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Effects of GM Disclosure Statements on Consumer Perceptions of Selected Food Products in Survey and Sensory Panel Settings

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Effects of GM Disclosure Statements on Consumer Perceptions of Selected Food Products in Survey and Sensory Panel Settings

Ellyn Margaret Newcomb

A thesis submitted to the faculty of Brigham Young University in partial fulfillment of the requirements for the degree of Masters of Science

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ABSTRACT

Effects of GM Disclosure Statements on Consumer Perceptions of Selected Food Products in Survey and Sensory Panel Settings

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The National Bioengineered Food Disclosure Standard (PL 114-216) will require nearly all foods sold in the U.S. to bear a statement disclosing whether they contain genetically modified (GM) material. Past studies suggest the presence of such a statement could have profound effects on consumers; however, research comparing consumer response towards different GM-disclosure statements is scarce. PL 114-216 states that GM foods shall not be considered more or less safe than their non-bioengineered counterparts, nevertheless it would benefit regulators and food manufacturers to be aware of the possible effects such disclosures might have on consumers. In a nationwide survey, multiple disclosure statements with varying degrees of public familiarity were compared to evaluate consumer perceptions and attitudes associated with each statement. Average consumer knowledge level of GM processes was also measured. The statements were then paired with actual food items to determine whether specific product categories influenced consumer responses. A select few of these statements and foods were included in a taste panel, allowing researchers to analyze if disclosure statements affected a consumer’s sensorial experience. Results suggested that consumers were most favorable towards statements indicating the absence of GM-material, however they also responded less negatively towards new disclosure statements that do not have negative connotations. Additionally, consumers may react differently depending on the food accompanying a particular disclosure, although the taste panel data found no evidence that statements affected actual eating experience. Importantly, data from both surveys and taste panel suggested a disclosure statement may affect consumer willingness to buy a product.

Keywords: food label, attitudes, purchase likelihood, bio-designed, bioengineered, genetically designed, genetically modified, genetically engineered, genetic biotechnology
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# TABLE OF CONTENTS

**Title Page**: 1

**Abstract**: 2

**Acknowledgements**: 3

**Table of Contents**: 4

**List of Tables**: 5

**List of Figures**: 6

**Manuscript**: 7

1. **Introduction**: 8

2. **Materials and Methods**: 10

   2.1. Testing the effects of 7 GM disclosure statements on U.S. consumers 11

   2.2. Comparing consumer self-assessed and quantified GMO knowledge 12

   2.3. Testing the effects of 5 disclosure statements in conjunction with 5 food items 13

   2.4. Testing the effects of disclosure statements in a taste panel setting 14

   2.5. Data analysis 15

3. **Results**: 16

   3.1. Measuring the effects of 7 GM disclosure statements on U.S. consumers 17

   3.2. Comparing consumer self-assessed and quantified GMO knowledge 18

   3.3. Measuring the effects of 5 disclosure statements in conjunction with 5 food items 19

   3.4. Measuring the effects of disclosure statements in a taste panel setting 20

4. **Discussion**: 21

   4.1. 7 GM disclosure statements on U.S. consumers 22
4.2. Consumer self-assessed and quantified GMO knowledge ................................................ 25
4.3. Effects of 5 disclosure statements in conjunction with 5 food items ......................... 26
4.4. Effects of disclosure statements in a taste panel setting ................................................ 29
5. Conclusions ............................................................................................................................... 30
References ..................................................................................................................................... 32
Tables and Figures ........................................................................................................................ 35
APPENDIX A: TABLES .............................................................................................................. 49
APPENDIX B: SENSORY BALLOTS ........................................................................................ 56
APPENDIX C: NATIONAL SURVEY 1 .................................................................................... 69
APPENDIX D: NATIONAL SURVEY 2 .................................................................................... 74
LIST OF TABLES

Table 1 - Comparison of 7 Statements ................................................................. 44
Table 2 - Differences in GMO Knowledge .............................................................. 45
Table 3 - Education and Eating Habits ................................................................. 45
Table 4 - Statement-Food Comparisons by Food .................................................. 46
Table 5 - Statement-Food Comparisons by Statement .......................................... 47
Table 6 - Purchase Likelihood Comparisons ......................................................... 48
Table 7 – Average Ratings of 7 Statements ......................................................... 49
Table 8 – Average Ratings for Apples ................................................................. 50
Table 9 – Average Ratings for Rice ................................................................. 51
Table 10 – Average Ratings for Salmon ............................................................... 52
Table 11 – Average Ratings for Vegetable Oil ...................................................... 53
Table 12 – Average Ratings for Wheat Bread ...................................................... 54
Table 13 - Statement-Food Interaction for Purchase Likelihood ......................... 55
Table 14 - Purchase Likelihood Average Ratings .................................................. 55
LIST OF FIGURES

Figure 1 – Survey 1 Average Ratings for Attitudes ................................................................. 35
Figure 2 – Survey 1 Average Ratings for Dependent Questions ........................................... 36
Figure 3 - Survey Covariates of GMO knowledge ................................................................. 37
Figure 4 - Survey Covariates of GMO knowledge ................................................................. 37
Figure 5 - Attitude Average Ratings for Apples ................................................................. 38
Figure 6 - Dependent Question Average Ratings for Apples ............................................... 38
Figure 7 - Attitude Average Ratings for Rice .................................................................... 39
Figure 8 - Dependent Question Average Ratings for Rice ................................................. 39
Figure 9 - Attitude Average Ratings for Salmon ................................................................. 40
Figure 10 - Dependent Question Average Ratings for Salmon .......................................... 40
Figure 11 - Attitude Average Ratings for Vegetable Oil ..................................................... 41
Figure 12 - Dependent Question Average Ratings for Vegetable Oil .................................. 41
Figure 13 - Attitude Average Ratings for Wheat Bread ..................................................... 42
Figure 14 - Dependent Question Average Ratings for Wheat Bread .................................. 42
Figure 15 - Purchase Likelihood Average Ratings ............................................................. 43
Abstract

The National Bioengineered Food Disclosure Standard (PL 114-216) will require nearly all foods sold in the U.S. to bear a statement disclosing whether they contain genetically modified (GM) material. Past studies suggest the presence of such a statement could have profound effects on consumers; however, research comparing consumer response towards different GM-disclosure statements is scarce. PL 114-216 states that GM foods shall not be considered more or less safe than their non-bioengineered counterparts, nevertheless it would benefit regulators and food manufacturers to be aware of the possible effects such disclosures might have on consumers. In a nationwide survey, multiple disclosure statements with varying degrees of public familiarity were compared to evaluate consumer perceptions and attitudes associated with each statement. Average consumer knowledge level of GM processes was also measured. The statements were then paired with actual food items to determine whether specific product categories influenced consumer responses. A select few of these statements and foods were included in a taste panel, allowing researchers to analyze if disclosure statements affected a consumer’s sensorial experience. Results suggested that consumers were most favorable towards statements indicating the absence of GM-material, however they also responded less negatively towards new disclosure statements that do not have negative connotations. Additionally, consumers may react differently depending on the food accompanying a particular disclosure, although the taste panel data found no evidence that statements affected actual eating experience. Importantly, data from both surveys and taste panel suggested a disclosure statement may affect consumer willingness to buy a product.
1. Introduction

Genetically modified (GM) foods have been available for public purchase in the marketplace since the early 1990s. However, only recently has there been an increased demand from consumers that such foods are labeled. The outcomes of this consumer concern were manifested in Vermont’s legislation that required the inclusion of the statement, “Produced with genetic engineering” or “Partially produced with genetic engineering,” on qualifying products (H. 112 2015). Similar ballot initiatives were also seen in other states. All food companies must observe the most recent federal bill signed into law in 2016 and the new regulations, which require “that the form of a food disclosure…be a text, symbol, or electronic or digital link” displayed on the point of sale food packaging, but may exclude “Internet website Uniform Resource Locators not embedded in the link, with the disclosure option to be selected by the food manufacturer” (National Bioengineered Food Disclosure Standard 2016). Alternative options are provided in the cases where the packages are very small packages or the food company itself is large enough to sustain the labeling changes. Importantly (and much to the dissatisfaction of many US consumers) this federal law supersedes all individual state labeling regulations and instead establishes a nationwide standard.

Although this recent federal mandate addresses the pressing consumer need for a labeling statement, there is still much ambiguity that surrounds the actual characteristics of the disclosure. This ambiguity includes what terminology is to be incorporated into the statement itself, whether exhibited on the package in a disclosure statement or included in the link-directed site. Although the federal mandate specifies that the food companies may choose which disclosure option is to be placed on their products, in referring to the actual terminology the subtitle only stated “bioengineering, and any similar term, as determined by the Secretary…referring to a food that
contains genetic material that has been modified through in vitro recombinant deoxyribonucleic acid (DNA) techniques; and for which the modification could not otherwise be obtained through conventional breeding or found in nature” (National Bioengineered Food Disclosure Standard 2016). Since studies have found that some terms such as “genetically modified” (GM) elicit confusion and hesitation in consumers (Carter and others 2003) it is advantageous to explore the effects of different statement disclosures on consumers before the two-year implementation period of the new national disclosure law is finished. Importantly, such research may predict the effects of a mandatory labeling law on consumers and the food industry, which has been a source of concern for food companies even before individual states began passing their own legislation.

The degree to which consumer preferences is affected by the terminology used in the disclosure statement is unclear. The effect of statement wording is important to understand, as the terms themselves may have effects on consumers that are comparable to that of the absence or presence of a statement in general. For example, is Bioengineered, the term that is used in the national disclosure, perceived differently from Genetically modified? If so, do these perceptions influence consumer purchasing behaviors?

Previous research has concluded that consumer attitudes towards genetically modified organisms (GMOs) are largely formed, or at least influenced by the negative connotations perpetuated by the media and organic industries (Loureiro and others 2005, Saher and others 2006). This information opens the possibility that consumers will have varying reactions towards different terms because some terms are used more frequently in the media, often in a negative context. For this reason, it would be insightful to compare the effects that these terms have to those which have not been propagated by the media, lawmakers, scientists, or the food industries. More specifically, it would be advantageous to compare terminology that spans a broad range of
public awareness – from terms with widely circulated negative connotations to terms that consumers have never heard of/have never been used before.

To date, many studies have investigated the effects of GM food labeling on consumers using a wide variety of foods. Lusk and others (2001) concluded that consumers associated corn chips containing GM corn as having a reduced value compared to chips with non-GM corn. This finding was supported by Bukenya and others (2007) who concluded that consumers in Alabama were willing to pay more for non-GMO tomatoes than for those from GM plants. Other studies similarly demonstrate that US consumers prefer non-GM foods like bananas, corn flakes, and corn-beef when given the choice (Costa-Font and others 2008, Onyango and others 2004).

Previous research has also suggested that the type of product that is labeled also plays a determining factor in consumer attitudes and purchase likelihood. One study found that brand equity had a stronger impact on US students’ purchase likelihood to purchase chips than whether or not chips were manufactured with genetically engineered corn (Lusk and others 2001). Another study found that consumers were willing to pay substantial premiums for non-GM vegetable oil and salmon but not for GM tofu (Chern and others 2003). Therefore, it would be beneficial to analyze the effect a broad range of food types have on consumer perception of a disclosure statement. Are consumers less influenced, for example, by a statement on a food considered more processed like a chip, as the aforementioned studies have demonstrated, compared to a food that is perceived as less processed, such as an apple?

The extent of consumer GMO-knowledge in the United States (US) has also been studied. The International Food Information Council Foundation found that high awareness of food biotechnology concepts was restricted to around 10% of consumers surveyed (Hemphill and others 2015). Consumers in countries throughout the world appear to have a limited
understanding of the definition of a GMO and have many misconceptions about the science behind the term (Wunderlich and others 2015). Analyzing the prevalence of these misconceptions among consumers by comparing their self-assessed GMO knowledge to the actual knowledge they demonstrate would provide useful information for those charged with crafting the new GM labeling regulations.

Lastly, previous studies question whether the aversion towards GMOs often expressed in surveys would actually influence purchase intent (Noussair and others 2004). It is suggested that data testing the effects of GM statements on survey respondents does not accurately predict purchase intent, since surveys place respondents in the role of citizens who make judgments from society’s point of view; these same individuals would have different responses if they were to instead take on the role of a consumer who makes actual purchase decisions. Therefore, it would be conducive to test if the attitudes and perceptions elicited by combinations of statement terminology and food items would differ in an online survey setting compared to a more real life setting, such as a taste panel.

The aims of this study were to (1) analyze current consumer attitudes towards food product disclosure statements with varying terminology and their effects on purchase likelihood and product perception; (2) measure consumer self-rated GMO knowledge compared to actual GMO knowledge; (3) investigate associations between the disclosure statements and a broad range of food items; (4) compare survey results to those of a taste panel to evaluate the influence of moving from a hypothetical survey setting to a real life tasting experience.

2. Materials and Methods

Two nationwide surveys were created and administered using Qualtrics, LLC survey®
software. The objective of Survey 1 was to assess consumer response towards seven GM-related disclosure statements with differing terminology. The objective of Survey 2 was to study a selected set of these disclosure statements in connection with specific food items. For both surveys, panelists initially received an online invitation from ESOMAR to take the survey and if interested, clicked on a URL link which took them to a pre-screening page to determine eligibility. Eligibility criteria included US residents aged 18 years or older. Individuals also had to either share equally in grocery shopping or were the primary grocery shopper for the household. Eligible participants were then directed to the consent form and once consented, taken to the actual survey. During both surveys, after 10% of participants from the total projected sample size completed the survey, Qualtrics paused survey administration for researcher review to ensure survey completeness and functionality. In both cases, no adjustments were needed and data collection was continued until the desired target sample size was reached. Responses were collected electronically through Qualtrics’ online database only accessible to the researchers. Data was used from both surveys to conclude which foods and disclosure statements would be incorporated into a sensory panel. The sensory panel took place at the Brigham Young University Sensory Lab (BYUSL) (Provo Utah, USA). Brigham Young University’s Institutional Review Board approved all surveys and panel. Panelists were compensated for their time, based on panel rates previously established by Qualtrics and the BYUSL. Consumer data for both national surveys was collected using Qualtrics, LLC survey® software (Provo Utah, USA).

