yes" or "no". On the other hand, double-bounded method offers a series of bids: the respondent is asked to accept or reject some initial amount then he/she is offered a premium (discount) if "yes" ("no") is chosen. (Hanneman, Loomis, Kanninen, 1991). Hanneman, Loomis, and Kanninen (1991) show that double-bounded method is an improvement over single-bounded in terms of statistical efficiency. The CV question in our survey was stated in the following way:

"The average price of apples is $0.99/lb. If you were going to purchase apples today, and if apples with wax coatings which are naturally enriched with antioxidants were offered at the same price than typical wax coated apples, would you purchase them?" (Yes/No)

If the respondent answered "yes" to this question, then they were asked whether they would purchase the new type of apples if they were offered at a higher price (i.e.

premium). On the other hand, if the respondent answered "no" to the initial question, they were asked whether they would purchase the new type of apples if they were offered at a lower price (i.e. discount). Four sets of premiums/discounts where randomly presented to the consumers (5%, 10%, 20%, 30%).

Empirical Model

The empirical model for our research is derived from a random utility model. An individuals' utility is a function of a good and income. Individuals' utility function is broken into an observable part and a random part. The observed part of the utility is assumed to have a linear functional form and can be presented as

(1) $U_0(0,Y;X) = V_0(0,Y;X) + \varepsilon_0 = \alpha_0 + \rho Y + Z_0'X + \varepsilon_0$

$U_1(1,Y\text{-}P;X) = V_1(1,Y\text{-}P;X) + \varepsilon_1 = \alpha_1 + \rho(Y - P) + Z_1'X + \varepsilon_1$

where U_0 and U_1 are the utility functions when an individual buys regular food (indicated by 0) and functional food (indicated by 1) respectively, Y represents income, X represents individuals' characteristics that affect the decision process, P is the price of the extra price of the functional food ρ is the marginal utility of income, ε_0 and ε_1 are i.i.d. random errors with mean 0.

An individual will prefer the functional food over the conventional food if the utility from the functional food is greater than the utility received from the conventional food, i.e.

(2) $U_0(0,Y;X) \geq U_1(1,Y\text{-}P;X)$

or

$\alpha_1 + \rho(Y - P) + Z_1'X + \varepsilon_1 \geq \alpha_0 + \rho Y + Z_0'X + \varepsilon_0$

After some simple operations Equation (2) can be written as

(3) $W \equiv \alpha + \rho P + Z'X \geq \varepsilon$

where $\alpha = (\alpha_1 - \alpha_0)$, $Z = (Z_1 - Z_0)$, and $\varepsilon = (\varepsilon_0 - \varepsilon_1)$ that is assumed to have a logistic distribution with mean 0 and variance $\sigma^2 = (\pi/\sqrt{3})^2$. Thus, the probability that an individual will chose the functional food over the conventional food can be characterized as

(4) $P(\text{Buy Functional Food}) = P(\alpha + \rho P + Z'X \geq \varepsilon) = F(\alpha + \rho P + Z'X)$

where F(•) is a logistic cumulative distribution function.

Our survey respondents can be divided into 4 groups: those who answered "yes" to both CV questions, those who answered "no" to both CV questions, those who answered "yes" to the first CV question (with the initial price) and "no" to the second question (with the premium price), and those who answered "no" to the first CV question and "yes" to the second question (with the discount price). Following Equation (4) probabilities of respondents being in each group can be presented as follows.

