Consumer Understanding of Food Labels

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Abstract

This is a study that investigates consumer understanding of food labels and the impact it has on their purchasing decisions and preferences. It examines the food labels that consumers find appealing, the sources of information they refer to when making purchasing decisions, and their understanding of what those food labels mean. A literature review provides background information and research that has been performed prior to this study. An online survey has provided data in a mostly qualitative format. Data analysis is used to further reveal any relationships between the variables of the study. A misunderstanding has been found to exist regarding the standards of labels and what they actually mean about how the product displaying the label was produced. Specific sources of information and the believes about a label's standard are found to have a significant relationship with the appeal a consumer finds in a label.

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Chapter 1: Introduction

Background and Setting

In the last 30 years, there has been a rise in consumer demand and concern as they pertain to food production practices (Bonroy & Constantos, 2014). The goal of agriculture has always been to simply supply consumers with food, but now consumers have demands and requirements that they want to see met. No longer are consumers focused on having enough affordable food, but instead food purchasing decisions are being driven by values and traits related to topics such as health, ethics, and the environment (Bonroy & Constantos, 2014). Additionally, the rise of claims being made by food production companies and brands on food labels has created stronger consumer opinions and preferences related to food purchasing decisions (Ellison, Brooks, & Mieno, 2017).

Various studies have examined the values or claims that are driving consumer purchasing decisions. A study by Lusk and Briggerman (2009) found that 34.2% of consumers consider safety to be the most important food value. Nutrition and taste were also among the three most important consumer food values, followed by natural food and price (Lusk & Briggeman, 2009). When looking at claims, consumers consider claims pertaining to production practices to be the most important (Ellison, Brooks, & Mieno, 2017). The most important of these claims are non-GMO, no growth hormones (for animal products), and the humane treatment of animals (Ellison, Brooks, & Mieno, 2017). Also on this list was production of products without the use of anti-biotics. The absence of biotechnology was another a driving factor for the adoption of the value of naturalness (Lusk & Briggerman, 2009). Naturalness was also appealing to consumers purchasing organic products, who were reported to value the environment and showed a willingness to pay more money for organic products as well (Lusk & Briggeman, 2009).

Some of these beliefs and values can actually be harmful to certain markets (Bonroy & Constantos, 2014). Not only can they be detrimental, but it can often be hard to tell if these values or preferences are justified (Bonroy & Constantos, 2014). That is, many of the labels supporting these values are placed on products after they have been deemed to meet standards determined by a third party, such as the USDA (Bonroy & Constantos, 2014). These third parties are not determining if the claims of the labels are improving the product, just that the standard has been met.

A study on *livestock production claims that matter to consumers* found that the use, or lack thereof, of growth hormones, was on the most important to consumers purchasing beef, chicken, dairy, etc. (Ellison, Brooks, & Mieno, 2017). While these products all had a label claiming that no hormones were used in the production of the product, it was especially interesting for poultry products since the USDA prohibits the use of hormones in poultry being raised for human consumption (Ellison, Brooks, & Mieno, 2017). This has also been seen in relation to the term natural, which 77% of consumers believed made a product very healthy, despite the fact that the USDA has no definition or certification standard for a natural food label (Haroldson &Yen, 2016).

Another study regarding labeling found the majority of participants said they understood terms such as GMO, natural, organic, and gluten free but were unable to correctly define the terms, with over 90% of participants providing incorrect definitions for the terms natural and organic (Haroldson & Yen, 2016). Despite the fact that consumers could not define these terms, 87% of consumers still believe non-GMO products to be healthier than GMO products (Health Focus International, 2015). With the demands of consumers dictating the markets and methods

of modern agriculture, it is important to understand if the demands being made are based on a true understanding, or if the motivations behind these demands are based on misunderstandings.

Statement of the Problem

The growing consumer concern around food production methods, and the increasing distance of consumers from the farm, has led consumers to make purchasing decisions based on food labels and attribute claims that are difficult to interpret and fully understand.

Purpose of the Study

In order to produce enough food, fuel, and fiber to support a growing population, and to do so in a sustainable manner, the gap between the public, science, and agriculture must be bridged. The modern consumer is exposed to a variety of buzz words in the grocery environment and often does not receive information concerning these words from a reliable, scientific source. Consumers today are farther removed from agriculture than any other time in history. With a growing world population, it is important that the public understand a need for a diverse selection of resources that are produced efficiently and in way that supports the welfare of animals, farmers, and consumers alike. The purpose of this study is to determine the factors and values that influence consumer food purchasing decisions.

This study will seek to answer the following questions:

1. Can consumers define words they see on food packaging, such as “GMO”, “Organic”, and “Antibiotic Free”?
2. What are the values driving consumer purchasing decisions?
3. What sources of information do consumers rely on when making purchasing decisions?