2.1. Testing the effects of 7 GM disclosure statements on U.S. consumers

A convenience sample of adults (N=1325.) currently enrolled as survey panelists completed an online survey that tested consumer response towards seven different disclosure
statements via seven different surveys (n=189). These seven statements included: *Produced with genetic engineering*, *Produced with genetic modification*, *Produced with genetic biotechnology*, *Genetically designed*, *Bio-designed*, *Bioengineered* and *Not produced with GMOs*. *Bioengineered* and *Produced with genetic engineering* were taken from terminology used in federal and state laws, respectively (Furman, 2016). *Produced with genetic modification* and *Produced with genetic biotechnology* were incorporated because of previous public and media exposure of the statements, as well as their inclusion in previous research (Lusk and others 2004, Bukenya and others 2007). *Not produced with GMOs* was incorporated as a control, as this statement is widely used on packaging, and was the only disclosure statement that indicated the absence rather than the presence of GM material. The remaining two statements *Genetically designed* and *Bio-designed* were created and included in order to test consumer response towards terms which, to our knowledge, had not been used publicly and would not be associated with previous negative connotations.

A stratified sampling method was used to collect a random sample from each geographical region in the United States. Relatively equal ratios of gender were obtained with close to half (n = 664, 50.1%) of the panelists identifying as female and half identifying as male (n = 661, 49.9%). Participants were screened out by the question “Who does most of the grocery shopping in your household” (1 = You, 2 = You and someone else in the household equally share the grocery shopping, 3 = Someone else in your household). Survey participants who chose the third option were directed to the end of the survey. Incomplete survey data was discarded and not used in the results analysis.

An equal number of survey participants (n = 189) received one of the seven disclosure statements and were asked a series of questions with regard to that statement. The questions were
asked in the same order in each survey. The first question regarding attitude was phrased “1. How would you rate your overall attitudes towards a food product that stated (the GM disclosure statement was inserted here)?” Responses to this question were entered on three different scales (negative to positive, dislike to like, unfavorable to favorable), each comprised of a discrete 8-point scale where 0 = Negative, Dislike, or Unfavorable, and 7 = Positive, Like or Favorable. The use of synonymous term in three different scales was done to avoid ambiguity, and to capture appropriate consumer attitudes, which would not necessarily be conveyed through a single numerical scale with two word-anchors.

Participants were then asked the following question in regards to “a general food product they regularly purchased”: “2. How likely would you be to purchase the food if the label stated (the GM disclosure statement was inserted here)?” This question will be referred to as “purchase likelihood” later in this paper. Responses were recorded on a discrete 5-point scale where 1 = Much less likely, 2 = Somewhat less likely, 3 = Neither more likely nor less likely, 4 = Somewhat more likely, and 5 = Much more likely. The subsequent 9 questions were scored on a discrete 5-point scale where 1 = Greatly decrease, 2 = Somewhat decrease, 3 = Stay the same, 4 = Somewhat increase, 5 = Greatly increase; and were worded as follows: “3. How do you think the price of the food would be affected if its label stated: (the GM disclosure statement was inserted here)?” This question will be referred to as “price” later in this paper. “4. How do you think the safety of the food would be affected if its label stated: (the GM disclosure statement was inserted here)?” This question will be referred to as “safety” later in this paper. “5. How do you think the nutrition of the food would be affected if its label stated: (the GM disclosure statement was inserted here)?” This question will be referred to as “nutrition” later in this paper. “6. How do you think the healthfulness of the food would be affected if its label stated: (the GM
disclosure statement was inserted here)?” This question will be referred to as “healthfulness” later in this paper. “7. How do you think the quality of the food would be affected if its label stated (the GM disclosure statement was inserted here)?” This question will be referred to as “quality” later in this paper. “8. How do you think the fair trade of the food would be affected if its label stated: (the GM disclosure statement was inserted here)?” Here, survey panelists were also given a side note explaining fair trade which stated: “Fair trade refers to trade in which fair prices are paid to producers in developing countries.” This question will be referred to as “fair trade” later in this paper. “9. How do you think the environmental impact of the food would be affected if its label stated: (the GM disclosure statement was inserted here)?” This question will be referred to as “environmental impact” later in this paper. “10. How do you think your overall eating experience of the product would be affected if it was labeled: (the GM disclosure statement was inserted here)?” This question will be referred to as “eating experience” later in this paper. An attention screener was added between questions 7 and 8 to test whether participants were reading the questions closely and if survey fatigue were present. Data from participants who did not pass the attention screener was automatically discarded and not included in the final analysis.

2.2. Comparing consumer self-assessed and quantified GMO knowledge

In order to analyze the effect of consumer GMO knowledge on overall statement ratings, survey recipients of Survey 1 were asked “How knowledgeable do you consider yourself on the topic of GMOs (genetically modified organisms)?” Responses were scored on a 6-point scale with corresponding numerical values 1 = Not at all knowledgeable, 2 = Slightly knowledgeable, 3 = Somewhat knowledgeable, 4 = Moderately knowledgeable, 5 = Very knowledgeable, and 6 =
Extremely knowledgeable. This question was followed by a question asking participants to demonstrate their knowledge level: “In your own words, describe a GMO (genetically modified organism).” Written consumer responses were reviewed by researchers and were assigned a numerical score from 1 to 6, where 1 indicated that the survey participant’s response demonstrated that they did not understand the concept of GMOs at all, 2 indicated that they mostly did not understand it, 3 indicated that they slightly did not understand, 4 indicated that they slightly understood the concept, 5 indicated they mostly understood it, and 6 indicated that the consumer’s answer demonstrated excellent knowledge of the concept of a GMO. Consumer responses were standardized and compared using the World Health Organization’s (WHO) definition of genetically modified organisms where GMO’s are defined as “organisms (i.e. plants, animals or microorganisms) in which the genetic material (DNA) has been altered in a way that does not occur naturally by mating and/or natural recombination (World Health Organization, 2017). Respondents had to include terms and concepts that were similar enough to this standard so it was apparent that they understood the processes involved in order to receive a more knowledgeable score.

2.3. Testing the effects of 5 disclosure statements in conjunction with 5 food items

Survey 2 was administered to a convenience sample of adults (N = 2624) currently enrolled as Qualtrics survey panelists, using the same prescreening and eligibility criteria as Survey 1. Survey participants in this survey completed an online questionnaire designed to measure the effects of five of the seven disclosure statements on perceptions of five different food items. Each of the five disclosure statements was randomly paired to each of the five food items. Together, disclosure statements and food items made up 25 unique combinations, where
equal ratios of participants received one of the 25 statement-food item surveys (n = 104). The five disclosure statements included: Produced with genetic engineering, Produced with genetic biotechnology, Bio-designed, Bioengineered and Not produced with GMOs. The justification for including these statements were as follows: Not produced with GMOs was continued as the control, or a statement that disclosed the absence of GM material; both Bioengineered and Produced with Genetic Engineering were kept due to their inclusion in the federal disclosure law and individual state bills, respectively; Bio-designed was included due to its significantly higher consumer ratings; and Produced with genetic biotechnology was kept because it was not found to be significantly different to Bio-designed in many of the dependent questions and researchers wanted to test if the inclusion of food items affected the contrast between these two statements.

The five foods comprised apples, rice, wheat bread, salmon, and vegetable oil. This combination was chosen to test the effects of a broad range of food products on consumer perceptions. Four of the five food items (apples, salmon, rice, and vegetable oil) were chosen because GM versions of these already exist. Although GM apples and rice were not currently for sale in the market at the time of this study, there had been fair amount of publicity regarding genetic modification of these two commodities. The fifth food item, wheat bread, was used because previous studies have confirmed that consumers mistakenly believe GM wheat is available for sale in the market place (Hallman and others 2013). Therefore, wheat bread was incorporated because consumers believed it plausible for the main component of this food item to be GM.

Similar to Survey 1, a stratified sampling method was incorporated to collect a simple random sample from each of the geographical regions. Equal ratios of gender were obtained with 50.0% (n = 1313) of the panelists identifying as female and 50.0% identifying as male (n =
The same attention screeners that were used in Survey 1 were included in this one as well. Once again, any incomplete survey data was discarded and not used in the results analysis.

In order to have relevant surveys distributed to each participant, participants were asked to rate their purchasing frequency of the above-mentioned food items on a 5 point scale (5 = More frequently than once a week, 4 = Once a week to every month, 3 = Once a month to every 3 months, 4 = Once every three months to once a year, 5 = Never). The question was phrased as follows: “How often do you purchase each of the following?” Participants were allocated to one of twenty-five surveys based on how they responded to this question, ensuring that consumers were not given a survey for a food item that they reportedly “never” purchased. Survey participants were then given a disclosure statement and a food item and asked the same dependent questions as those in Survey 1. The only difference was that each question included one of the five food items in it. For example, the first question regarding attitude was phrased “1. How would you rate your overall attitudes towards (insert food item here) that stated (the GM disclosure statement was inserted here)?” As in Survey 1, this question will be referred to as “attitude” later in this paper. Participants were then asked the following question in regards to the food item assigned and its statement: “2. “How likely would you be to purchase the (insert food item here) if the label stated (the GM disclosure statement was inserted here)?” As in Survey 1, this question will be referred to as “purchase likelihood” later in this paper. Responses were recorded on a discrete 5-point scale where 1 = Much less likely, 2 = Somewhat less likely, 3 = Neither more likely nor less likely, 4 = Somewhat more likely, and 5 = Much more likely. The same subsequent 9 questions were asked regarding price, safety, nutrition, healthfulness, quality, fair trade, environmental impact, and eating experience, with the only difference being the inclusion of a food item. These questions were scored on a discrete 5-point scale where 1 =
Greatly decrease, 2 = Somewhat decrease, 3 = Stay the same, 4 = Somewhat increase, 5 = Greatly increase. An attention screener was added between Questions 7 and 8 to test whether participants were reading the questions closely and if survey fatigue were present. Data from participants who did not pass the attention screener was automatically discarded and not included in the final analysis.

2.4. Testing the effects of disclosure statements in a taste panel setting

Before the commencement of the sensory panel, a general survey was sent out to individuals in the BYU Sensory Lab (BYUSL) panelist database to determine if there were enough potential participants willing to taste GM foods in the database. Panelists were recruited based on their willingness to consume GM foods. The 534 individuals available to participate in the taste panel were then divided equally among the five days during which the panel took place (n = 106). Panelists were screened for food allergies and selected to equally represent both gender and age categories (ages 18-29, 30-39, 40-49, 50-59, and 60+).

The panel comprised four GM disclosure statements and a control. The statements used were Produced with GMOs, Bio-designed, Bioengineered, Not produced with GMOs, and No label statement. Bio-designed, Bioengineered, and Not produced with GMOs were taken from both national surveys in order to compare effects of these statements in a sensory panel to a survey setting. Produced with GMOs was a new statement that was included to act as a type of positive control in contrast to Not produced with GMOs. No label statement served as the main control to evaluate whether the presence of wording itself affected consumer perception of food items. The four disclosure statements and the control were combined with the three food items previously selected from the Survey 2. These three food items included smoked salmon, whole
wheat bread, and gala apples. All food items were presented to panelists in identical serving dishes to control for presentation bias.

The smoked salmon fillets had been purchased from a wholesaler and came vacuum wrapped and in whole fillet form. The fillets were stored in their original packaging at refrigeration temperatures for 48 hours before serving. Fillets were checked 24 hours before serving to ensure taste, color, and odor were not affected. The fillets were cut into individual portion sizes of approximately 0.043kg and 0.025m by 0.05m the night before the panel. Tail and mouth portions were discarded. The apples (Gala variety) used in the panel were purchased from a different wholesaler and were all from the same lot. After receiving them from the wholesaler, they were refrigerated for 48 hours before the panel. Apples were washed and checked for any imperfections that might influence consumer results and were sliced as needed during the panel using a round six-segment apple-slicer. Each panelist received two identical slices. Pre-sliced whole wheat bread loaves were purchased from the same wholesaler 48 hours before the panel and stored at room temperature. The loaves were checked for mold and aesthetic imperfections the morning before the panel. Each slice was cut vertically, so that each panelist received one half slice of wheat bread. During the panel, each panelist was presented with one statement and a sample of each of the three foods. Statements and the order of which the foods were presented were both randomized. Panelists were instructed to take a bite of an unsalted cracker and a sip of filtered, room temperature water to cleanse their palates between each food.

Panelists were asked to rate their attitudes, consumption frequency, and purchase frequency, in regards to each of the three foods. The panelist was then presented with their food samples and a series of questions about that food and its accompanying disclosure statement. Each question set per food item was identical and each panelist received only one disclosure
statement. Sample order and question presentation were handled by Compusense® (Version 5.6, Compusense Inc., Ontario Canada). Responses to questions regarding sample appearance, aroma, flavor, texture, and aftertaste acceptability were scored via a 9-point hedonic scale where 1 = Dislike extremely, 2 = Dislike very much, 3 = Dislike moderately, 4 = Dislike slightly, 5 = Neither like nor dislike, 6 = Like slightly, 7 = Like moderately, 8 = Like very much, and 9 = Like extremely. Panelists were then asked the following question after evaluating the samples: “How likely or unlikely would you be to purchase this food with the statement “(the GM disclosure statement was inserted here)” if it was priced comparable to other similar products at the grocery store?” 1 = Extremely unlikely, 2 = Very unlikely, 3 = Moderately unlikely, 4 = Slightly unlikely, 5 = Neither likely nor unlikely, 6 = Slightly likely, 7 = Moderately likely, 8 = Very likely, 9 = Extremely likely.

2.5. Data analysis

Data from the surveys and the sensory panel were analyzed using Statistical Analysis Software SAS® version 9.4 (SAS Institute Inc, Cary North Carolina, USA). The independent variables for the surveys included the disclosure statement, food item, education, age, lifestyle, and consumer self-assessed GMO knowledge. The dependent variables for the surveys included consumer attitudes, purchase likelihood, price, safety, nutrition, healthfulness, quality, fair trade, environmental impact, and eating experience. The independent variables for the taste panel included age, gender, attitude, and consumption frequency. The dependent variables for the taste panel included appearance, aroma, flavor, texture, aftertaste, and purchase likelihood.