(5) $P(\text{Yes, Yes}) = P(W^0 \geq \varepsilon \cap W^U \geq \varepsilon) = P(W^0 \geq \varepsilon \mid W^U \geq \varepsilon)\, P(W^U \geq \varepsilon)$

$= P(W^U \geq \varepsilon) = F(\alpha + \rho P^U + Z'X)$

$P(\text{No, No}) = P(W^0 \leq \varepsilon \cap W^L \leq \varepsilon) = P(W^0 \leq \varepsilon \mid W^L \leq \varepsilon)\, P(W^L \leq \varepsilon)$

$= P(W^L \leq \varepsilon) = 1 - F(\alpha + \rho P^L + Z'X)$

$P[(\text{Yes, No}) \text{ or } (\text{No, Yes})] = P[(W^0 \geq \varepsilon \cap W^U \leq \varepsilon) \cup (W^0 \leq \varepsilon \cap W^L \geq \varepsilon)]$

$= P(W^U \leq \varepsilon \leq W^0) + P(W^0 \leq \varepsilon \leq W^L) = F(W^U) - F(W^0) - F(W^0) - F(W^L)$

$= F(\alpha + \rho P^U + Z'X) - F(\alpha + \rho P^L + Z'X)$

where P^0, P^L, and P^U are initial, lower, and upper prices respectively. Utility is non-increasing in prices and $P^L < P^0 < P^U$, therefore $W^U < W^0 < W^L$. Consequently, in Equation (5) $P(W^0 \geq \varepsilon \mid W^U \geq \varepsilon) = P(W^0 \leq \varepsilon \mid W^L \leq \varepsilon) = 1$.

The log-likelihood function, therefore, is presented in Equation (6). The variables d_i^{yy}, $d_i^{yn/ny}$, d_i^{nn} are indicators for each group. The solution to the first order conditions gives us maximum likelihood estimates for our parameters.

$$\text{(6)} \quad \begin{aligned} \ln L = \sum_{i=1}^{n} \{ & d_i^{yy} \ln F(\alpha + \rho P_i^P + Z' X_i) + d_i^{yn/ny} \ln(F(\alpha + \rho P_i^P + Z' X_i) - F(\alpha + \rho P_i^L + Z' X_i)) \\ & + d_i^{nn} \ln(1 - F(\alpha + \rho P_i^L + Z' X_i)\} \end{aligned}$$

Data

Table 1 gives a brief description of the variables used in the estimated model. The variable representing Seattle is included to test whether there is a significant difference in consumers' WTP between Seattle grocery stores and Spokane grocery store. "Info" is a variable which represents the presence of a positive statement about antioxidants in the questionnaire. This will allow us to test whether the inclusion of this particular positive statement has a significant effect on consumers' WTP. Also, we can test whether male shoppers will pay more (or less) for apples enriched with antioxidants by including "Gender" variable in the model. The "Education" variable is included to test the effect of education on shoppers' WTP, in particular whether having a college degree (or above) affects the WTP. Further, we can test whether higher income people would possibly pay more for the new type of apples by including "Income" variable. Age may also be a significant factor in consumers' WTP. In addition, an interaction variable between age and education is included to test whether older educated people have significantly different WTP.

The next set of variables capture individuals' perceptions and preferences and their effect on individuals' WTP for apples naturally enriched with antioxidants. One of the questions in the questionnaire asked to rate the importance of higher nutrition in the

food against the importance of low price. The response to this question is included as a variable in our model. Two variables have been created from the response to question 4, which asked to express feelings about nutritionally enriched food. One variable captures positive feelings, and the other – negative feelings. Three variables have been created from responses to the question which asked about feelings with regards to apples enriched with antioxidants. The variables separately capture positive feelings, neutral feelings, and very negative feelings.

Finally, we can to test whether various factors that affect consumers' choice of where to shop also affects their WTP for apples enriched with antioxidants. In order to do that, four variables are introduced in the model. These variables capture each factor affecting the choice of where to shop for food: price, quality, variety, and location.

Estimation Results

The model in (2) has been estimated using MAXLIK module in GAUSS 7.0. To assess the significance of the model and the goodness of fit we performed a Likelihood Ration test (LR) and estimate an R-square equivalent measure designed specifically for double-bounded logit models. The LR test statistic is $LR = -2[\ln L_R - \ln L_U]$, where L_R represents the value of the restricted log-likelihood function where all parameters but that of the bid and constant are set to zero; L_U represents the value of the unrestricted log-likelihood function using all the parameters in the model. LR-statistic is quite large (268.43), so we reject the null hypothesis that all the parameters in the model jointly equal to zero.