Based on a review of literature, the proposed hypothesis is that the majority of consumers do not have an understanding of terms used to label their food and describe its production. Additionally,

consumers have a misconception of the health benefits or perceived risks associated with different labels and production methods. This misconception also holds true for the environmental benefits or risks associated with certain labels and methods.

Definition of Terms

Antibiotic free- The animal was raised without any use of antibiotics (USDA, 2015)

Biotechnology- Breeding tools, such has genetic engineering, that are used to alter and improve organisms or products (USDA, 2015)

Organic- A product that is certified organic has been certified by the USDA and was not grown with the use of genetic engineering, prohibited synthetic substances, or on land that has been exposed to any of these prohibited substances within 3 years. Organic products "must demonstrate that they are protecting natural resources, conserving biodiversity, and using only approved substances" (USDA, 2013).

Genetic engineering- The process of changing an organism's DNA using techniques called recombinant DNA techniques (USDA, n.d)

GMO- Genetically modified organisms are produced with genetic modification (USDA, n.d)

Limitations of the Study

The research will be restricted by the following limitations:

1. The opinions and values held by the consumers contributing to data are subject to change at any time. Therefore, the results of this study are representative of the time the data was collected and cannot be assumed to be true in the future.
2. Data collection will be limited to those willing to share their opinions and values.

3. Consumer opinions and values are dependent upon the circumstances at the time the data was collected. They can be affected by current financial status, recent exposure to media, or personal experience.
4. It will be unknown to the researcher if a consumer researches terms and topics and therefore changes their opinion during the study.

Basic Assumptions of the Study

The following assumptions will be made about this study:

1. Consumer opinions and values will be honest and accurate.
2. Consumer purchasing habits are stated as accurately as possible.
3. Terms defined in the operational definitions and later referred to in the study are representative of the stated operational definition.
4. Consumers are not scientists or researches studying the field of nutrition or food science.
5. Consumers will not be provided definitions of any terms as it may affect their true and honest answers to questions.

Significance of the Study

The study of consumer understanding of food production methods and terminology is significant for many reasons. The first reason is that significant changes have been seen in the last few years in consumer demands and interests in their food and the way its produced. Studies have shown that many of the demands are based on false understandings (Bonroy & Constantos, 2014.) Second, some consumer demands are actually detrimental to animal welfare and environmental sustainability. Third, consumers are making choices that they believe are healthier for their families with little understanding of the truth behind that belief.

The review of literature, combined with a randomly selected survey of consumers will be used to collect data pertaining to the purchasing habits, knowledge, and values consumers have in association with food. This information will be used to prove if there is a disconnect between consumers and their food production, creating an unnecessary and harmful shift in market demands.

Chapter 2: Literature Review

Introduction

The purpose of this chapter is to present a review of the related literature for this research study. This review will examine the factors involved with the labeling of food in terms of production practices and consumer views of those practices and labels. This review is divided into the following sections: 1) Introduction; 2) Recent changes in food and agriculture; 3) Review of labels used to indicate production practices; 4) Common misconceptions of labels; 5) Driving factors of consumer purchasing decisions; 6) Summary.

Recent changes in food and agriculture

Today's agriculture industry looks far different than it did 100, 50, or even 25 years ago. In the last century the number of people working in the agriculture industry dropped from 3.4 million to just over 1 million (U.S. Bureau of Labor Statistics, 2013). In 1900, 41% of the workforce was employed in agriculture (Dimitri, Effland, & Conklin, 2005). This number continued to drop to 2% in 1980 and then to .9% in 2012 (Dimitri, Effland, & Conklin, 2005). As the years go on, the people involved in the production of food and in agriculture continues to decline, while the demand for food continues to grow.

At its peak in 1935, U.S. Agriculture consisted of 6.8 million farms (USDA, 2018). In 1999, that number had dropped to 2.2 million farms (Levins, 2002), and when the number was

last measured in 2016 it had dropped further to 2.06 million farms (USDA, 2018). It should be noted that the USDA's definition of a farm is "any establishment from which $1,000 or more of agricultural products were sold or would normally be sold during the year" (Levins, 2002). In fact, almost 90% off farms today are actually not full-time businesses, but rather provide a very minute secondary income to another source of off farm income (USDA, 2018). According to Agricultural Economist, Richard A. Levins (2002), there are only about "350,000 family sized farms that could possibly gross enough to make a decent living." While the number of farms has continued to decrease, so too has the number of farms that are operating as a family's sole source of income.

As the number of farms and farm families have decreased, it would not be surprising that the number of consumers exposed to farms and food production would also decrease. With less exposure comes the potential for less understanding. In recent years, consumers have continued to show an increasing concern for farm production methods (Wolf, Tonsor, & Olynk, 2011). This increase in concern for farm production methods has also led to an increase in consumer demand for labels that make claims along the lines of "naturally derived, minimally process, organic, and non-GMO" (Scholl- Grissemann, 2017). Studies have shown that women are the group of people most concerned with these claims (Baker & Burnham, 2001).