Average consumer ratings for each question presented in the surveys and taste panel were calculated to give mean values for statistical comparison using an analysis of covariance.
Average ratings of consumer self-assessed GMO knowledge and the quantified knowledge scores were also analyzed and compared using an analysis of covariance. A post-hoc Tukey Kramer method (α=0.05) was then applied to measure all possible pairwise differences of mean values received from the analysis of covariance, as this method would adjust for the slight variation in participant sample sizes.

3. Results

3.1. Measuring the effects of 7 GM disclosure statements on U.S. consumers

In the first online survey, dependent variables (attitude, purchase likelihood, price, safety, nutrition, healthfulness, quality, fair trade, environmental impact, eating experience) were all significantly influenced by disclosure statement. Specifically, the statement *Not produced with GMOs* afforded the biggest contrast compared to other disclosure statements (Figure 1) and (Figure 2) as it received significantly higher means for all dependent variables queried (p<0.01) (Table 1). For many of the questions (further explained below) *Bio-designed* received higher ratings than *Genetically designed, Produced with genetic biotechnology, Produced with genetic modification, and Produced with genetic engineering*. However, *Bio-designed* did not receive ratings that were statistically higher than *Bioengineered* for any questions asked.

**Attitude**

The three scales regarding the attitude question (negative to positive, dislike to like, unfavorable to favorable) resulted in identical results of significant disclosure statement comparisons (p=0.000), suggesting that survey participants attitudes towards these nuanced phrases mirrored each other, or that participants did not interpret the three attitude scales differently. For each of the three attitude scales, *Bio-designed* received significantly higher
ratings in comparison to *Produced with genetic biotechnology, Produced with genetic engineering, Produced with genetic modification*, and *Genetically designed* (p<0.043).

Interestingly, *Bioengineered*, with its more pronounced ties to technology, was not rated as significantly different than *Bio-designed*.

**Purchase Likelihood**

Similar trends were observed for purchase likelihood as participants rated themselves significantly more likely to purchase a product bearing *Not produced with GMOs* compared to the other six statements (p=0.000). Survey participants also rated themselves as significantly more likely to purchase a product with the statement *Bio-designed* rather than *Produced with genetic biotechnology, Produced with genetic engineering, Produced with genetic modification,* and *Genetically designed* (p=0.022, p=0.000, p=0.001, p=0.000, respectively).

**Price**

Consumer ratings regarding price also showed some interesting differences. Survey participants rated foods bearing the disclosure statement *Not produced with GMOs* as expectantly more expensive than those bearing *Produced with genetic biotechnology, Produced with genetic engineering, Produced with genetic modification,* and *Genetically designed* (p<0.009). Foods bearing the statement *Bio-designed* were rated by participants as more expensive than those labeled either with *Produced with genetic modification* (p=0.003) or *Genetically designed* (p=0.031), but for this question *Bio-designed* was not rated higher than *Produced with genetic biotechnology* or *Produced with genetic engineering*. Foods bearing the disclosure statement *Bioengineered* were rated slightly more expensive than those with *Produced with genetic modification* (p=0.046).
Safety

Continuing with consumer trends exhibited thus far, the dependent variable of safety expectation demonstrated significantly higher ratings for the disclosure statement *Not produced with GMOs* in comparison to *Bio-designed, Bioengineered, Produced with genetic biotechnology, Produced with genetic engineering, Produced with genetic modification,* and *Genetically designed* (p=0.000). Interestingly, the statement *Bio-designed* received higher safety ratings in comparison to disclosure statements *Produced with genetic modification* and *Genetically designed* (p=0.000, p=0.007, respectively).

Nutrition

The nutrition dependent variable produced results that were similar to the attitudes and purchase likelihood questions. *Not produced with GMOs* was rated significantly more nutritious than *Bio-designed, Bioengineered, Produced with genetic biotechnology, Produced with genetic engineering, Produced with genetic modification,* and *Genetically designed* (p=0.000). The statement *Bio-designed* was rated as more nutritious than *Produced with genetic engineering, Produced with genetic modification,* and *Genetically designed* (p=0.011, p=0.005, and p=0.000, respectively). There was not a significant difference in consumer nutrition expectation between *Bio-designed* and *Produced with genetic biotechnology*.

Healthfulness

Similar to the nutrition variable, healthfulness demonstrated that *Not produced with GMOs* was rated significantly more healthful than *Bio-designed, Bioengineered, Produced with genetic biotechnology, Produced with genetic engineering, Produced with genetic modification,* and *Genetically designed* (p=0.000). The disclosure statement *Bio-designed* was rated as more healthful than *Produced with genetic engineering, Produced with genetic modification,* and
Genetically designed (p=0.031, p=0.004, and p=0.005, respectively) but not significantly different than Produced with genetic biotechnology.

Quality

In regards to quality, average ratings were significantly higher for Not produced with GMOs compared to all other six disclosure statements (p=0.000). Bio-designed was rated significantly higher in quality compared to Produced with genetic engineering, Produced with genetic modification, and Genetically designed (p=0.035, p=0.001, p=0.016) but was not rated significantly higher than Produced with genetic biotechnology.

Fair Trade

Likewise, the fair trade variable demonstrated that Not produced with GMOs received significantly higher ratings in comparison to all other disclosure statements (p=0.000). Bio-designed was rated significantly higher in fair trade when compared to Produced with genetic modification, and Genetically designed (p=0.026, p=0.019, respectively) but was not rated significantly higher than Produced with genetic engineering or Produced with genetic biotechnology in regards to consumer expectation of fair trade.

Environmental Impact

With respect to environmental impact, participants expected foods bearing Not produced with GMOs to have a greater environmental impact than foods labeled Bio-designed (p=0.001), as well as those labeled with Bioengineered, Produced with genetic biotechnology, Produced with genetic engineering, Produced with genetic modification, and Genetically designed (p=0.000). Bio-designed was not rated significantly higher than any of the other statements.

Eating Experience

Expectation for eating experience was significantly higher for Not produced with GMOs
compared to all other six disclosure statements (p=0.000). Bio-designed was rated significantly higher for this dependent variable compared to Produced with genetic engineering, Produced with genetic modification, and Genetically designed (p=0.010, p=0.000, p=0.001) but was not rated significantly higher quality than Produced with genetic biotechnology.

3.2. Comparing consumer self-assessed and quantified GMO knowledge

As shown in Table 2, the average ratings of consumer self-rated GMO knowledge compared to the quantified value given based on their answer, was significantly higher (2.89 vs 2.42, respectively). This yielded an estimated difference of 0.37 (15%) for the 1325 survey participants in Survey 1 (p<.0001). The covariates that were controlled for were age, education, and eating habits. Age, although significant, was dropped from the model after detecting false responses in at least 2.0% of the survey participants.

The covariates education and eating habits demonstrated significant correlations with consumers rating their GMO knowledge higher than that of the actual GMO knowledge score (Figure 3 and Figure 4). Survey participants who responded that their highest education level was a high school graduate gave themselves a GMO knowledge rating that was on average 0.45 higher than the quantified value (p<0.05) as shown in Table 3. Participants who chose other education options did not give themselves a GMO knowledge rating that was significantly higher or lower than the quantified GMO knowledge score.

Survey respondents who rated their eating habits as 1 (very unhealthy) gave themselves a GMO knowledge rating that was, on average, -0.79 lower than the quantified value (p=0.05). Those that rated themselves a 4 (somewhat healthy) rated themselves, on average, 0.24 higher than the quantified value (p=0.04). Lastly, participants that gave themselves a 5 (very healthy)
also rated their GMO knowledge to be on average 1.10 higher than the quantified value they received (p<.0001).

3.3. Measuring the effects of 5 disclosure statements in conjunction with 5 food items

The results of Survey 2 suggested that, similar to findings from Survey 1, consumers rated each of the five food items with the accompanying statement *Not produced with GMOs* significantly higher than food items with other disclosure statements (p<.0001). This was observed for apples (Figure 5 and Figure 6), rice (Figure 7 and Figure 8), salmon (Figure 9 and Figure 10), vegetable oil (Figure 11 and Figure 12), and wheat bread (Figure 13 and Figure 14).

Overall, the results suggested that *Bio-designed* resulted in higher ratings for apples, rice, vegetable and wheat bread, but not salmon, when compared to their counterparts labeled with *Bioengineered*, *Produced with Genetic Engineering*, and *Produced with Genetic Biotechnology*. This was observed for the survey questions regarding attitude, environmental impact, healthfulness, eating experience, price, quality, and purchase likelihood (Table 4). This data supports the trends exhibited in Survey 1 that consumers perceived *Bio-designed* less negatively for most questions when it was compared to all other statements except *Not produced with GMOs*.

Our data demonstrated that vegetable oil with either the *Bioengineered* or *Produced with genetic biotechnology* disclosure statement received higher average ratings than apples, salmon, or wheat bread with the same statement. This trend was exhibited only for the survey questions concerning attitudes, environmental impact, eating experience, price, and purchase likelihood (Table 5).
Attitude

For dependent questions Positive/Negative, vegetable oil with the disclosure statement Bioengineered was rated significantly higher than apples, wheat bread, and salmon (p=0.00, p=0.00, p=0.00, respectively). For the same dependent variable, vegetable oil with the statement Produced with genetic biotechnology was rated higher than wheat bread and salmon (p=0.00, p=0.05, respectively). For dependent question Unfavorable/Favorable, vegetable oil with the statement Bioengineered was rated significantly higher than apples, wheat bread, and salmon (p=0.00, p=0.01, and p=0.03, respectively). Vegetable oil with the statement Produced with genetic biotechnology was also rated significantly higher than wheat bread, apples, and salmon (p=0.00, p=0.01, and p=0.04, respectively). For Dislike/Like attitude scale, vegetable oil with the disclosure statement Bioengineered was rated significantly higher than apples, wheat bread, and salmon (p=0.00, p=0.00, and p=0.01, respectively). For the same scale, vegetable oil with the statement Produced with genetic biotechnology was rated significantly higher than wheat bread only (p=0.00).

Purchase Likelihood

For purchase likelihood, vegetable oil with the disclosure statement Bioengineered was rated significantly higher than apples, wheat bread, and salmon (p=0.00, p=0.00, and p=0.02, respectively). For the same question, vegetable oil with the disclosure statement Produced with genetic biotechnology was rated significantly higher than wheat bread (p=0.00).

Price

The survey question regarding price demonstrated that apples matched with the statement Bioengineered were rated significantly higher than salmon with the same statement (p=0.00). This comparison was the one anomaly since it did not involve vegetable oil, as the other
significant interactions did. Likewise, for this same question, Bioengineered vegetable oil received significantly higher average ratings than salmon matched with the same disclosure statement (p=0.00).

Environmental Impact

With regards to environmental impact, vegetable oil with the statement Produced with genetic biotechnology was rated significantly higher than wheat bread (p=0.03). This was the only significant comparison in the data for this dependent variable.

Eating Experience

For the average ratings for the question of eating experience, vegetable oil with Bioengineered was rated significantly higher than wheat bread and apples (p=0.00, p=0.00). Vegetable oil with the statement Produced with genetic biotechnology was rated significantly higher than wheat bread as well (p=0.03).

3.4. Measuring the effects of disclosure statements in a taste panel setting

The only dependent variable in which the statement-food item interaction was significant in the taste panel data was purchase likelihood. This interaction was not found to be significant in regards to any of the other questions asked during the panel (appearance, aroma, flavor, texture, and aftertaste). Observed trends seen in both national surveys, where Not produced with GMOs and Bio-designed generally received higher average ratings, did not repeat themselves in the panel setting (Figure 15).

Table 6 shows the five significant interactions observed for all of the pairwise comparisons between the food and statement pairings for purchase likelihood. For this question, there was a significant difference in apples and wheat bread matched with Bio-designed (p=0.01), demonstrating that apples with this statement were rated higher. Apples also received
statistically higher purchase likelihood ratings compared to salmon and wheat bread with the control No label statement (p=0.03, p=<.0001, respectively). Apples matched with the statement Not produced with GMOs received statistically higher ratings than wheat bread with the same statement (p=0.01). Lastly, apples paired with Produced with GMOs received average ratings that were statistically higher than wheat bread with the same statement (p=0.00).

4. Discussion

4.1. 7 GM disclosure statements on U.S. consumers

Our findings where Not produced with GMOs received significantly and comparatively higher ratings is consistent with previous studies that have found consumers perceive products without GM material are healthier and cause fewer long-term health problems than products that claim they contain GM ingredients (Roe and others 2007). This undermines previous research on purchase likelihood from Heslop (2006) whose study found that there were minimal effects of GM labeling overall. One explanation for the present results may be that consumer perception of GM-containing products have been shaped by false impressions delivered by past reports and exacerbated by the media and organic food industry (Loureiro and others 2005, Saher and others 2006).

It is worthwhile to note that consumer average ratings for Bio-designed were not found to be significantly different from those of Bioengineered in any of the questions asked in the surveys. Additionally, results showed that Bio-designed was not rated as significantly higher in any area compared to Produced with genetic biotechnology except for the purchase likelihood and attitude questions. These results may suggest that consumers perceive the term “bio” more positively than either “engineering” or “modification”. It is unlikely that the above phenomena is
due to the term “designed” since Bio-designed was found to be significantly more well-received by consumers than Genetically designed. The fact that Bio-designed was significantly rated higher than Genetically designed also undermines the notion that consumers react more positively towards a fabricated statement simply because there are no negative connotations yet associated with it.