Further, we employ the so-called "sequential classification procedure" (SCP) to estimate a model fit measure equivalent to R^2. Kanninen and Khawaja (1995) show that the conventional R^2 measures, such as McFadden Pseudo R^2 and Pearson Chi-Square are

not appropriate for double-bounded logit models. They suggest using the SCP that explicitly takes the sequential, conditional nature of the double-bounded model into account.

Table 5 provides the maximum likelihood parameter estimates for the model. The offered bid is negatively related to the WTP, i.e. as the hypothetical price increases in the questionnaire the probability that a consumer would like to purchase the product goes down. The variable representing that survey was conducted in Seattle stores appeared to be statistically significant with a negative coefficient. Thus, there is evidence that consumers in Seattle grocery stores are less likely to pay premium for apples enriched with antioxidants than Spokane shoppers. Education appeared to have positive statistically significant effect on consumers' WTP. Therefore, there is evidence that educated consumers are more likely to pay premium for the new type of apples. In addition, the interaction variable between age and education turned out to have a significant negative effect on WTP. Thus, the data suggests that older and educated people are less likely to pay premium.

Consumers' responses to the question that provides a tradeoff between high nutritious food and low price food indicated a significant negative effect on their WTP for apples with antioxidants. Therefore, consumers who prefer low price food to higher nutritious food are less likely to pay premium for enriched apples. Both variables representing consumers' feelings about nutritionally enriched food appeared to be statistically significant. It has been found that consumers who feel positively about nutritionally enriched food are more likely to pay a premium for apples enriched with antioxidants. In contrary, those who have negative feelings are less likely to pay a premium.

Variables representing consumers general feelings about apples enriched with antioxidants also appeared to be statistically significant in the model. Those who feel positively and those who are neutral about apples enriched with antioxidants are more likely to pay a premium for them. On the other hand, consumers who feel very negatively about apples enriched with antioxidants are less likely to pay premium for them.

Furthermore, the estimation results suggest that consumers who find price as the most important factor in choosing where to shop for food are less likely to pay a premium for apples enriched with antioxidants. On the other hand, consumers who find variety as the most important factor in choosing where to shop for food are more likely to pay a premium for apples enriched with antioxidants.

Mean WTP

Following procedures described by Hanemann (1984 and 1991) the mean WTP for apples enriched with antioxidants was estimated as

$$(7) \qquad WTP = -\frac{1}{\hat{\rho}}(\hat{\alpha} + \hat{Z}'\overline{X})$$

The results are shown in table 6. We use the initial bid of $0.99 as a benchmark for estimating the mean WTP. The mean WTP was estimated for the whole sample and for the Seattle and Spokane grocery stores separately. Mean WTP for the whole sample was found to be $1.059/lb with ($1.036, $1.081) as a 95% confidence interval. In other words, consumers on average are willing to pay roughly a 6% premium for apples enriched with antioxidants. Also, it can be said with 95% confidence that the mean WTP for apples enriched with antioxidants falls between a 3.6% to 8.1% interval.

The estimated mean WTP for the consumers in Seattle grocery stores is $1.037/lb with ($1.012, $1.063) as a 95% confidence interval, or roughly a 4% premium with (1.2%, 6.3%) as a 95% confidence interval. The mean WTP in the Spokane grocery store was estimated to be $1.123 with ($1.076, $1.17) as a 95% confidence interval, or a 12.3% premium with (7.6%, 17.0%) as a 95% confidence interval.

Conclusions

The purpose of the article was to examine consumers' attitudes towards functional foods and their WTP for apples enriched with antioxidants. Three rounds of face-to-face surveys have been conducted in the State of Washington and a total of 730 responses have been received. The results suggest that overall consumers have positive attitude towards functional foods.