Many people today are familiar with the array of labels that can be found on any given food product on the shelves of grocery stores. There are the nutrition facts and sell by dates, and likely one or more labels that make some claim in reference to the methods used to produce the product or the ingredients in the product. These production labels have not always been a staple on our food packaging though. In the last 30 years, consumers have become more concerned

with how the methods used to produce their food effects their health, the environment, and the ethics related to production practices (Bonroy & Constantos, 2014).

Review of labels used to indicate production practices

There are a variety of common labels that appear throughout the literature as well as in grocery store aisles. For the most part, these labels refer to the production practices used to produce food (Ellison, Brooks, & Mieno, 2017). While the wording of these labels and claims may vary, they generally refer to the naturalness of a food, if its organic, if it contains Genetically Modified Organisms (GMOs), and for animal products if they were raised using antibiotics and hormones. These labels are accompanied by a variety of different regulations, enforcements, and definitions.

The United States Food and Drug Administration, referred to as the USDA moving forward, defines natural food as a "product that contains no artificial ingredient or added color and is minimally processed" (USDA, 2015). Organic products are products that were not produced using GMOs, hormones, antibiotics, or pesticides (Kuchler et al, 2017). For a product to be considered USDA certified organic, indicated by the USDA certified organic label, it must meet the following: "not grown with the use of genetic engineering, prohibited synthetic substances, or on land that has been exposed to any of these prohibited substances within 3 years" (USDA, 2015). A product claiming to be non-GMO or GMO free is one that is free of any ingredients which were not produced with genetic modification (USDA, 2015). Products bearing a Non-GMO Project Verified label specifically should have less than 0.9% genetically engineered content (Kuchler, 2017). Animal products with labels claiming the animal was raised without hormones or antibiotics refer to the raising of that animal without the administration of hormones or antibiotics (USDA, 2015).

According to Bonroy and Constantos (2014), labels are used to "indicate if a third party has certified if the product meets the standard for certain attributes". The interesting thing about these labels is that they are not mandated by one specific group and many of them are not regulated (Kuchler et al, 2017). These labels may be organized by: the private sector represented by non-profits; the public sector represented by the government; a mix of the two; or by federal regulatory agencies such as the USDA (Kuchler et al, 2017). The only food label claim that is regulated by the government is *USDA organic* (Kuchler et al, 2017). The rest of the labels that are seen in grocery store aisles are voluntary and have minimal requirements for production and manufacturing (Kuchler et al, 2017).

Common misconceptions of labels

It has been made evident that there are a variety of different labels used to indicate the production practices or methods used to make certain foods. Some of these labels are mandatory and regulated while others are voluntary and unregulated. This inconsistency of labeling and claims may not be beneficial to consumers as it creates a lot of confusion in the market place (Kuchler et al, 2017). There are multiple examples of this confusion but the product claim of being raised without antibiotics, or RWA, is a great example. The Consumer's Union found that there are 24 different labels refer to the idea that a product is RWA, not all of which are USDA approved and most of which are hard to understand, making it very confusing for consumers (Kuchler et al, 2017). "Consumers are largely unable to distinguish between different antibiotic claims and for the most part do not understand the complex relationship between antibiotic use, animal health, and antibiotic resistance" (Kuchler et al, 2017).

Another way to look at consumer misconceptions of labels are the elaborate likelihood model, or ELM, and the "halo effect". The ELM is the idea that "consumers may make inaccurate

inferences about an entire food product due to the marketing terms on the package" (Haroldson, 2016). The halo effect is a term seen in much of the literature and occurs "when an individual assumes a food or food product is healthy based on a component or characteristic of that food, such as a marketing term on the food package" (Haroldson, 2016). Both of these ideas are a result for what many studies refer to as the "magic bullet effect", meaning the claims made cause people to associate the product with other claims (Scholl-Grisseman, 2017). An example of this is consumers associating foods with organic labels to be low in calories and more nutritious than non-organic food options (Song & Im, 2017). Without knowing the meaning of these labels and claims, consumers assume that they are related to the healthfulness of the product (Haroldson, n.d) which may affect their purchasing decisions.

Sometimes consumers truly do not understand the meaning of a label. In a survey of consumer labeling knowledge, consumers were asked to define certain claims found on different foods and products, such as gluten free, non-GMO, and organic. It was found that "the majority of participants who indicated they understood the particular terms did not provide accurate definitions of the nutrition marketing terms assessed" (Haroldson, n.d). Of the consumers surveyed, 95.7% defined at least half of the terms incorrectly (Haroldson, n.d). A 2015 study found that 64% of consumers believed natural to mean a product contains no artificial hormones, 59% believed natural meant animals were not fed antibiotics, and 57% believed natural to mean the product did not contain antibiotics (Kuchler et al, 2017). With that being said, studies have also shown that providing consumers with more knowledge of labels and claims such as GMOs can make about the same number of consumers more accepting of GMOs as it can less (Kuchler et al, 2017). Therefore, education may not be the key to resolving consumer confusion but it does warrant a seat at the table.