4.2. Consumer self-assessed and quantified GMO knowledge

The significant discrepancy of 0.37 points between survey respondent self-rated GMO knowledge and quantified knowledge is supported by Wunderlich and others (2015) who concluded that a distinction needed to be made between self-reported familiarity with GMOs and a scientific understanding of it. The former could be described as “GMO knowledge” as it was referred to in the present study; however, the latter involves a deeper knowledge of its principles. The methods by which the present study measured this deeper knowledge are similar to the research conducted by Vecchione and others (2015) where consumers’ GMO knowledge was measured by their ability to define the term. It is important that a distinction is made as those who rate themselves as having higher self-assessed GMO knowledge, or GMO familiarity, tend to be more resistant to bioengineering, while those with higher scientific knowledge scores on the subject tend to have less negative attitudes towards GMOs (Wunderlich and others 2015, Baker and others 2001). McComas and others (2014) likewise show that those who have a higher scientific understanding are more likely to have less negative opinions of GM products, higher product acceptance ratings, and less distinction between types of genetic modification than those who are less informed.
The current study suggests that those with only a high school diploma rate themselves statically higher than the quantified value assigned based on their written answers (Figure 3). This was the only education level that was significant in the covariate’s association with the discrepancy between consumers’ self-rated GMO knowledge and the quantified knowledge values (Table 3). Since previous research has found that those who rate themselves as having a higher GMO knowledge compared to their actual scientific knowledge tend to be more resistant to bioengineering, consumers from this education level may be more likely to hold greater negative attitudes towards GMOs (Wunderlich and others 2015). This notion is supported by the questionnaire-based study by Harrison and others (2005), who found that consumers whose highest education level was a high school diploma were less willing to purchase GM foods compared with both consumers with less and higher education. Likewise, another survey of US consumers concluded that participants whose highest level of education was a high school diploma were 12% less likely to believe in the usefulness of GMOs compared to those who have obtained higher education (Puduri and others 2010). Despite these findings, there has not yet been a study in which education level reliably predicts GMO attitude or understanding (Mielby and others 2013). Therefore, although the current study supports the notion that those with a high school education show higher self-rated GMO knowledge, it is only suggested that this is correlated with increased negative attitude and greater resistance to bioengineering.

4.3. Effects of 5 disclosure statements in conjunction with 5 food items

Overall findings from Survey 2 demonstrated a strong preference for the disclosure statement Not produced with GMOs in regards to all food items when matched with each of the five statements. This was consistent with previous research by Chern and others (2003) whose
survey found that consumers were willing to pay substantial premiums for both non-GM vegetable oil and salmon. The lack of significant differences among the pairwise comparisons suggested that consumers are still more favorable towards this disclosure statement, regardless of the food it is paired with. These findings accurately portray trends in consumer behavior regarding all non-GMO products. Findings reported by Nielsen Holdings NV (a global information and measurement company) state that sales of these products exceeded $10 billion in 2014 and since 2010 have been growing at a faster pace than sales of gluten-free items (Strom, 2015). Additionally, the growth in sales was expected to continue in following years (Sarich, 2014).

The disclosure statement Bio-designed received significantly higher consumer ratings for four of the five food items in regards to each of the dependent questions asked in the survey. Specifically, when salmon was paired with Bio-designed, the pairing was not found to be significantly more favorable compared to salmon with other disclosure statements. Besides this inconsistency, the rest of the data suggested trends which were similar to Survey 1. Namely, this data still strongly supports consumer preference toward the Bio-designed disclosure statement compared to other statements affirming the presence of GM material.

Several trends were noticed while analyzing the differences among food items bearing the same statement. The main observation was that vegetable oil consistently received higher ratings than apples, wheat bread, and salmon for questions regarding attitude, environmental impact, purchase likelihood, eating experience and price. However, these comparisons were significant only with regards to disclosure statements Bioengineered and Produced with Genetic Biotechnology. Disclosure statements Not produced with GMOs, Bio-designed, and Produced
with genetic engineering did not show significant differences among food items with these statements.

Interestingly, the questions relating to healthfulness and nutrition did not show any significant label-food interactions besides each food receiving higher average ratings when paired with Not produced with GMOs, as mentioned earlier. The lack of significant differences for these questions are supported by previous research that demonstrated that health risks is one of the key concerns of consumers involving the use of GM technologies (Teisl and others 2003).

Combining data comparing food items with the same statement and data comparing single foods with different statements, our results demonstrated that only specific pairings affect consumer perceptions. Specifically, all foods paired with Not produced with GMOs received greater average ratings for all questions, while all foods except for salmon with the Bio-designed statement received less negative ratings when compared to Bioengineered, Produced with genetic biotechnology, and Produced with genetic engineering (Table 4). Meanwhile, when the statement is kept constant and matched with different foods, only the statements Produced with genetic biotechnology and Bioengineered afforded any significant difference. However, these significant differences were only observed when vegetable oil was paired with apples, salmon, and wheat bread. One theory that evolved from this data was that consumers were less negatively affected by GM statements on foods constituting as cooking ingredients, however, this was undermined when it was found that vegetable oil was not found to be significant compared to rice with Bioengineered or Produced with genetic biotechnology. Regardless, overall data from Survey 2 demonstrated that consumer perception of disclosure statements were in fact influenced by the food item presented.
4.4. Effects of disclosure statements in a taste panel setting

Interestingly, while *Bioengineered* and *Produced with Genetic Biotechnology* vegetable oil received higher purchase likelihood ratings in Survey 2, apples received higher purchase likelihood ratings when paired with each of the statements tested in the taste panel. Apples received higher purchase likelihood ratings for wheat bread when both food items were paired with *Bio-designed* (p=0.01), *Not produced with GMOs* (p=0.01), and *Produced with GMOs* (p=0.00). The control, *No label statement* also demonstrated a higher purchase likelihood ratings for apples than salmon and wheat bread (p=0.03, p<.0001, respectively), even when purchase frequency of each food item was controlled for in the analysis. This data suggests that taste panelists were more likely to purchase apples accompanied by any disclosure statement, just as data from Survey 2 indicated that survey participants were more likely to purchase vegetable oil with *Bioengineered* and *Not produced with genetic biotechnology*.

It is worthwhile to note that purchase likelihood was the only question in the panel where the statement-food item interaction was significant. There were no differences in appearance, aroma, flavor, texture and aftertaste of the food samples regarding the disclosure statement. This data greatly contrasts with results from both national surveys, where statements *Not produced with GMOs* and *Bio-designed* were correlated with a significantly higher eating experience overall. The fact that *Not produced with GMOs* was not accompanied by greater ratings for purchase likelihood for all panel food items differs greatly from trends exhibited by both surveys as well. The inconsistencies exhibited between the national surveys and the taste panel could be due to differences in consumer thought process in the two settings, as proposed by previous research (Noussair and others 2004). One study in particular concluded that consumer response in a survey setting may be influenced by societal rules and an innate desire to portray themselves
as conforming to those rules. Since society currently portrays GM food products in an unfavorable light, these results would consequently provide unrealistically negative projections of how consumers might actually respond in real market situations (Mather and others 2011). Additional studies support this finding that professed consumer attitudes and behavioral intentions continually fail to predict actual marketplace behavior (Arts and others 2011). These studies collectively suggest that the inconsistent trends exhibited between the survey and panel data may be a result of survey participants being more influenced by society’s current view on GMOs while panelists demonstrated a more accurate representation of how consumers might respond in a marketplace. Conversely, our panel findings cannot accurately portray how consumers would respond in an actual purchasing situation, since sensory panels are catered to providing data on eating experience rather than actual buying scenarios.

5. Conclusions

Findings from both surveys indicated that even with the inclusion of various food items, consumers strongly preferred the disclosure statement Not produced with GMOs and were more likely to purchase food products with this statement as opposed to the same foods bearing different statements. Our results suggested that consumer ratings of products were influenced by the terminology used when a disclosure statement affirmed the presence of GM material. Bio-designed consistently received higher ratings than other statements affirming GM material. This trend was unlikely due solely to the originality of this statement or its lack of negative connotations. Instead, our survey data indicated that consumers might have felt less negatively towards the term “bio”.


Consumers’ more positive perception of Bio-designed as demonstrated in Survey 1 extended to all food items tested in Survey 2, with the exception of salmon. The incorporation of vegetable oil in Survey 2 also demonstrated that consumers tended to rate this food higher than salmon, wheat bread, and apples when paired with the statement Bioengineered or Produced with genetic biotechnology.

Overall, results from the sensory panel indicated that disclosure statements did not seem to affect consumer eating experience. Unlike the data from Survey 2, Not produced with GMOs did not yield higher purchase likelihood ratings for each food tested in the panel. Survey and taste panel findings concerning which statement-food item pairings were more favorably perceived than others were inconsistent. However, data from both settings suggested that certain disclosure statements may affect consumer willingness to buy a product. Further research is warranted to examine the effects of disclosure statements on consumer purchase behavior, particularly studies that simulate the experience of an actual buying scenario.
References


V.T. Legis. H.112. 2013. Page 1 of 19


Tables and Figures

Figures

Figure 1 – Survey 1 Average Ratings for Attitudes

Average ratings of attitude scores for each of the seven statements. Values are based on 95% confidence intervals where p=0.05, n=189, total sample N=1325.
Figure 2 – Survey 1 Average Ratings for Dependent Questions

Average ratings of dependent question ratings for each of the seven statements. Values are based on 95% confidence intervals where p=0.05, n=189, total sample N=1325.
Figure 3 - Survey Covariates of GMO knowledge

Average ratings of self-assessed GMO knowledge compared to actual GMO knowledge scores based on education level. Values are based on 95% confidence intervals where p=0.05, total sample N=1325.

Figure 4 - Survey Covariates of GMO knowledge

Average ratings of self-assessed GMO knowledge compared to actual GMO knowledge scores based on eating habits. Values are based on 95% confidence intervals where p=0.05, total sample N=1325.
Figure 5 - Attitude Average Ratings for Apples

Average ratings of attitude scores for the five statements paired with apples. Values are based on 95% confidence intervals where $p=0.05$, $n=104$, total sample $N=2624$.

Figure 6 - Dependent Question Average Ratings for Apples

Average ratings of dependent question scores of the five statements paired with apples. Values are based on 95% confidence intervals where $p=0.05$, $n=104$, total sample $N=2624$. 
Figure 7 - Attitude Average Ratings for Rice

Average ratings of attitude scores for the five statements paired with rice. Values are based on 95% confidence intervals where $p=0.05$, $n=104$, total sample $N=2624$.

Figure 8 - Dependent Question Average Ratings for Rice

Average ratings of dependent question scores for the five statements paired with rice. Values are based on 95% confidence intervals where $p=0.05$, $n=104$, total sample $N=2624$. 

39
Figure 9 - Attitude Average Ratings for Salmon

Average ratings of attitude scores for the five statements paired with salmon. Values are based on 95% confidence intervals where p=0.05, n=104, total sample N=2624.

Figure 10 - Dependent Question Average Ratings for Salmon

Average ratings of dependent question scores for the five statements paired with salmon. Values are based on 95% confidence intervals where p=0.05, n=104, total sample N=2624.
Figure 11 - Attitude Average Ratings for Vegetable Oil

Average ratings of attitude scores for the five statements paired with vegetable oil. Values are based on 95% confidence intervals where p=0.05, n=104, total sample N=2624.

Figure 12 - Dependent Question Average Ratings for Vegetable Oil

Average ratings of dependent question scores for the five statements paired with vegetable oil. Values are based on 95% confidence intervals where p=0.05, n=104, total sample N=2624.
Figure 13 - Attitude Average Ratings for Wheat Bread

Average ratings of attitude scores for the five statements paired with wheat bread. Values are based on 95% confidence intervals where $p=0.05$, $n=104$, total sample $N=2624$.

Figure 14 - Dependent Question Average Ratings for Wheat Bread

Average ratings of dependent question scores for the five statements paired with wheat bread. Values are based on 95% confidence intervals where $p=0.05$, $n=104$, total sample $N=2624$. 

42
Figure 15 - Purchase Likelihood Average Ratings

Average ratings of purchase likelihood scores for each of the five statements tested in the taste panel, grouped by food item. Values are based on 95% confidence intervals where $p=0.05$, $n=106$, total sample $N=534$. 
Table 1 - Comparison of 7 Statements

Significance in adjusted p-values using Tukey adjustment for multiple comparisons of means (n = 189 per statement group, N=1325 for total convenience sample)

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<td>Genetic Modification</td>
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<td>1313</td>
<td>0.046</td>
</tr>
<tr>
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<td>Not Produced with GMOs</td>
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<td>1313</td>
<td>0.000</td>
</tr>
<tr>
<td>Safety</td>
<td>Bio-Designed</td>
<td>Genetic Modification</td>
<td>0.12</td>
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<td>0.000</td>
</tr>
<tr>
<td>Safety</td>
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<td>Genetically designed</td>
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<td>1313</td>
<td>0.007</td>
</tr>
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<td>Safety</td>
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<td>Not Produced with GMOs</td>
<td>0.12</td>
<td>1313</td>
<td>0.000</td>
</tr>
<tr>
<td>Nutrition</td>
<td>Bio-Designed</td>
<td>Genetic Biotechnology</td>
<td>0.11</td>
<td>1313</td>
<td>0.011</td>
</tr>
<tr>
<td>Nutrition</td>
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<td>Genetic Modification</td>
<td>0.11</td>
<td>1313</td>
<td>0.005</td>
</tr>
<tr>
<td>Nutrition</td>
<td>Bio-Designed</td>
<td>Genetically designed</td>
<td>0.11</td>
<td>1313</td>
<td>0.000</td>
</tr>
<tr>
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<td>Bio-Designed</td>
<td>Genetic Engineering</td>
<td>0.12</td>
<td>1313</td>
<td>0.031</td>
</tr>
<tr>
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<td>Genetic Modification</td>
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<td>1313</td>
<td>0.004</td>
</tr>
<tr>
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<td>Bio-Designed</td>
<td>Genetically designed</td>
<td>0.12</td>
<td>1313</td>
<td>0.005</td>
</tr>
<tr>
<td>Healthfulness</td>
<td>All other statements</td>
<td>Not Produced with GMOs</td>
<td>0.12</td>
<td>1313</td>
<td>0.000</td>
</tr>
<tr>
<td>Nutrition</td>
<td>All other statements</td>
<td>Not Produced with GMOs</td>
<td>0.11</td>
<td>1313</td>
<td>0.000</td>
</tr>
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<td>Genetic Engineering</td>
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<td>1313</td>
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<td>1313</td>
<td>0.001</td>
</tr>
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<td>1313</td>
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<td>1313</td>
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<td>1313</td>
<td>0.000</td>
</tr>
<tr>
<td>Environ impact</td>
<td>Bio-Designed</td>
<td>Not Produced with GMOs</td>
<td>0.12</td>
<td>1314</td>
<td>0.001</td>
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<tr>
<td>Environ impact</td>
<td>All other statements</td>
<td>Not Produced with GMOs</td>
<td>0.12</td>
<td>1314</td>
<td>0.000</td>
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<tr>
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<td>Genetic Engineering</td>
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<td>1314</td>
<td>0.010</td>
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<td>Genetic Modification</td>
<td>0.11</td>
<td>1314</td>
<td>0.000</td>
</tr>
<tr>
<td>Eating exp</td>
<td>Bio-Designed</td>
<td>Genetically designed</td>
<td>0.11</td>
<td>1314</td>
<td>0.001</td>
</tr>
<tr>
<td>Eating exp</td>
<td>All other statements</td>
<td>Not Produced with GMOs</td>
<td>0.11</td>
<td>1314</td>
<td>0.000</td>
</tr>
</tbody>
</table>
Table 2 - Differences in GMO Knowledge