Regarding apples that are enriched with antioxidants, fewer of the respondents expressed positive feelings than to functional foods in general. We suggest that this is due to the product being a fresh produce as opposed to processed food products such as orange juice or cereal. The attitudes, nevertheless, were positive in general and the market does not seem to reject the idea of this new product.

The results of the double-bounded model estimation suggest that educated consumers are more likely to pay a premium for the product**.** Consumers who think variety is the most important factor in choosing where to shop for food are more likely to pay a premium as well. On average consumers are willing to pay up to 6% premium for apples enriched with antioxidants. The 95% confidence interval for this estimate was found to be 3.6% - 8.1%. Also, there is evidence that consumers in regular Spokane supermarket are more likely to pay a premium for the product then consumers in

supermarkets in Seattle. The estimated mean WTP in Spokane supermarket was between 7.6% and 17% while the estimated mean WTP in Seattle supermarkets was between 1.2% and 6.3%. In our opinion, the main reason for this can be that since Seattle is a large growing market for organic produce, consumers are more skeptical about functional foods which involve various additives.

The major reasons some consumers reject the idea of apples enriched with antioxidants are their perceptions that wax in general is not pleasant for consumption, additives in food are unnecessary and sometime unhealthy, there is not enough information about the product and its safety, organic food is better and is more healthy, and additives in fruit are unnatural.

The statement providing positive information about antioxidants included in some questionnaires did not appear to have significant effect on consumers' WTP**.** In our opinion this was due to the fact that health benefits of antioxidants have recently been subject to a considerable publicity. Also, the survey respondents appeared to be quite knowledgeable about antioxidants.

Concluding, we can say that there is a high possibility that more functional foods will be seen in the market in the near future. Therefore, more clearly defined policies need to be developed for functional foods to avoid false health claims in marketing them. In regards to apples enriched with antioxidants, a careful marketing strategy can lead to this product being marketed in the near future.

Table 1 Demographic characteristics of the respondents

Number of Respondents	730
Average age (years)	45
Average household size (number of members)	3
	Proportion of the respondents
Gender	
Male	39%
Female	61%
Children under 18 present in the household	35%
Education (highest level)	
Some school	2%
High School diploma	12%
Some college	28%
Bachelor's degree	31%
Advanced degree or graduate degree	27%
Household Income (in 2005)	
Less than $39,999	25%
$40,000 - $79,999	37%
$80,000 - $109,000	20%
$110,000 - $149,000	11%
$150,000 - $199,999	6%
Greater than $200,000	2%
Employment status	
Formally employed	62%
Self employed	16%
Unemployed	3%
Retired	11%
Student	5%
Housewife	4%

Table 2 Attitudinal questions about functional foods

How would you feel about …	*Proportion of the respondents*
Nutritionally enriched food	
Very positive	25%
Somewhat positive	38%
Neutral	25%
Somewhat negative	8%
Very negative	2%
Don't know	2%
Apples with wax coatings which are enriched with antioxidants	
Very positive	15%
Somewhat positive	27%
Neutral	28%
Somewhat negative	19%
Very negative	6%
Don't know	5%

Table 3 Shopping behavior of the respondents

	Proportion of the respondents
Primary shopper in the household	85%
How often do you shop for food?	
Daily	8%
Between 2-5 times per week	58%
Once a week	28%
Once every two weeks	5%
Once a month	1%
Most important factor in choosing where to shop for food	
Price	16%
Quality	65%
Variety	12%
Location	17%
Other (organic)	4%
Importance of higher nutrient content in food compared to buying food at the lowest price (1 = higher nutrient foods are the most important … 10 = lower price is the most important)	5.4