Often times products are needlessly labeled, only leading to more consumer confusion. For example, there are many products on the shelf bearing a non-GMO claim, despite the fact that none of the ingredients have a GE option. "Consumers may believe that products labeled as non-GE are inherently safer; they may not understand that some products are labeled as non-GE even though there is no GE crop variety available" (Kuchler et al, 2017). Additionally, many certified organic products also have a non-GMO label, despite the fact that a requirement of certified organic products is that they contain no GMO products (USDA, 2015). More than half of Non- GMO Project verified products are certified organic products, making the non-GMO label redundant (Kuchler et al, 2017). In a study of consumer preferences when purchasing poultry, claims related to absence of growth hormone use was found to be one of the most important to consumers, "a particularly interesting finding in the case of chicken as the USDA prohibits the use of hormones in poultry" (Ellison, Brooks and Mieno, 2017).

Driving factors of consumer purchasing decisions

While studies have shown that consumers chose foods and products with certain labels because of the perceived healthfulness they associate with the label, there are also a few other driving factors. Some of these factors may be safety, nutrition, taste, the perceived naturalness of a food, and price (Lusk & Briggerman, 2009). These factors consumers look for in foods may be driven by past events or current issues in the world around them, such as past food safety scares, society's push for more environmentally friendly practices, and the rise in obesity over the last few decades (Scholl-Grissemann, 2017). These are all realistic and rationale concerns that consumers have. However, they are seeking their solutions in the confusing world of food labeling and claims, with some of the most important claims being "GMOs not used in

production", "no growth hormones given to animals", and "animals humanely raised" (Ellison, Brooks, Mieno, 2017).

As was previously mentioned, there are many consumers that truly do not understand the labels and claims found on food. Their purchasing decisions are not necessarily educated ones. However, some consumers are educated and do understand these labels and claims. Some of these consumers know the science but still chose to make decisions that are not always considered to be supported by science. "Most moms will assume they are eating antibiotics in the food and that is the casual process. Some continue to believe this even after reviewing literature that explains the issue is really about transmission of resistant bacteria" (Kuchler et al, 2017). In a study done by the Pew Research Center comparing the opinions of scientists from the American Association for the Advancement of Science to consumers it was found that 88% of scientists say that GM foods are safe while only 37% of consumers say GM foods are safe (2015). It was also found that 68% of scientists said it was safe to eat food grown with pesticides, a statement only 28% of consumers agreed with, and 82% of scientists said that the growing population will become a problem, a statement 59% of consumers agreed with (Pew Research Center, 2015).

Clearly, a divide exists between what consumers believe and what scientists believe. Some of this may have to do with trust. Consumers today trust the information they receive from farmers and universities the most, followed by government and environmental agencies (Vecchione, Feldman, & Wunderlich, 2015). The sources of information they trust the least are grocery stores and good manufacturers (Vecchione, Feldman, & Wunderlich, 2015). This distrust, especially in European countries, may be a result of a previously experienced food safety issue (Vecchione, Feldman, & Wunderlich, 2015). Some consumers have grown to

distrust the labels and claims used by manufacturers because they find the labels to be overused or the information provide to be overwhelming and confusing (van Dijk et al, 2012).

Another factor that can influence a consumer's purchasing decisions is attitude. A study on consumer attitudes and behaviors found that there is a strong relationship between a consumer's attitude and their behavior or purchasing decisions (Vecchione, Feldman, & Wunderlich, 2015). However, it was found that knowledge has little correlation with consumer attitude and behavior (Vecchione, Feldman, & Wunderlich, 2015).

> Consumers sometimes perceive information to conform to their previous attitudes, because they tend to seek consistency between new information and their previously-held beliefs. According to the assimilation effect in social judgment theory, when highly involved consumers holding a positive attitude of an object receives a related information, they tend to evaluate the information more positively (Song & Im, 2017).

Consumers want to believe what they think is true and therefore look for information that aligns with their attitudes more positively. It has been found that "consumer behavior is less about what they know and more about what they believe" (Baker & Burnham, 2001). That is not to say that education plays no role in what is believed. Consumer beliefs and attitudes are said to be affected by how a message is presented, if they understand the message being told, the education the consumer has, and if any proposed technology is improving social welfare (Vecchione, Feldman, & Wunderlich, 2015).