Average ratings of consumer self-rated GMO knowledge and quantified knowledge based on accuracy of answer (N=1325 for total convenience sample)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Pr &gt;</th>
<th>t</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Self rated knowledge</td>
<td>2.89</td>
<td>1.36</td>
<td>1.00</td>
<td>6.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantified knowledge</td>
<td>2.42</td>
<td>1.38</td>
<td>1.00</td>
<td>6.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Estimated mean diff

| Self-rated - Quantified | 0.37 | 1.77 | -4.00 | 5.00 | <.0001 |

Note: The average ratings of both consumer self-rated GMO knowledge and quantified knowledge were compared. The estimated difference was received as 0.37. Based on a standard deviation of 1.0, and ~189 subjects per group, an estimate difference greater than 0.30 was considered significant. Statistically significant p-values < 0.05

Table 3 - Education and Eating Habits

Significance in adjusted p-values using Tukey Kramer adjustment for multiple comparisons. Means for education, eating habits

<table>
<thead>
<tr>
<th>Variable</th>
<th>DF</th>
<th>Level</th>
<th>LSMEAN</th>
<th>StdErr</th>
<th>Pr &gt;</th>
<th>t</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
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<td>1</td>
<td>0.29</td>
<td>0.30</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>0.45</td>
<td>0.12</td>
<td>0.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>0.07</td>
<td>0.12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0.29</td>
<td>0.15</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>-0.22</td>
<td>0.13</td>
<td>0.59</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>0.15</td>
<td>0.20</td>
<td>0.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>0.01</td>
<td>0.37</td>
<td>0.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>-0.08</td>
<td>0.50</td>
<td>0.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>-0.49</td>
<td>0.57</td>
<td>0.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eating habits</td>
<td>4</td>
<td>1</td>
<td>-0.79</td>
<td>0.40</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>-0.25</td>
<td>0.18</td>
<td>0.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>-0.03</td>
<td>0.14</td>
<td>0.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0.24</td>
<td>0.11</td>
<td>0.85</td>
<td></td>
<td></td>
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<td>5</td>
<td>1.10</td>
<td>0.14</td>
<td></td>
<td>&lt;.0001</td>
<td></td>
</tr>
</tbody>
</table>

Note: Covariates education and eating habits were significant in their influence in the estimated difference between self-rated GMO knowledge and quantified knowledge. For education, 1=Less than high school, 2=High school graduate, 3=Some college, 4=2 year degree, 5=4 year degree, 6=Masters degree, 7=Professional degree, 8=Doctorate, 9=Other. For eating habits, 1=Very unhealthy, 2=Somewhat unhealthy, 3=Neither healthy nor unhealthy, 4=Somewhat healthy, 5= Very healthy. P-values <.05 are considered statistically significant.
Table 4 - Statement-Food Comparisons by Food

Table showing comprehensive list of significant pairwise comparisons for label-food pairings for all food items.

<table>
<thead>
<tr>
<th>Question</th>
<th>Food_Item</th>
<th>Label_Statement1</th>
<th>Label_Statement2</th>
<th>Estimate</th>
<th>StdErr</th>
<th>Adj P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pos/Neg</td>
<td>Apples</td>
<td>Bio-designed</td>
<td>Bioengineered</td>
<td>1.23</td>
<td>0.29</td>
<td>0.00</td>
</tr>
<tr>
<td>Dislike/Like</td>
<td>Apples</td>
<td>Bio-designed</td>
<td>Bioengineered</td>
<td>1.12</td>
<td>0.29</td>
<td>0.02</td>
</tr>
<tr>
<td>Purchase</td>
<td>Apples</td>
<td>Bio-designed</td>
<td>Bioengineered</td>
<td>0.53</td>
<td>0.15</td>
<td>0.05</td>
</tr>
<tr>
<td>Purchase</td>
<td>Veg Oil</td>
<td>Bio-designed</td>
<td>Genetic Engineering</td>
<td>0.72</td>
<td>0.15</td>
<td>0.00</td>
</tr>
<tr>
<td>Purchase</td>
<td>Veg Oil</td>
<td>Bioengineered</td>
<td>Genetic Engineering</td>
<td>0.54</td>
<td>0.15</td>
<td>0.04</td>
</tr>
<tr>
<td>Purchase</td>
<td>Wheat Bread</td>
<td>Bio-designed</td>
<td>Bioengineered</td>
<td>0.55</td>
<td>0.15</td>
<td>0.04</td>
</tr>
<tr>
<td>Purchase</td>
<td>Wheat Bread</td>
<td>Bio-designed</td>
<td>Genetic Biotechnology</td>
<td>0.61</td>
<td>0.15</td>
<td>0.01</td>
</tr>
<tr>
<td>Price</td>
<td>Rice</td>
<td>Bio-designed</td>
<td>Bioengineered</td>
<td>0.52</td>
<td>0.14</td>
<td>0.04</td>
</tr>
<tr>
<td>Price</td>
<td>Rice</td>
<td>Bio-designed</td>
<td>Genetic Engineering</td>
<td>0.74</td>
<td>0.14</td>
<td>0.00</td>
</tr>
<tr>
<td>Price</td>
<td>Veg Oil</td>
<td>Bio-designed</td>
<td>Genetic Engineering</td>
<td>0.52</td>
<td>0.14</td>
<td>0.04</td>
</tr>
<tr>
<td>Nutrition</td>
<td>Wheat Bread</td>
<td>Bio-designed</td>
<td>Bioengineered</td>
<td>0.56</td>
<td>0.14</td>
<td>0.01</td>
</tr>
<tr>
<td>Nutrition</td>
<td>Wheat Bread</td>
<td>Bio-designed</td>
<td>Genetic Engineering</td>
<td>0.55</td>
<td>0.14</td>
<td>0.02</td>
</tr>
<tr>
<td>Healthful</td>
<td>Wheat Bread</td>
<td>Bio-designed</td>
<td>Bioengineered</td>
<td>0.58</td>
<td>0.14</td>
<td>0.02</td>
</tr>
<tr>
<td>Healthful</td>
<td>Wheat Bread</td>
<td>Bio-designed</td>
<td>Genetic Biotechnology</td>
<td>0.63</td>
<td>0.14</td>
<td>0.00</td>
</tr>
<tr>
<td>Healthful</td>
<td>Wheat Bread</td>
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<td>Genetic Engineering</td>
<td>0.60</td>
<td>0.14</td>
<td>0.01</td>
</tr>
<tr>
<td>Quality</td>
<td>Wheat Bread</td>
<td>Bio-designed</td>
<td>Genetic Biotechnology</td>
<td>0.55</td>
<td>0.14</td>
<td>0.03</td>
</tr>
<tr>
<td>Environ impact</td>
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<td>Bioengineered</td>
<td>0.57</td>
<td>0.14</td>
<td>0.01</td>
</tr>
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<td>Genetic Biotechnology</td>
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<td>0.00</td>
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<td>Bioengineered</td>
<td>0.54</td>
<td>0.14</td>
<td>0.02</td>
</tr>
<tr>
<td>Eating exp</td>
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<td>Genetic Biotechnology</td>
<td>0.52</td>
<td>0.14</td>
<td>0.03</td>
</tr>
<tr>
<td>Eating exp</td>
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<td>Genetic Engineering</td>
<td>0.53</td>
<td>0.14</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Note: This table only includes statements affirming the presence of GM material. Not Produced with GMOs is not included among these comparisons. The “Estimate” column shows the average difference between ratings for Label_Statement1 and Label_Statement2 for that respective question (leftmost column). Positive estimate values indicate the label listed under Label_Statement1 received higher average ratings than the label listed under Label_Statement2. Only the significant and near significant comparisons are listed. Significance: p-value < 0.05
Table 5 - Statement-Food Comparisons by Statement

Table showing comprehensive list of significant differences among food items with the same disclosure statement.

<table>
<thead>
<tr>
<th>Question</th>
<th>Label Statement</th>
<th>Food_item1</th>
<th>Food_item2</th>
<th>Estimate</th>
<th>StdErr</th>
<th>DF</th>
<th>Adj P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neg/Pos</td>
<td>Bioengineered</td>
<td>Apples</td>
<td>Veg Oil</td>
<td>-1.56</td>
<td>0.29</td>
<td>2579</td>
<td>0.00</td>
</tr>
<tr>
<td>Neg/Pos</td>
<td>Bioengineered</td>
<td>Veg Oil</td>
<td>Wheat Bread</td>
<td>1.29</td>
<td>0.29</td>
<td>2579</td>
<td>0.00</td>
</tr>
<tr>
<td>Neg/Pos</td>
<td>Bioengineered</td>
<td>Salmon</td>
<td>Veg Oil</td>
<td>-1.14</td>
<td>0.29</td>
<td>2579</td>
<td>0.02</td>
</tr>
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<td>Veg Oil</td>
<td>Wheat Bread</td>
<td>1.48</td>
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<td>2579</td>
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</tr>
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<td>Salmon</td>
<td>Veg Oil</td>
<td>-1.07</td>
<td>0.29</td>
<td>2579</td>
<td>0.05</td>
</tr>
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<td>Unfavor/Favor</td>
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<td>Apples</td>
<td>Veg Oil</td>
<td>-1.49</td>
<td>0.30</td>
<td>2587</td>
<td>0.00</td>
</tr>
<tr>
<td>Unfavor/Favor</td>
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<td>Veg Oil</td>
<td>Wheat Bread</td>
<td>1.26</td>
<td>0.30</td>
<td>2587</td>
<td>0.01</td>
</tr>
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<td>Salmon</td>
<td>Veg Oil</td>
<td>-1.12</td>
<td>0.29</td>
<td>2587</td>
<td>0.03</td>
</tr>
<tr>
<td>Unfavor/Favor</td>
<td>Genetic Biotechnology</td>
<td>Veg Oil</td>
<td>Wheat Bread</td>
<td>1.55</td>
<td>0.30</td>
<td>2587</td>
<td>0.00</td>
</tr>
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<td>Apples</td>
<td>Veg Oil</td>
<td>-1.22</td>
<td>0.30</td>
<td>2587</td>
<td>0.01</td>
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<td>Unfavor/Favor</td>
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<td>Salmon</td>
<td>Veg Oil</td>
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<td>0.30</td>
<td>2587</td>
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<td>2587</td>
<td>0.00</td>
</tr>
<tr>
<td>Dislike/Like</td>
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<td>Veg Oil</td>
<td>Wheat Bread</td>
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<td>0.29</td>
<td>2587</td>
<td>0.00</td>
</tr>
<tr>
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<td>Veg Oil</td>
<td>-1.19</td>
<td>0.29</td>
<td>2587</td>
<td>0.01</td>
</tr>
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<td>Wheat Bread</td>
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<td>0.00</td>
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<td>Veg Oil</td>
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<td>2583</td>
<td>0.00</td>
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<td>Veg Oil</td>
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<td>0.15</td>
<td>2583</td>
<td>0.02</td>
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<tr>
<td>Eating exp</td>
<td>Bioengineered</td>
<td>Veg Oil</td>
<td>Wheat Bread</td>
<td>0.67</td>
<td>0.14</td>
<td>2583</td>
<td>0.00</td>
</tr>
<tr>
<td>Eating exp</td>
<td>Bioengineered</td>
<td>Apples</td>
<td>Veg Oil</td>
<td>-0.60</td>
<td>0.14</td>
<td>2583</td>
<td>0.00</td>
</tr>
<tr>
<td>Eating exp</td>
<td>Genetic Biotechnology</td>
<td>Veg Oil</td>
<td>Wheat Bread</td>
<td>0.53</td>
<td>0.14</td>
<td>2583</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Note: For this table, the “Estimate” column shows the average difference between ratings for Food_item1 and Food_item2 for that respective question (leftmost column). Positive estimate values indicate the food item listed under Food_item1 received higher average consumer ratings than the food item listed under Food_item2. Negative estimates indicate that the average ratings for the food item listed under Food_item1 received lower average ratings than the food item listed under Food_item2. Only the significant and near significant food comparisons are listed. Statistical significance is p-value < 0.05.
Table 6 - Purchase Likelihood Comparisons

Table showing comprehensive list of significant differences among food items with the same disclosure statement.

<table>
<thead>
<tr>
<th>Question</th>
<th>Label_Statement</th>
<th>Food_Item1</th>
<th>Food_Item2</th>
<th>Estimate</th>
<th>StErr</th>
<th>DF</th>
<th>Adj P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase</td>
<td>Bio-designed</td>
<td>APL</td>
<td>WHT</td>
<td>0.83</td>
<td>0.19</td>
<td>1055</td>
<td>0.01</td>
</tr>
<tr>
<td>Purchase</td>
<td>No Label Statement</td>
<td>APL</td>
<td>SAL</td>
<td>0.86</td>
<td>0.20</td>
<td>1055</td>
<td>0.03</td>
</tr>
<tr>
<td>Purchase</td>
<td>No Label Statement</td>
<td>APL</td>
<td>WHT</td>
<td>1.52</td>
<td>0.19</td>
<td>1055</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Purchase</td>
<td>Not Produced with GMOs</td>
<td>APL</td>
<td>WHT</td>
<td>0.78</td>
<td>0.19</td>
<td>1055</td>
<td>0.01</td>
</tr>
<tr>
<td>Purchase</td>
<td>Produced with GMO's</td>
<td>APL</td>
<td>WHT</td>
<td>0.85</td>
<td>0.18</td>
<td>1055</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: Adjusted p-values (Adj P) give the measure of significance for the comparison between Food_Item1 and Food_Item2 for the Label_Statement listed in the leftmost column. The “Estimate” column gives differences between foods listed under Food_Item1 and Food_Item2, respectively. Positive values indicate estimate average ratings for foods listed under Food_Item1 were greater than those for foods listed under Food_Item2. This table gives values for the average ratings for significant pairings for the purchase likelihood question only, where 1 = Extremely unlikely, 2 = Very unlikely, 3 = Moderately unlikely, 4 = Slightly unlikely, 5 = Neither likely nor unlikely, 6 = Slightly likely, 7 = Moderately likely, 8 = Very likely, 9 = Extremely likely.
Table 7 – Average Ratings of 7 Statements

Least squares means of average ratings from dependent variable responses categorized by disclosure statement (N=1325 for total convenience sample, or 189 per statement) p = 0.05. Standard error included below ratings.