Table 4 Description of explanatory variables

Variable	Description
Seattle	1=Seattle, 0=Spokane
Info	1=Presence of positive statement, 0=absence of positive statement
Gender	1=male, 0=female
Education	1=Bachelors' degree and above, 0=otherwise
Income	Household income, 1 if income is more than or equal to $80,000
Age	Reported age
Age*Education	Interaction variable between age and education
X_1	Tradeoff between higher nutrition and low price food, continuous scale of 1 to 10 (See Q.3 in the Appendix)
X_2	Feelings about nutritionally enriched food, 1 if response is "very positive" or "somewhat positive" (See Q.4 in the Appendix)
X_3	Feelings about nutritionally enriched food, 1 if response is "somewhat negative" or "very negative" (See Q.4 in the Appendix)
X_4	Feelings about apples nutritionally enriched with antioxidants, 1 if response is "very positive" or "somewhat positive" (See Q.8 in the Appendix)
X_5	Feelings about apples nutritionally enriched with antioxidants, 1 if response is "neutral" (See Q.8 in the Appendix)
X_6	Feelings about apples nutritionally enriched with antioxidants, 1 if response is "very negative" (See Q.8 in the Appendix)
X_7	Most important factor in choosing where to shop, 1=price (See Q.13 in the Appendix)
X_8	Most important factor in choosing where to shop, 1=quality (See Q.13 in the Appendix)
X_9	Most important factor in choosing where to shop, 1=variety (See Q.13 in the Appendix)
X_{10}	Most important factor in choosing where to shop, 1=location (See Q.13 in the Appendix)

Table 5 Maximum Likelihood parameter estimates

Parameter	Coefficient	St. Error	P-value
α	6.5039***	0.6205	0
ρ	-7.288***	0.3882	0
Seattle	-0.2674*	0.1964	0.0867
Info	-0.1006	0.156	0.2595
Gender	0.1765	0.161	0.1365
Education	0.6835*	0.5331	0.0999
Income	0.0016	0.1948	0.4967
Age	0.0049	0.0076	0.26
Age*Education	-0.018*	0.0112	0.0551
X_1	-0.0377*	0.0285	0.0931
X_2	0.3262**	0.1771	0.0327
X_3	-0.7051***	0.3082	0.0111
X_4	2.399***	0.2244	0
X_5	1.214***	0.2172	0
X_6	-1.8117***	0.4694	0.0001
X_7	-0.3126*	0.2221	0.0796
X_8	0.0732	0.1946	0.3533
X_9	0.4776**	0.2656	0.0361
X_{10}	0.0386	0.2225	0.4312
N	670		
LR-stat	268.43		
R^2 equivalent	0.655		

*10% significance level, **5% significance level, ***1% significance level

Table 6 Estimates of mean WTP

Sample	WTP	95% Confidence interval
Full Sample	$1.059 (5.9% premium)	$1.036 - $1.081 (3.6% - 8.1% premium)
Seattle	$1.037 (3.7% premium)	$1.012 - $1.063 (1.2% - 6.3% premium)
Spokane	$1.123 (12.3% premium)	$1.076 - $1.17 (7.6% - 17.0% premium)

Appendix

Q.3 When purchasing food, how important is **higher nutrient content** in food, compared to buying food at the **lowest price**? Please rate your feeling of importance on a scale of 1 to 10, where 1 means higher nutrient foods are the most important and 10 means buying food at the lowest price is the most important.

1 2 3 4 5 6 7 8 9 10

Q.4 How do you feel about **nutritionally enriched food**, e.g. orange juice with added calcium, high fiber cereal, etc.?

- ☐ Very positive → **SKIP to Q.6**
- ☐ Somewhat positive → **SKIP to Q.6**
- ☐ Neutral → **SKIP to Q.6**
- ☐ Somewhat negative
- ☐ Very negative
- ☐ Don't know → **SKIP to Q.6**

Q.8 Since in washing apples they loose their natural coating, natural wax is used as a coating to protect them. ***Fruit enhanced with natural antioxidants will improve its' health benefits by helping to prevent cancer, cardiovascular and other diseases.*** How would you feel about wax coated apples **naturally enriched with antioxidants**?