Summary

The purpose of this study was to review the literature as it relates to the purchasing decisions and demands of consumers based on production methods and terminology they do not fully understand. This review of literature demonstrated that many consumers do not fully

understand the food labeling and claims on foods or the production practices of modern agriculture. As the literature showed, there have been drastic decreases in the number of people directly involved in agriculture in the past 100 years and less. As consumers become farther removed from agriculture they look to food labels for guidance in their food purchasing decisions. However, the literature suggests that some labels and claims may be causing consumer confusion because they are not clearly defined, not easily understood, and overused. In many cases, these terms have no formal definition or associated regulation. Consumer purchasing decisions can be affected by a variety of different things from attitude to education. The literature did show that consumers value things such as nutrition, taste, safety, and ethics when it comes to their food and the way it was produced. With confusion about labels, distrust of certain groups of people involved in food production, and often a misunderstanding of information, consumers attempt to make what they believe are the best purchasing decisions.

Chapter 3: Methodology

This chapter contains information pertaining to the methodology used to conduct the study of consumer understanding of food labels and attributes. The methodology will provide information about the assessment used to collect data, how the assessment was administered to the population, how the sample population was selected, and how the data was analyzed. The methodology is divided into the following sections: research design, subject selection, instrumentation, and data analysis procedures.

Research Design

This study used an embedded design consisting of both qualitative and quantitative data, making it a mixed-methods study. A mixed-methods study was chosen given that the research

questions are multiple and diverse and may require answers that can only be derived from both quantitative and qualitative responses.

The variables in this study are the consumer demographics, consumer values, and consumer understanding of labels and food attributes. The independent variables are consumer demographics and consumer values, and the dependent variables are consumer understanding of food labels and attributes. Some of the questions establish consumer demographics such as age, parenthood, access to information, and values. Understanding of food labels and attributes was measured through questions asking consumers to define certain terms and through a set of statements consumers must agree or disagree with. There is some variability, as the amount and type of outside knowledge consumers have regarding certain food attributes cannot be controlled.

Subject Selection

Participants were food consumers, specifically those who are involved in food purchasing decisions. The survey was administered online and therefore was able to lend anonymous samples which are primarily random. The survey was posted to specific Facebook groups that may reach consumers who are likely to make organic, non-GMO, or anti-biotic free food choices. Because of this, the survey is considered to have used purposive sampling. This was able to lend a sample population that is making food purchasing decisions and likely has preferences in regards to food labels and attributes.

Instrumentation

Prior to participation in the study, participants were asked to agree to the consent form found in Appendix A. The full survey administered to participants can be found in Appendix B. Response frequency tables for each question can be found in Appendix C. Questions consist of

both qualitative open-ended response type questions as well as quantitative ranking, multiple choice, and likertt scale type questions. The survey was created and administered via Survey Monkey, a survey development platform. This allowed all of the data to be stored in the same place. Survey Monkey data can also be exported to SPSS, the data analytic software used.

Few studies have been done about the direct validity and reliability of Survey Monkey specifically as a measurement instrument. One of the studies states that Survey Monkey and other online survey platforms are only as valid and reliable as the questions the researcher constructs (Evans, R.R., et al). Questions created for this study represented the data needed while also providing data that would allow for comparisons and correlations to be made between variables. Furthermore, the questions were not leading and will further contribute to the study's validity. Consumer views and opinions are constantly changing, but the questions in this study should not contribute any further to that reliability. "Internal consistency reliability of all evaluation and referral components was adequate based on coefficient alphas to retain all components" (Evans, R.R et al.).

Before the survey was administered, permission was granted from the internal review board (IRB). The IRB application can be found in Appendix D. CITI Program Certification can be found in Appendix E.

Data Analysis

Data from this research was analyzed using frequency tables and cross tabulation, specifically a chi-square test. The chi-square test required the development of a null and alternative hypothesis. If the p-value was less than .05, the null hypothesis was rejected with 95% confidence and alternative hypothesis was accepted, meaning a significant relationship exists between the two variables being analyzed.

Chapter 4: Results

The majority of the sample population of 1104 respondents was female. This is supported by the review of literature which does suggest women are more involved in food purchasing decisions on average (Baker & Burnam, 2001). The sample population includes participants ages 18 and older, with the majority of respondents between the ages of 18 and 33. The majority of respondents did not have children. There was no significant relationship found between a consumer's age and food values or label appeal. There was also no significant relationship found between consumers with or without children and their label preference or food values. Survey respondent demographics can be seen in Table 1.

Table 1

Summary of Respondents' Demographic Characteristics

		f	%
Age			
	18-26	399	36.1
	27-33	276	25.0
	34-40	153	13.9
	41-47	58	5.3
	Over 47	214	19.4
Gender			
	Male	297	26.9
	Female	799	72.4
	Other	1	.1
	N/A	4	.4
Table 1 *continued*			
Children			
	Yes	384	34.8
	No	718	65.0

In order to determine if consumers can define words they see on food packaging, such as "GMO", "Organic", and "Antibiotic Free", respondents were asked a variety of questions that would indicate their understanding and ability to define certain labels. Table 2 shows the

frequency of terms present in definitions provided by respondents when asked how they interpret an "organic" label. The idea that the product was grown without any pesticides was included in 39.5% of responses. Of the responses, 20.8% included the idea that the product was not produced with the use of any chemicals. Only 6.4% of responses specified that the product was produced without the use of synthetic pesticides, 5.6% of responses stated that the organic label meant that the product was non-GMO, 2.4% included that fact that organic foods must be USDA certified, and only .1% of respondents made some mention of the conservation of biodiversity.