<table>
<thead>
<tr>
<th>Survey Questions</th>
<th>Genetic engineering</th>
<th>Genetic modification</th>
<th>Genetic biotechnology</th>
<th>Genetically designed</th>
<th>Biodesigned</th>
<th>Bio engineered</th>
<th>Not produced with GMOs</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pos/Neg</td>
<td>2.60 (0.19)</td>
<td>2.78 (0.19)</td>
<td>2.89 (0.19)</td>
<td>2.79 (0.19)</td>
<td>3.57 (0.19)</td>
<td>3.24 (0.19)</td>
<td>5.27 (0.19)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Dislike/Like</td>
<td>2.44 (0.18)</td>
<td>2.67 (0.18)</td>
<td>2.71 (0.18)</td>
<td>2.66 (0.18)</td>
<td>3.43 (0.19)</td>
<td>3.05 (0.19)</td>
<td>5.18 (0.18)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Unfav/Fav</td>
<td>2.58 (0.19)</td>
<td>2.70 (0.19)</td>
<td>2.85 (0.18)</td>
<td>2.85 (0.19)</td>
<td>3.52 (0.19)</td>
<td>3.18 (0.19)</td>
<td>5.27 (0.19)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Purchase</td>
<td>2.29 (0.09)</td>
<td>2.32 (0.10)</td>
<td>2.42 (0.09)</td>
<td>2.27 (0.10)</td>
<td>2.79 (0.10)</td>
<td>2.57 (0.10)</td>
<td>3.82 (0.10)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Price</td>
<td>3.12 (0.09)</td>
<td>2.99 (0.10)</td>
<td>3.14 (0.09)</td>
<td>3.07 (0.10)</td>
<td>3.42 (0.10)</td>
<td>3.34 (0.10)</td>
<td>3.82 (0.10)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Safety</td>
<td>2.62 (0.10)</td>
<td>2.44 (0.10)</td>
<td>2.61 (0.10)</td>
<td>2.52 (0.10)</td>
<td>2.93 (0.10)</td>
<td>2.61 (0.10)</td>
<td>3.71 (0.10)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Nutrition</td>
<td>2.61 (0.09)</td>
<td>2.59 (0.10)</td>
<td>2.75 (0.09)</td>
<td>2.51 (0.10)</td>
<td>3.00 (0.10)</td>
<td>2.80 (0.10)</td>
<td>3.54 (0.10)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Healthful</td>
<td>2.56 (0.10)</td>
<td>2.49 (0.10)</td>
<td>2.58 (0.10)</td>
<td>2.50 (0.10)</td>
<td>2.92 (0.10)</td>
<td>2.65 (0.10)</td>
<td>3.78 (0.10)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Quality</td>
<td>2.65 (0.09)</td>
<td>2.54 (0.10)</td>
<td>2.83 (0.10)</td>
<td>2.62 (0.10)</td>
<td>3.00 (0.10)</td>
<td>2.86 (0.10)</td>
<td>3.65 (0.10)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Fair trade</td>
<td>2.65 (0.09)</td>
<td>2.62 (0.10)</td>
<td>2.73 (0.09)</td>
<td>2.61 (0.10)</td>
<td>2.97 (0.10)</td>
<td>2.87 (0.10)</td>
<td>3.48 (0.09)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Environ impact</td>
<td>2.85 (0.10)</td>
<td>2.78 (0.10)</td>
<td>2.80 (0.10)</td>
<td>2.84 (0.10)</td>
<td>3.07 (0.10)</td>
<td>2.90 (0.10)</td>
<td>3.56 (0.10)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Eating exp</td>
<td>2.60 (0.09)</td>
<td>2.50 (0.10)</td>
<td>2.70 (0.09)</td>
<td>2.54 (0.10)</td>
<td>2.99 (0.10)</td>
<td>2.70 (0.10)</td>
<td>3.66 (0.09)</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

Note: The average ratings of each dependent variable was calculated using either an 8-pt or 5-pt discreet scale. Attitude questions (Negative/Positive, Dislike/Like, Unfavorable/Favorable) were scored on an 8-pt scale where 0 indicated an attitude of negative, dislike, or unfavorable, and 7 indicated positive, like or favorable. All other dependent variables were scored on a 5-pt scale where 1 = Greatly decrease, 2 = Somewhat decrease, 3 = Stay the same, 4 = Somewhat increase, 5 = Greatly increase. Each statement received scores from ~189 survey participants. The difference between average ratings of statements was statistically significant regarding each dependent variable with a p-value of <.0001. Standard error included under ratings in parenthesis.
Table 8 – Average Ratings for Apples

Least squares means of average ratings for dependent variable ratings per disclosure statement, displaying results for Apples only. (N=2624 for total convenience sample, n=104 per group) Standard error included under estimates in parenthesis.

<table>
<thead>
<tr>
<th>Disclosure Statement</th>
<th>Bio-designed</th>
<th>Bio-engineered</th>
<th>Not produced with GMOs</th>
<th>Genetic biotechnology</th>
<th>Genetic engineering</th>
<th>Adj P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>Question</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apple</td>
<td>Pos/Neg</td>
<td>4.08</td>
<td>2.85</td>
<td>5.58</td>
<td>3.64</td>
<td>3.46</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.27)</td>
<td>(0.28)</td>
<td>(0.28)</td>
<td>(0.28)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dislike/Like</td>
<td>3.78</td>
<td>2.72</td>
<td>5.44</td>
<td>3.35</td>
<td>3.53</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.26)</td>
<td>(0.27)</td>
<td>(0.27)</td>
<td>(0.27)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unfavour/Fav</td>
<td>2.7</td>
<td>2.17</td>
<td>3.81</td>
<td>2.53</td>
<td>2.41</td>
</tr>
<tr>
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<td></td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.12)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Purchase</td>
<td>3.57</td>
<td>3.38</td>
<td>3.95</td>
<td>3.52</td>
<td>3.35</td>
</tr>
<tr>
<td></td>
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<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Price</td>
<td>2.98</td>
<td>2.72</td>
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<td>2.7</td>
<td>2.72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Safety</td>
<td>2.96</td>
<td>2.75</td>
<td>3.53</td>
<td>2.93</td>
<td>2.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nutrition</td>
<td>3.03</td>
<td>2.67</td>
<td>3.82</td>
<td>2.85</td>
<td>2.69</td>
</tr>
<tr>
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<td></td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.12)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Healthful</td>
<td>2.99</td>
<td>2.76</td>
<td>3.58</td>
<td>3.01</td>
<td>2.58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td>2.82</td>
<td>2.83</td>
<td>3.37</td>
<td>2.77</td>
<td>2.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fair trade</td>
<td>3.05</td>
<td>3.02</td>
<td>3.48</td>
<td>2.94</td>
<td>2.95</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environ impact</td>
<td>2.85</td>
<td>2.52</td>
<td>3.59</td>
<td>2.72</td>
<td>2.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td></td>
</tr>
</tbody>
</table>

Note: The average ratings of each dependent variable was calculated using either an 8-pt or 5-pt discreet scale. Attitude questions (Negative/Positive, Dislike/Like, Unfavorable/Favorable) were scored on an 8-pt scale where 0 indicated an attitude of negative, dislike, or unfavorable, and 7 indicated positive, like or favorable. All other dependent variables were scored on a 5-pt scale where 1 = Greatly decrease, 2 = Somewhat decrease, 3 = Stay the same, 4 = Somewhat increase, 5 = Greatly increase. Each statement received scores from ~189 survey participants. The difference between average ratings of statements was statistically significant regarding each dependent variable with a p-value of <.0001. Standard error included under ratings in parenthesis.
### Table 9 – Average Ratings for Rice

Least squares means of average ratings for dependent variable ratings per disclosure statement, displaying results for Rice only. (N=2624 for total convenience sample, n=104 per group) Standard error included under estimates in parenthesis.

<table>
<thead>
<tr>
<th>Food</th>
<th>Question</th>
<th>Disclosure Statement</th>
<th>Adj P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Bio-designed</td>
<td>Bio engineered</td>
</tr>
<tr>
<td>Rice</td>
<td>Pos/Neg</td>
<td>4.06</td>
<td>3.71</td>
</tr>
<tr>
<td></td>
<td>Dislike/Like</td>
<td>3.93</td>
<td>3.67</td>
</tr>
<tr>
<td></td>
<td>Unfav/Fav</td>
<td>3.96</td>
<td>3.62</td>
</tr>
<tr>
<td></td>
<td>Purchase</td>
<td>2.81</td>
<td>2.55</td>
</tr>
<tr>
<td></td>
<td>Price</td>
<td>3.74</td>
<td>3.22</td>
</tr>
<tr>
<td></td>
<td>Safety</td>
<td>2.99</td>
<td>2.69</td>
</tr>
<tr>
<td></td>
<td>Nutrition</td>
<td>3.21</td>
<td>2.94</td>
</tr>
<tr>
<td></td>
<td>Healthful</td>
<td>3.15</td>
<td>2.88</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td>3.08</td>
<td>2.83</td>
</tr>
<tr>
<td></td>
<td>Fair trade</td>
<td>2.91</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td>Environ impact</td>
<td>3.36</td>
<td>2.79</td>
</tr>
<tr>
<td></td>
<td>Eating exp</td>
<td>2.97</td>
<td>2.75</td>
</tr>
</tbody>
</table>

Note: The average ratings of each dependent variable was calculated using either an 8-pt or 5-pt discreet scale. Attitude questions (Negative/Positive, Dislike/Like, Unfavorable/Favorable) were scored on an 8-pt scale where 0 indicated an attitude of negative, dislike, or unfavorable, and 7 indicated positive, like or favorable. All other dependent variables were scored on a 5-pt scale where 1 = Greatly decrease, 2 = Somewhat decrease, 3 = Stay the same, 4 = Somewhat increase, 5 = Greatly increase. Each statement received scores from ~189 survey participants. The difference between average ratings of statements was statistically significant regarding each dependent variable with a p-value of <.0001. Standard error included under ratings in parenthesis.
Table 10 – Average Ratings for Salmon

Least squares means of average ratings for dependent variable ratings per disclosure statement, displaying results for Salmon only. (N=2624 for total convenience sample, n=104 per group) Standard error included under estimates in parenthesis.

<table>
<thead>
<tr>
<th>Food</th>
<th>Question</th>
<th>Bio-designed</th>
<th>Bio engineered</th>
<th>Not produced with GMOs</th>
<th>Genetic biotechnology</th>
<th>Genetic engineering</th>
<th>Adj P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salmon</td>
<td>Pos/Neg</td>
<td>3.82</td>
<td>3.26</td>
<td>5.62</td>
<td>3.62</td>
<td>3.77</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.28</td>
<td>0.28</td>
<td>0.27</td>
<td>0.28</td>
<td>0.28</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.66</td>
<td>3.14</td>
<td>5.5</td>
<td>3.55</td>
<td>3.51</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dislike/Like</td>
<td>0.27</td>
<td>0.27</td>
<td>0.26</td>
<td>0.27</td>
<td>0.27</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.6</td>
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<td>5.55</td>
<td>3.47</td>
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</tr>
<tr>
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<td>Unfav/Fav</td>
<td>0.27</td>
<td>0.28</td>
<td>0.27</td>
<td>0.27</td>
<td>0.27</td>
<td>&lt;.0001</td>
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<td>2.66</td>
<td>2.39</td>
<td>3.94</td>
<td>2.53</td>
<td>2.49</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Purchase</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.23</td>
<td>2.77</td>
<td>4.11</td>
<td>3.21</td>
<td>3.02</td>
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</tr>
<tr>
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<td>Price</td>
<td>0.11</td>
<td>0.10</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.84</td>
<td>2.66</td>
<td>3.86</td>
<td>2.78</td>
<td>2.74</td>
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</tr>
<tr>
<td></td>
<td>Safety</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>Nutrition</td>
<td>2.95</td>
<td>2.81</td>
<td>3.77</td>
<td>2.82</td>
<td>2.72</td>
<td></td>
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<td>0.12</td>
<td>0.12</td>
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</tr>
<tr>
<td></td>
<td>Healthful</td>
<td>2.87</td>
<td>2.66</td>
<td>3.96</td>
<td>2.81</td>
<td>2.68</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
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<td>3.79</td>
<td>2.78</td>
<td>2.71</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fair trade</td>
<td>2.99</td>
<td>2.76</td>
<td>3.74</td>
<td>2.7</td>
<td>2.73</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environ impact</td>
<td>3.14</td>
<td>3.05</td>
<td>3.7</td>
<td>3.02</td>
<td>2.93</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eating exp</td>
<td>2.7</td>
<td>2.64</td>
<td>3.73</td>
<td>2.66</td>
<td>2.56</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.12</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.12</td>
<td></td>
</tr>
</tbody>
</table>

Note: The average ratings of each dependent variable was calculated using either an 8-pt or 5-pt discreet scale. Attitude questions (Negative/Positive, Dislike/Like, Unfavorable/Favorable) were scored on an 8-pt scale where 0 indicated an attitude of negative, dislike, or unfavorable, and 7 indicated positive, like or favorable. All other dependent variables were scored on a 5-pt scale where 1 = Greatly decrease, 2 = Somewhat decrease, 3 = Stay the same, 4 = Somewhat increase, 5 = Greatly increase. Each statement received scores from ~189 survey participants. The difference between average ratings of statements was statistically significant regarding each dependent variable with a p-value of <.0001. Standard error included under ratings in parenthesis.
Table 11 – Average Ratings for Vegetable Oil

Least squares means of average ratings for dependent variable ratings per disclosure statement, displaying results for Vegetable Oil only. (N=2624 for total convenience sample, n=104 per group) Standard error included under estimates in parenthesis.