- ☐ Very positive → **SKIP to Q.10**
- ☐ Somewhat positive → **SKIP to Q.10**
- ☐ Neutral → **SKIP to Q.10**
- ☐ Somewhat negative
- ☐ Very negative
- ☐ Don't know → **SKIP to Q.10**

Q.13 What is the most important factor to you in your choice of where to shop for **food**?

- ☐ Price
- ☐ Quality
- ☐ Variety
- ☐ Location
- ☐ Other, please fill in _____

Reference:

Center for Science in the Public Interest Report. "Functional Foods: Public Health Boon or 21st Century Quakery?" (March 1999)

Department of Health and Human Services, Food and Drug Administration. Conventional Foods Being Marketed as 'Functional Foods'; Public Hearing. 21 CFR Parts 101 and 170 (Dated October 2006)

Donovan, G., Hasseln, H. 2004. Consumer Willingness to Pay for a Naturally Decay-Resistant Wood Product. Western journal of Applied Forestry. 19: (July) 160-164.

Hanemann, Michael W. 1984. Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses. American Journal of Agricultural Economics 66(3):332-341

Hanemann, W.M., J. Loomis and B.J. Kanninen. 1991. Statistical Efficiency of Double-Bounded Dichotomous Choice Contingent Valuation. American Journal of Agricultural Economics 73:1255-1263.

Hanemann, W.M., J. Loomis and B.J. Kanninen. 1999. The Statistical Analysis of Discrete Response CV Data in Valuing Environmental Preferences. I.J. Bateman and K.G. Willis, eds. Oxford University Press, New York, pp. 302-442.

----------2005. Functional Foods: Opportunities and Challenges. Institute of Food Technologists. Available from *http://members.ift.org/IFT/Research/IFTExpertReports/functionalfoods_report.htm*.)

Hu, Wuyang, Chen, Kevin, Yoshida, Kentaro. 2006. Japanese Consumers' Perceptions on and Willingness to Pay for Credence Attributes Associated with Canola Oil. Journal of Agricultural and Applied Economics.38 (1): 91-103

International Food Information Council. March 2006. Functional Foods Fact Sheet: Antioxidants. Available from http://www.ific.org/publications/factsheets/antioxidantfs.cfm

Kanninen, B.J. 1993. Optimal Experimental Design for Double-Bounded Dichotomous Choice Contingent Valuation. Land Economics 69 (2): 138-146.

Kanninen, B.J. and M. Sami Khawaja. 1995. Measuring Goodness of Fit for the Double-Bounded Logit Model. American Journal of Agricultural Economics 77 November: 885-890

Louteiro, Maria L., Gracia, Azucena, and Nayga, Rodolfo M. Jr. 2006. Do Consumers Value Nutritional Labels? European Review of Agricultural Economics 33 (2): 249 – 268.

Maynard, Leigh J; Franklin, Sharon T. 2003. Functional Foods as a Value-Added Strategy: The Commercial Potential of "Cancer-Fighting" Dairy Products. *Review of Agricultural Economics* 25 (2): 316-31.

McCluskey Jill J., Grimsrud, Kristine M., Ouchi, Hiromi, and Thomas I. Wahl. 2003. Consumer Response to Genetically Modified Foods in Japan. *Agricultural and Resource Economics Review*

National Cancer Institute. July 2004. Antioxidants and Cancer Prevention: Fact Sheet. Available from http://www.cancer.gov/cancertopics/factsheet/antioxidantsprevention

Veeman, Michele. 2002 Policy Development for Novel Foods: Issues and Challenges for Functional Food. *Canadian Journal of Agricultural Economics* 50 (4): 527-39

West, Gale E; et al. 2002. Consumers' Valuation of *Functional* Properties of *Foods*: Results from a Canada-Wide Survey. *Canadian Journal of Agricultural Economics* 50 (4): 541-58