Table 2

Frequency of terms present in definition of "organic" as interpreted on a food label

	n	*f*(%)
No synthetic pesticides	1104	71(6.4)
Non-GMO	1104	62(5.6)
USDA certified	1104	27(2.4)
Conservation of biodiversity	1104	1(.1)
No pesticides	1104	436(39.5)
No chemicals	1104	230(20.8)
Cruelty free	1104	6(.5)
I don't know	1104	14(1.3)

While 39.5% of respondents identified that they believed products with an organic food label were grown without the use of any pesticides, when asked directly if they thought certified organic foods were grown without the use of any pesticides, 53% of respondents agreed and 14% of respondents were unsure, as is seen in Figure 1.

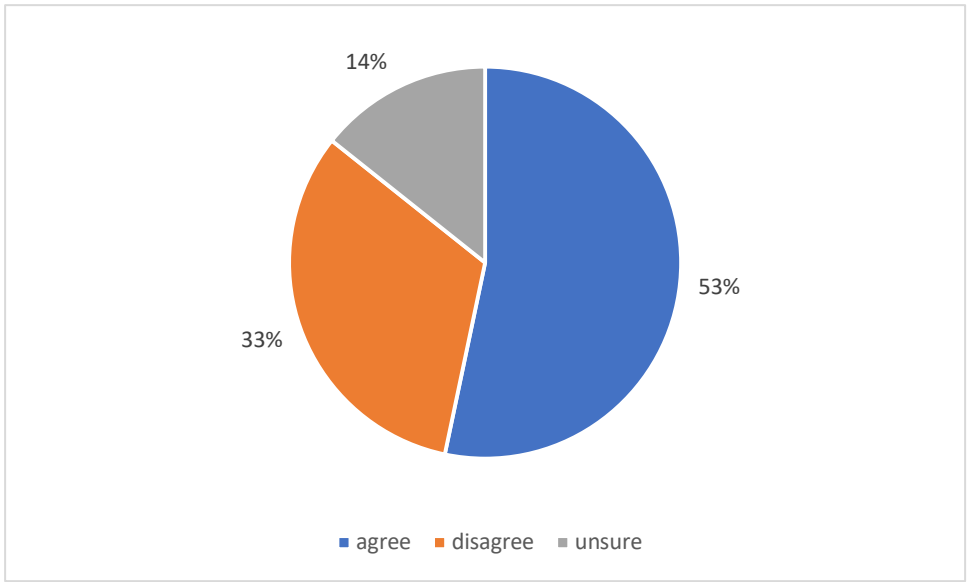

Figure 1. Certified organic foods are produced without the use of any pesticides.

When asked to state whether they agreed or disagreed with the statement, *Organic food has more nutritional value than conventionally produced food,* 17% of respondents agreed with the statement and 16% weren't sure, as seen in Figure 2. This means that over a quarter of respondents did not know that the organic label is not an indicator of nutritional value.

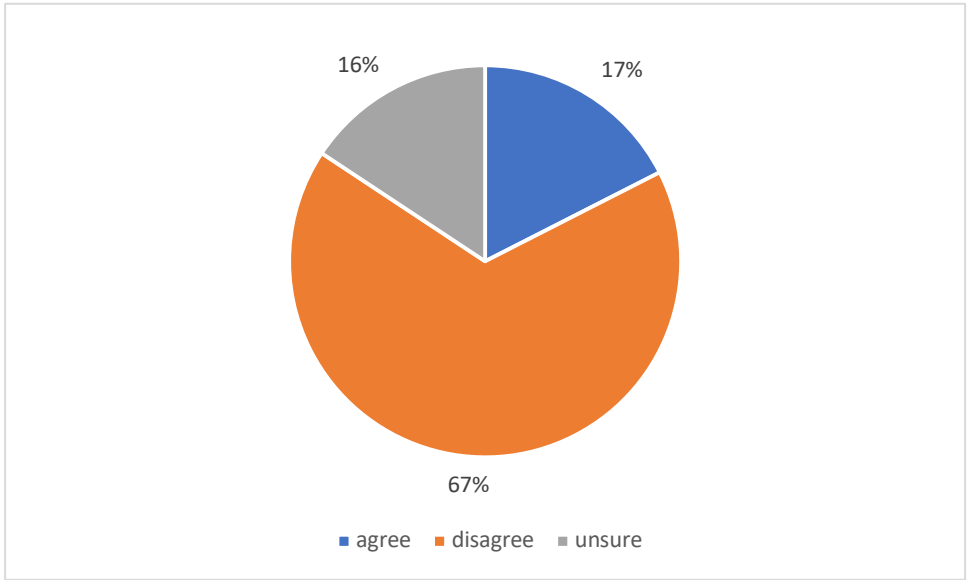

Figure 2. Organic food has more nutritional value than conventionally produced food.