<table>
<thead>
<tr>
<th>Food</th>
<th>Question</th>
<th>Disclosure Statement</th>
<th>Adj P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetable Oil</td>
<td>Pos/Neg</td>
<td>Bio-designed 4.7, Bio engineered 4.41, Not produced with GMOs 5.87, Genetic biotechnology 4.69, Genetic engineering 3.72</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>Dislike/Like</td>
<td>4.62, 4.33, 5.55, 4.47, 3.77</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unfav/Fav</td>
<td>0.27, 0.27, 0.27, 0.27, 0.27</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>Purchase</td>
<td>5.87, 4.41, 3.92, 2.88, 2.42</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>Price</td>
<td>3.14, 2.96, 3.92, 2.88, 2.42</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>Safety</td>
<td>3.14, 3.11, 3.68, 3.08, 2.69</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>Nutrition</td>
<td>0.12, 0.12, 0.12, 0.12, 0.12</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>Healthful</td>
<td>3.24, 3.04, 3.88, 3.13, 2.84</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td>3.18, 3.07, 3.71, 3.08, 2.87</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>Fair trade</td>
<td>0.11, 0.11, 0.11, 0.11, 0.11</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>Environ</td>
<td>3.15, 3.05, 3.49, 2.95, 2.88</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>impact</td>
<td>3.38, 3.17, 3.67, 3.2, 2.91</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>Eating exp</td>
<td>0.11, 0.11, 0.11, 0.11, 0.11</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

Note: The average ratings of each dependent variable was calculated using either an 8-pt or 5-pt discreet scale. Attitude questions (Negative/Positive, Dislike/Like, Unfavorable/Favorable) were scored on an 8-pt scale where 0 indicated an attitude of negative, dislike, or unfavorable, and 7 indicated positive, like or favorable. All other dependent variables were scored on a 5-pt scale where 1 = Greatly decrease, 2 = Somewhat decrease, 3 = Stay the same, 4 = Somewhat increase, 5 = Greatly increase. Each statement received scores from ~189 survey participants. The difference between average ratings of statements was statistically significant regarding each dependent variable with a p-value of <.0001. Standard error included under ratings in parenthesis.
Table 12 – Average Ratings for Wheat Bread

Least squares means of average ratings for dependent variable ratings per disclosure statement, displaying results for Wheat Bread only. (N=2624 for total convenience sample, n=104 per group) Standard error included under estimates in parenthesis.

<table>
<thead>
<tr>
<th>Disclosed Statement</th>
<th>Disclosure</th>
<th>Bio-designed</th>
<th>Bio engineered</th>
<th>Not produced with GMOs</th>
<th>Genetic biotechnology</th>
<th>Genetic engineering</th>
<th>Adj P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat Bread</td>
<td>Pos/Neg</td>
<td>3.95</td>
<td>3.12</td>
<td>5.43</td>
<td>3.21</td>
<td>3.22</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.28</td>
<td>0.28</td>
<td>0.28</td>
<td>0.28</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dislike/Like</td>
<td>3.87</td>
<td>2.84</td>
<td>5.26</td>
<td>3.08</td>
<td>3.16</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.27</td>
<td>0.27</td>
<td>0.27</td>
<td>0.27</td>
<td>0.26</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unfavor/Favor</td>
<td>3.83</td>
<td>2.95</td>
<td>5.27</td>
<td>3.02</td>
<td>3.14</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.27</td>
<td>0.27</td>
<td>0.27</td>
<td>0.27</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Purchase</td>
<td>2.76</td>
<td>2.21</td>
<td>3.66</td>
<td>2.15</td>
<td>2.25</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.12</td>
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<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Price</td>
<td>3.69</td>
<td>3.19</td>
<td>3.81</td>
<td>3.31</td>
<td>3.21</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Safety</td>
<td>3.03</td>
<td>2.77</td>
<td>3.62</td>
<td>2.52</td>
<td>2.62</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nutrition</td>
<td>3.31</td>
<td>2.74</td>
<td>3.58</td>
<td>2.8</td>
<td>2.76</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Healthful</td>
<td>3.26</td>
<td>2.69</td>
<td>3.77</td>
<td>2.63</td>
<td>2.66</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td>3.14</td>
<td>2.67</td>
<td>3.45</td>
<td>2.59</td>
<td>2.64</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.11</td>
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<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
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</tr>
<tr>
<td></td>
<td>Fair trade</td>
<td>2.96</td>
<td>2.63</td>
<td>3.42</td>
<td>2.69</td>
<td>2.56</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environ impact</td>
<td>3.33</td>
<td>3.01</td>
<td>3.44</td>
<td>2.65</td>
<td>2.85</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.11</td>
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<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eating exp</td>
<td>2.99</td>
<td>2.45</td>
<td>3.47</td>
<td>2.47</td>
<td>2.46</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td></td>
</tr>
</tbody>
</table>

Note: The average ratings of each dependent variable was calculated using either an 8-pt or 5-pt discreet scale. Attitude questions (Negative/Positive, Dislike/Like, Unfavorable/Favorable) were scored on an 8-pt scale where 0 indicated an attitude of negative, dislike, or unfavorable, and 7 indicated positive, like or favorable. All other dependent variables were scored on a 5-pt scale where 1 = Greatly decrease, 2 = Somewhat decrease, 3 = Stay the same, 4 = Somewhat increase, 5 = Greatly increase. Each statement received scores from ~189 survey participants. The difference between average ratings of statements was statistically significant regarding each dependent variable with a p-value of <.0001. Standard error included under ratings in parenthesis.
Table 13 - Statement-Food Interaction for Purchase Likelihood

Table showing Fixed Effect Test where the Food_Item*Label_Statement interaction for purchase likelihood was significant. (n = 106, N=534 total number of panelists).

<table>
<thead>
<tr>
<th>Effect</th>
<th>DF</th>
<th>DF</th>
<th>F Vale</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>How_feel</td>
<td>1.00</td>
<td>1055.00</td>
<td>6.02</td>
<td>0.01</td>
</tr>
<tr>
<td>How_often</td>
<td>1.00</td>
<td>1055.00</td>
<td>6.60</td>
<td>0.01</td>
</tr>
<tr>
<td>How_purchase</td>
<td>1.00</td>
<td>1055.00</td>
<td>36.22</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Food_Item</td>
<td>2.00</td>
<td>1055.00</td>
<td>43.90</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Label_Statement</td>
<td>4.00</td>
<td>529.00</td>
<td>3.44</td>
<td>0.01</td>
</tr>
<tr>
<td>Food_Item*Label_Statement</td>
<td>8.00</td>
<td>1055.00</td>
<td>2.45</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Note: Responses to questions were scored via a 9-point hedonic scale where 1 = Extremely unlikely, 2 = Very unlikely, 3 = Moderately unlikely, 4 = Slightly unlikely, 5 = Neither likely nor unlikely, 6 = Slightly likely, 7 = Moderately likely, 8 = Very likely, 9 = Extremely likely.

Table 14 - Purchase Likelihood Average Ratings

Estimate means of Food*Statement Interaction in BYU sensory panel data. (n = 106, N=534 total number of panelists).

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Bio-designed</th>
<th>Bioengineered</th>
<th>No Label statement</th>
<th>Not Produced with GMOs</th>
<th>Produced with GMOs</th>
<th>Standard Error</th>
<th>DF</th>
<th>Pr &gt;</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>APL</td>
<td>7.12</td>
<td>6.78</td>
<td>7.45</td>
<td>7.40</td>
<td>6.78</td>
<td>0.19</td>
<td>1055</td>
<td>&lt;.0001</td>
<td></td>
</tr>
<tr>
<td>SAL</td>
<td>6.90</td>
<td>6.39</td>
<td>6.59</td>
<td>7.18</td>
<td>6.51</td>
<td>0.20</td>
<td>1055</td>
<td>&lt;.0001</td>
<td></td>
</tr>
<tr>
<td>WHT</td>
<td>6.29</td>
<td>6.40</td>
<td>5.93</td>
<td>6.62</td>
<td>5.93</td>
<td>0.19</td>
<td>1055</td>
<td>&lt;.0001</td>
<td></td>
</tr>
</tbody>
</table>

Note: the significant statement-food item interactions are listed with their estimates above. In this table, the Estimate column values are the average ratings for those pairings for the purchase likelihood question only, where 1 = Extremely unlikely, 2 = Very unlikely, 3 = Moderately unlikely, 4 = Slightly unlikely, 5 = Neither likely nor unlikely, 6 = Slightly likely, 7 = Moderately likely, 8 = Very likely, 9 = Extremely likely.
APPENDIX B: SENSORY BALLOTS

Your Name___________________

Signature___________________ (Sign after reading consent form)

Welcome to the Food Science Sensory Laboratory. A copy of the form titled “Consent to Be a Research Subject” is posted in each booth. Please read it carefully before continuing. By signing your name above, you acknowledge that you have read and understand the consent form, and desire of your own free will and volition to participate in this study. Please inform the receptionist if you wish to withdraw.

In this session, you will evaluate THREE food items: Smoked Salmon, Gala Apples, and Wheat Bread one-at-a-time in a random order. Each of these foods will contain a label statement. Please read all instructions and questions carefully.

* What is your age category?
  ○ Under 18 years
  ○ 18 - 24 years
  ○ 25- 34 years
  ○ 35- 44 years
  ○ 45 - 54 years
  ○ 55 years or older

* What is your gender?
  ○ Female
  ○ Male

Locate the set of lights to the right of the computer screen and press the red button next to the green “READY” light to indicate that you are ready to receive your first sample. Please be patient; it will arrive shortly.

If at any time during the test you need any help, press the button by the “HELP” LIGHT to the right of the screen.

**DO NOT TASTE THE SAMPLE YET!**

...Please turn the page and continue…
Please write down which food (Smoked Salmon, Gala Apples, or Wheat Bread) you have received in the space provided below:

______________________________________________________________

DO NOT TASTE THE SAMPLE YET!
Please read answer the following questions carefully.

* What is your ATITUDE about this food?
  ○ I like it
  ○ I neither like nor dislike it
  ○ I dislike it

* How often do you eat ANY KIND of this food?
  ○ More than once a week
  ○ Once a week to every two weeks
  ○ Once every two weeks to once a month
  ○ Once a month to once every three months
  ○ Less than every three months

DO NOT TASTE THE SAMPLE YET.
You will first evaluate the APPEARANCE and AROMA.

...Please turn the page and continue…
This food contains the label statement:
“(insert statement here)”

Please read answer the following questions carefully.

* How much do you like or dislike the APPEARANCE of this food with the label statement “(insert statement here)”?

O Like extremely  
O Like very much  
O Like moderately  
O Like slightly  
O Neither like nor dislike  
O Dislike slightly  
O Dislike moderately  
O Dislike very much  
O Dislike extremely  

Please smell the sample before answering the next question. DO NOT taste it yet.

* How much do you like or dislike the AROMA of this food with the label statement “(insert statement here)”?

O Like extremely  
O Like very much  
O Like moderately  
O Like slightly  
O Neither like nor dislike  
O Dislike slightly  
O Dislike moderately  
O Dislike very much  
O Dislike extremely  

NOW TASTE THE SAMPLE.  
Use a bite of cracker and a sip of water between samples to refresh your sense of taste.

...Please turn the page and continue…
* How much do you like or dislike the **FLAVOR** of this food with the label statement “(insert statement here)”?

- O Like extremely
- O Like very much
- O Like moderately
- O Like slightly
- O Neither like nor dislike
- O Dislike slightly
- O Dislike moderately
- O Dislike very much
- O Dislike extremely

* How much do you like or dislike the **TEXTURE** of this food with the label statement “(insert statement here)”?

- O Like extremely
- O Like very much
- O Like moderately
- O Like slightly
- O Neither like nor dislike
- O Dislike slightly
- O Dislike moderately
- O Dislike very much
- O Dislike extremely

* How much do you like or dislike the **AFTERTASTE** of this food with the label statement “(insert statement here)”?

- O Like extremely
- O Like very much
- O Like moderately
- O Like slightly
- O Neither like nor dislike
- O Dislike slightly
- O Dislike moderately
- O Dislike very much
- O Dislike extremely

...Please turn the page and continue…
* How likely or unlikely would you be to **PURCHASE** this food with the label statement “(insert statement here)” if it was priced comparable to other similar products at the grocery store?

- Extremely likely
- Very likely
- Moderately likely
- Slightly likely
- Neither likely nor unlikely
- Slightly unlikely
- Moderately unlikely
- Very unlikely
- Extremely unlikely

**You will taste 3 food samples in a randomized order before finishing this test:** Gala Apples, Smoked Salmon, and Wheat Bread.

If you **HAVE NOT YET** received and tasted each of the 3 foods, please push your tray into the compartment and press the “**Next**” button to receive your next sample.

...Please turn the page and continue…
Please write down which food (Smoked Salmon, Gala Apples, or Wheat Bread) you have received in the space provided below:

____________________________________________________________________________________

DO NOT TASTE THE SAMPLE YET!

* What is your ATTITUDE about this food?
  ○ I like it
  ○ I neither like nor dislike it
  ○ I dislike it

* How often do you eat ANY KIND of this food?
  ○ More than once a week
  ○ Once a week to every two weeks
  ○ Once every two weeks to once a month
  ○ Once a month to once every three months
  ○ Less than every three months

DO NOT TASTE THE SAMPLE YET.
You will first evaluate the APPEARANCE and AROMA.

...Please turn the page and continue…
This food contains the label statement:
“(insert statement here)”

Please read the following questions carefully.

* How much do you like or dislike the **APPEARANCE** of this food with the label statement “(insert statement here)”?

   O Like extremely
   O Like very much
   O Like moderately
   O Like slightly
   O Neither like nor dislike
   O Dislike slightly
   O Dislike moderately
   O Dislike very much
   O Dislike extremely

Please smell the sample before answering the next question. **DO NOT** taste it yet.

* How much do you like or dislike the **AROMA** of this food with the label statement “(insert statement here)”?

   O Like extremely
   O Like very much
   O Like moderately
   O Like slightly
   O Neither like nor dislike
   O Dislike slightly
   O Dislike moderately
   O Dislike very much
   O Dislike extremely

**NOW TASTE THE SAMPLE.**
Use a bite of cracker and a sip of water between samples to refresh your sense of taste.

...Please turn the page and continue…
* How much do you like or dislike the **FLAVOR** of this food with the label statement “(insert statement here)”?

O Like extremely
O Like very much
O Like moderately
O Like slightly
O Neither like nor dislike
O Dislike slightly
O Dislike moderately
O Dislike very much
O Dislike extremely

* How much do you like or dislike the **TEXTURE** of this food with the label statement “(insert statement here)”?