Table 3 shows the frequency of terms present when respondents were asked how they interpret a "non-GMO" label. Of the definitions provided by respondents, 70.6% did identify that

GMO indicated genetic modification. Only 5.3% specified that GMO had something to do with a product's DNA and 5.3% also identified that GMO products had been modified to enhance traits of disease resistance, drought tolerance, or nutritional value. Of the responses, 1.5% associated GMOs with hormones and 1.9% associated them chemicals.

Table 3

Frequency of terms present in definition of "GMO" as interpreted on a food label

	n	*f*(%)
Genetically modified	1104	779(70.6)
DNA	1104	58(5.3)
Traits	1104	58(5.3)
Hormones	1104	17(1.5)
Chemicals	1104	21(1.9)
I don't know	1104	87(7.9)

There were also 7.9% respondents who were admittedly unsure of how to define GMO or what the label "non-GMO" meant. Furthermore, 61% of respondents said they were unsure if the statement, *there are currently only 10 genetically modified crops available commercially in the U.S,* was true. Another 24% said they disagreed with the statement, while only 15% agreed, as seen in Figure 3.

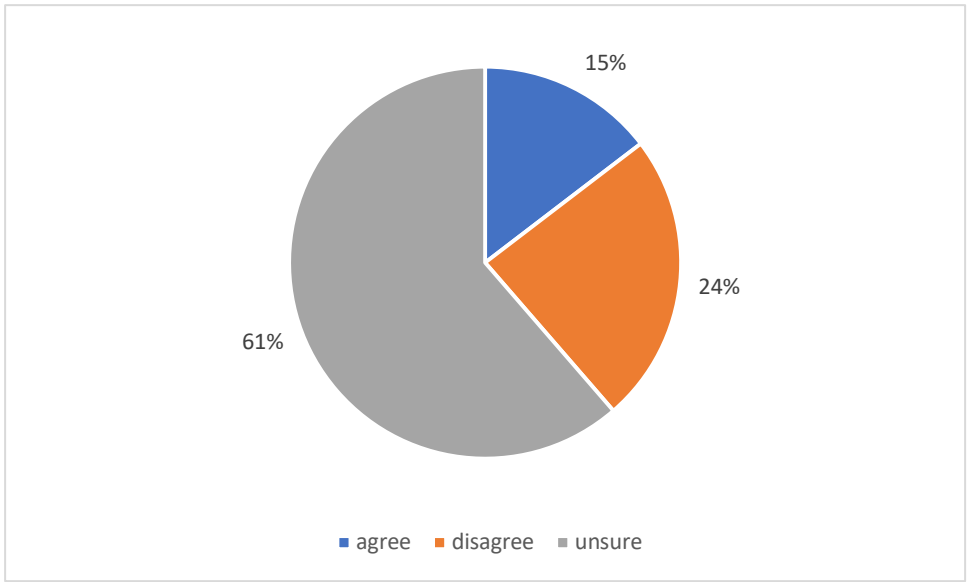

Figure 3. There are currently only 10 genetically modified crops available commercially in the U.S

In relation to antibiotics, 45% of respondents believe product labeled "raised without antibiotics" may contain antibiotics that are harmful to people and 26% are unsure, as seen in Figure 4. In Figure 5 it is shown that 53% of respondents believe most farmers use antibiotics to increase their animals' production, while 21% are unsure.