O Like extremely
O Like very much
O Like moderately
O Like slightly
O Neither like nor dislike
O Dislike slightly
O Dislike moderately
O Dislike very much
O Dislike extremely

* How much do you like or dislike the **AFTERTASTE** of this food with the label statement “(insert statement here)”?

O Like extremely
O Like very much
O Like moderately
O Like slightly
O Neither like nor dislike
O Dislike slightly
O Dislike moderately
O Dislike very much
O Dislike extremely

...Please turn the page and continue…
* How likely or unlikely would you be to **PURCHASE** this food with the label statement “(insert statement here)” if it was priced comparable to other similar products at the grocery store?

- Extremely likely
- Very likely
- Moderately likely
- Slightly likely
- Neither likely nor unlikely
- Slightly unlikely
- Moderately unlikely
- Very unlikely
- Extremely unlikely

**You will taste 3 food samples in a randomized order before finishing this test:** Gala Apples, Smoked Salmon, and Wheat Bread.

If you **HAVE NOT YET** received and tasted each of the 3 foods, please push your tray into the compartment and press the “Next” button to receive your next sample.

...Please turn the page and continue…
Please write down which food (Smoked Salmon, Gala Apples, or Wheat Bread) you have received in the space provided below:

______________________________________

DO NOT TASTE THE SAMPLE YET!

* What is your ATTITUDE about this food?
  ○ I like it
  ○ I neither like nor dislike it
  ○ I dislike it

* How often do you eat ANY KIND of this food?
  ○ More than once a week
  ○ Once a week to every two weeks
  ○ Once every two weeks to once a month
  ○ Once a month to once every three months
  ○ Less than every three months

DO NOT TASTE THE SAMPLE YET.
You will first evaluate the APPEARANCE and AROMA.

...Please turn the page and continue…
This food contains the label statement:
“(insert statement here)”

Please read the following questions carefully.

* How much do you like or dislike the APPEARANCE of this food with the label statement “(insert statement here)”?

  O Like extremely
  O Like very much
  O Like moderately
  O Like slightly
  O Neither like nor dislike
  O Dislike slightly
  O Dislike moderately
  O Dislike very much
  O Dislike extremely

Please smell the sample before answering the next question. DO NOT taste it yet.

* How much do you like or dislike the AROMA of this food with the label statement “(insert statement here)”?

  O Like extremely
  O Like very much
  O Like moderately
  O Like slightly
  O Neither like nor dislike
  O Dislike slightly
  O Dislike moderately
  O Dislike very much
  O Dislike extremely

NOW TASTE THE SAMPLE.
Use a bite of cracker and a sip of water between samples to refresh your sense of taste.

...Please turn the page and continue…
* How much do you like or dislike the **FLAVOR** of this food with the label statement “(insert statement here)”?

O Like extremely  
O Like very much  
O Like moderately  
O Like slightly  
O Neither like nor dislike  
O Dislike slightly  
O Dislike moderately  
O Dislike very much  
O Dislike extremely  

* How much do you like or dislike the **TEXTURE** of this food with the label statement “(insert statement here)”?

O Like extremely  
O Like very much  
O Like moderately  
O Like slightly  
O Neither like nor dislike  
O Dislike slightly  
O Dislike moderately  
O Dislike very much  
O Dislike extremely  

* How much do you like or dislike the **AFTERTASTE** of this food with the label statement “(insert statement here)”?

O Like extremely  
O Like very much  
O Like moderately  
O Like slightly  
O Neither like nor dislike  
O Dislike slightly  
O Dislike moderately  
O Dislike very much  
O Dislike extremely  

...Please turn the page and continue…
* How likely or unlikely would you be to **PURCHASE** this food with the label statement “(insert statement here)” if it was priced comparable to other similar products at the grocery store?

- O Extremely likely
- O Very likely
- O Moderately likely
- O Slightly likely
- O Neither likely nor unlikely
- O Slightly unlikely
- O Moderately unlikely
- O Very unlikely
- O Extremely unlikely

**You will taste 3 food samples in a randomized order before finishing this test:** Gala Apples, Smoked Salmon, and Wheat Bread.

If you **HAVE** tasted all 3 samples, please push your tray into the compartment and press the “**Finished**” button and see the receptionist.

**THANK YOU**
APPENDIX C: NATIONAL SURVEY 1

Who does MOST of the grocery shopping for your household?
- You
- Someone else in your household
- You and someone else in your household share equally in grocery shopping

If Someone else in your household Is Selected, Then Skip To End of Block

What is your biological sex?
- Male
- Female

In which region do you live?
- Northeast (CT, MA, ME, NH, NJ, NY, PA, RI, VT )
- Midwest (IA, IL, IN, KA, MI, MN, MO, ND, NE, OH, SD, WI)
- South (AL, AR, DE, FL, GA, KY, LA, MD, MS, NS, OK, SC, TN, TX, VA, WV)
- West (AK, AZ, CA, CO, HI, ID, MT, NM, NV, OR, UT, WA, WY)

What is your age?
_____ (Slide the cursor on the left so that the number that appears above the bar matches your age.)

What is your current marital status?
- Never Married
- Married
- Partners
- Divorced
- Separated
- Widowed

What is the highest level of education you have completed?
- Less than high school
- High school graduate
- Some college
- 2 year degree
- 4 year degree
- Master's degree
- Professional degree
- Doctorate
- Other (Please specify) ____________________
What is your household's combined annual income? The term household refers yourself and any individuals living with you in your current residence/dwelling who share finances.

- Below $10,000
- $10,000 - $19,999
- $20,000 - $29,999
- $30,000 - $39,999
- $40,000 - $49,999
- $50,000 - $59,999
- $60,000 - $69,999
- $70,000 - $79,999
- $80,000 - $89,999
- $90,000 - $99,999
- $100,000 - $149,999
- $150,000 or more

How healthy/unhealthy would you consider your diet/eating habits?
- Very healthy
- Somewhat healthy
- Neither healthy nor unhealthy
- Somewhat unhealthy
- Very unhealthy

How would you rate your overall attitudes towards a food product that stated “(insert statement here)” on the label?

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<tr>
<td>0=Negative:7=Positive</td>
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</tbody>
</table>

The next set of questions requires you to think of a food product you normally purchase, imagine that food product with the (provided) label statement, and respond based on how you think that statement would impact the food.

For a given food product that you regularly purchase, how likely would you be to purchase it if the label stated: “(insert statement here)”?
- Much more likely
- Somewhat more likely
- Neither more likely nor less likely
- Somewhat less likely
- Much less likely
For a given food product that you regularly purchase, how do you think the price of the food would be affected if its label stated: “(insert statement here)”?
- Greatly increase
- Somewhat increase
- Stay the same
- Somewhat decrease
- Greatly decrease

For a given food product that you regularly purchase, how do you think the safety of the food would be affected if its label stated: “(insert statement here)”?
- Greatly increase
- Somewhat increase
- Stay the same
- Somewhat decrease
- Greatly decrease

For a given food product that you regularly purchase, how do you think the nutrition of the food would be affected if its label stated: “(insert statement here)”?
- Greatly increase
- Somewhat increase
- Stay the same
- Somewhat decrease
- Greatly decrease

For a given food product that you regularly purchase, how do you think the healthfulness of the food would be affected if its label stated: “(insert statement here)”?
- Greatly increase
- Somewhat increase
- Stay the same
- Somewhat decrease
- Greatly decrease

For this question, please select the answer below that says "pear". This does not affect your other responses towards the label: “(insert statement here)”
- Apple
- Carrot
- Banana
- Watermelon
- Pear

If Pear Is Not Selected, Then Skip To End of Block
For a given food product that you regularly purchase, how do you think the quality of the food would be affected if its label stated: “(insert statement here)”?
- Greatly increase
- Somewhat increase
- Stay the same
- Somewhat decrease
- Greatly decrease

For a given food product that you regularly purchase, how do you think the fair trade of the food would be affected if its label stated: “(insert statement here)”?
(Fair trade refers to trade in which fair prices are paid to producers in developing countries.)
- Greatly increase
- Somewhat increase
- Stay the same
- Somewhat decrease
- Greatly decrease

For a given food product that you regularly purchase, how do you think the environmental impact of the food would be affected if its label stated: “(insert statement here)”?
- Greatly increase
- Somewhat increase
- Stay the same
- Somewhat decrease
- Greatly decrease

For a given food product that you regularly purchase, how do you think your overall eating experience of the product would be affected if it was labeled, “(insert statement here)”?
- Very likely to improve my eating experience of the food
- Somewhat likely to improve my eating experience of the food
- Neither likely nor unlikely to improve my eating experience of the food
- Somewhat likely to reduce my eating experience of the food
- Very likely to reduce my eating experience of the food

How knowledgeable do you consider yourself on the topic of GMOs (genetically modified organisms)?
- Not at all knowledgeable
- Slightly knowledgeable
- Somewhat knowledgeable
- Moderately knowledgeable
- Very knowledgeable
- Extremely knowledgeable
In your own words, describe a GMO (genetically modified organism). Please write clearly, your thoughtful response is important to our study.

How important is the topic of GMOs to you personally?
- Not at all important
- Slightly important
- Somewhat important
- Moderately important
- Very important
- Extremely important
APPENDIX D: NATIONAL SURVEY 2

Who does MOST of the grocery shopping for your household?
○ You
○ Someone else in your household
○ You and someone else in your household share equally in grocery shopping
If Someone else in your household Is Selected, Then Skip To End of Block

What is your biological sex?
○ Male
○ Female

What is your age?
______ (Slide the cursor on the left so that the number that appears above the bar matches your age.)

In which region do you live?
○ Northeast (CT, MA, ME, NH, NJ, NY, PA, RI, VT )
○ Midwest (IA, IL, IN, KA, MI, MN, MO, ND, NE, OH, SD, WI)
○ South (AL, AR, DE, FL, GA, KY, LA, MD, MS, NS, OK, SC, TN, TX, VA, WV)
○ West (AK, AZ, CA, CO, HI, ID, MT, NM, NV, OR, UT, WA, WY)

How often do you purchase each of the following?

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<thead>
<tr>
<th></th>
<th>More frequently than once a week</th>
<th>Once a week to every month</th>
<th>Once a month to every three months</th>
<th>Once every three months to once a year</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Rice</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Salmon</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Wheat Bread</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Vegetable Oil</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

What is your current marital status?
○ Never Married
○ Married
○ Partners
○ Divorced
○ Separated
○ Widowed
What is the highest level of education you have completed?
☐ Less than high school
☐ High school graduate
☐ Some college
☐ 2 year degree
☐ 4 year degree
☐ Master's degree
☐ Professional degree
☐ Doctorate
☐ Other (Please specify) ____________________

What is your household's combined annual income? The term household refers yourself and any individuals living with you in your current residence/dwelling who share finances.
☐ Below $10,000
☐ $10,000 - $19,999
☐ $20,000 - $29,999
☐ $30,000 - $39,999
☐ $40,000 - $49,999
☐ $50,000 - $59,999
☐ $60,000 - $69,999
☐ $70,000 - $79,999
☐ $80,000 - $89,999
☐ $90,000 - $99,999
☐ $100,000 - $149,999
☐ $150,000 or more

How healthy/unhealthy would you consider your diet/eating habits?
☐ Very healthy
☐ Somewhat healthy
☐ Neither healthy nor unhealthy
☐ Somewhat unhealthy
☐ Very unhealthy

How do you feel about (insert food item here)?
☐ I extremely like them
☐ I moderately like them
☐ I neither like nor dislike them
☐ I moderately dislike them
☐ I extremely dislike them
How often do you purchase (insert food item here)?
☐ More frequently than once a week
☐ Once a week to every two weeks
☐ Once every two weeks to once a month
☐ Once a month to once every three months
☐ Less frequently than every three months
☐ Never
If Never Is Selected, Then Skip To End of Block

How would you rate your overall attitudes towards (insert food item here) that stated “(insert statement here)” on the label?

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The next set of questions requires you to think of the above food product, imagine that food product with a provided label statement, and respond based on how you think that statement would impact the food.

How likely would you be to purchase (insert food item here) if the label stated: “(insert statement here)”?
☐ Much more likely
☐ Somewhat more likely
☐ Neither more likely nor less likely
☐ Somewhat less likely
☐ Much less likely

How do you think the price of (insert food item here) would be affected if the label stated: “(insert statement here)”?
☐ Greatly increase
☐ Somewhat increase
☐ Stay the same
☐ Somewhat decrease
☐ Greatly decrease
How do you think the safety of (insert food item here) would be affected if the label stated: “(insert statement here)”?

- Greatly increase
- Somewhat increase
- Stay the same
- Somewhat decrease
- Greatly decrease

How do you think the nutrition of (insert food item here) would be affected if the label stated: “(insert statement here)”?

- Greatly increase
- Somewhat increase
- Stay the same
- Somewhat decrease
- Greatly decrease

How do you think the healthfulness of (insert food item here) would be affected if the label stated: “(insert statement here)”?

- Greatly increase
- Somewhat increase
- Stay the same
- Somewhat decrease
- Greatly decrease

For this question, please select the answer below that says "pear". This does not affect your other responses towards the label: “(insert statement here)”

- Apple
- Carrot
- Banana
- Watermelon
- Pear

If Pear Is Not Selected, Then Skip To End of Block

How do you think the quality of (insert food item here) would be affected if the label stated: “(insert statement here)”?

- Greatly increase
- Somewhat increase
- Stay the same
- Somewhat decrease
- Greatly decrease
How do you think the fair trade of (insert food item here) would be affected if the label stated: “(insert statement here)”?
(Fair trade refers to trade in which fair prices are paid to producers in developing countries.)
- Greatly increase
- Somewhat increase
- Stay the same
- Somewhat decrease
- Greatly decrease

How do you think the environmental impact of (insert food item here) would be affected if the label stated: “(insert statement here)”?
- Greatly increase
- Somewhat increase
- Stay the same
- Somewhat decrease
- Greatly decrease

How do you think your overall eating experience of (insert food item here) would be affected if the label stated: “(insert statement here)”?
- Very likely to improve my eating experience
- Somewhat likely to improve my eating experience
- Neither likely nor unlikely to improve my eating experience
- Somewhat likely to reduce my eating experience
- Very likely to reduce my eating experience