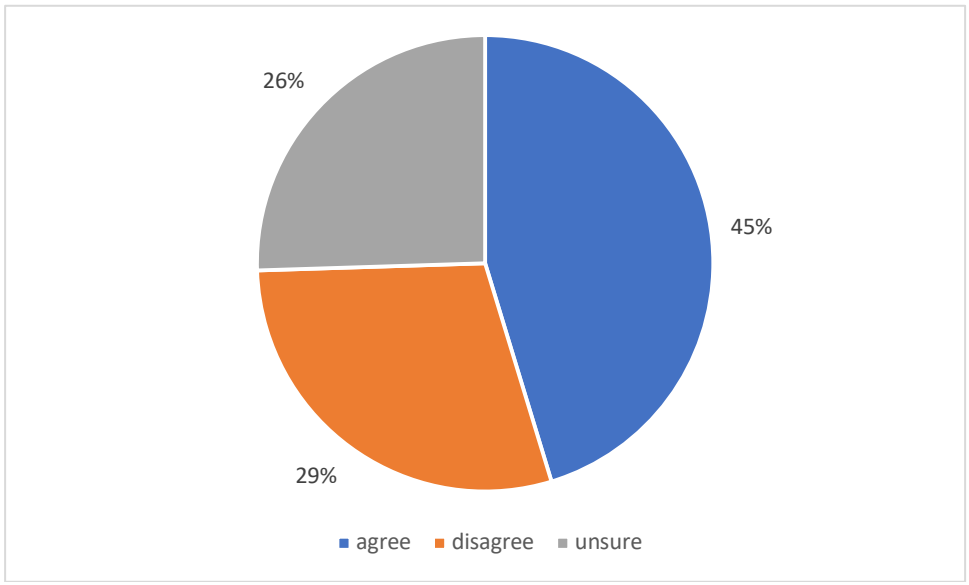

Figure 4. Meats and animal products not labeled "raised without antibiotics" may contain antibiotics that are harmful to people

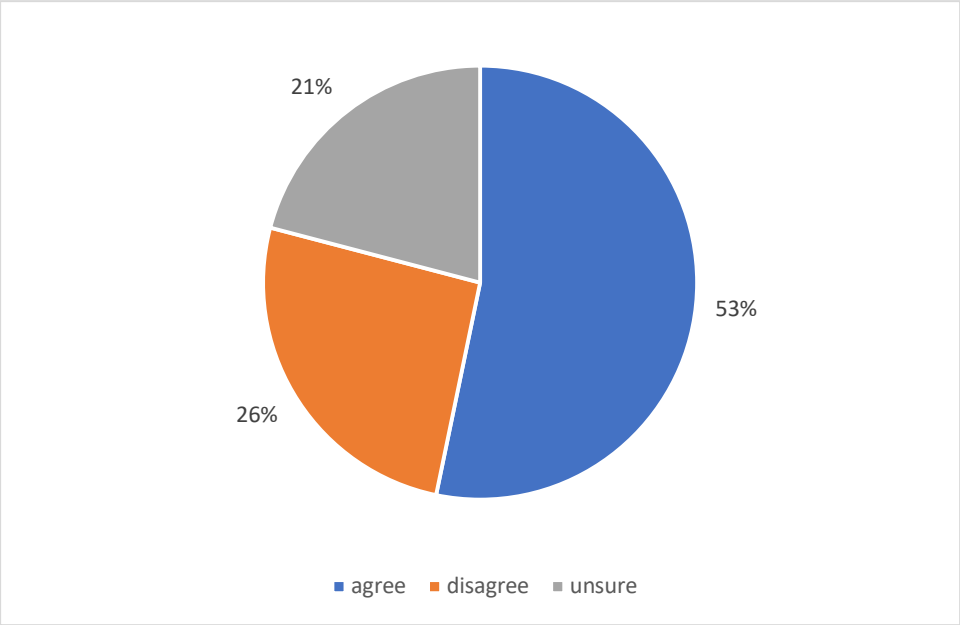

Figure 5. Most farmers use anti-biotics to increase their animals' production

To establish the values driving consumer purchasing decisions, respondents were asked to rank from most important to least important the values that drive food purchasing decisions. Forty point nine percent of respondents identified nutritional value as the most important value driving their decisions, as seen in Table 4. Both environmental impact and the ethics or welfare of people and animals involved in production were identified as the least important value by 32.9% of respondents. Price was ranked as the second most important value by 29.1% of respondents and food safety as the 3rd most important valued by 33.4% of respondents.

Table 4

Frequency Responses for Values that Drive Food Purchasing Decisions

	n	1 Most Important *f*(%)	2 *f*(%)	3 *f*(%)	4 *f*(%)	5 Least Important *f*(%)
Price	1104	306(27.7)	**321(29.1)**	224(20.3)	94(8.5)	131(11.9)
Food Safety	1104	216(19.6)	218(19.7)	**369(33.4)**	129(11.7)	137(12.4)
Environmental Impact	1104	35(3.2)	83(7.5)	172(15.6)	**422(38.2)**	363(32.9)
Ethics/ welfare of people and animals involved in production	1104	64(5.8)	104(9.4)	188(17.0)	**371(33.6)**	363(32.9)

Nutritional Value	1104	**452(40.9)**	354(32.1)	138(12.5)	66(6.0)	91(8.2)

More than half of respondents believed organic labels to have an official government standard, as seen in Figure 6. Organic was also the most appealing food labels, with 45.8% of respondents identifying it as a label they found appealing. Non-GMO is a label 44.8% of people believed to have an official government standard, though only 28.4% indicated it was a label they found appealing. About 30% of respondents believed there was an official government standard for both antibiotic free or raised without antibiotic labels, and 36.3% said it was a label they found appealing. Only 10.1% of respondents thought that all natural labels had an official government standard, but 34.9% said it was a label they found appealing.

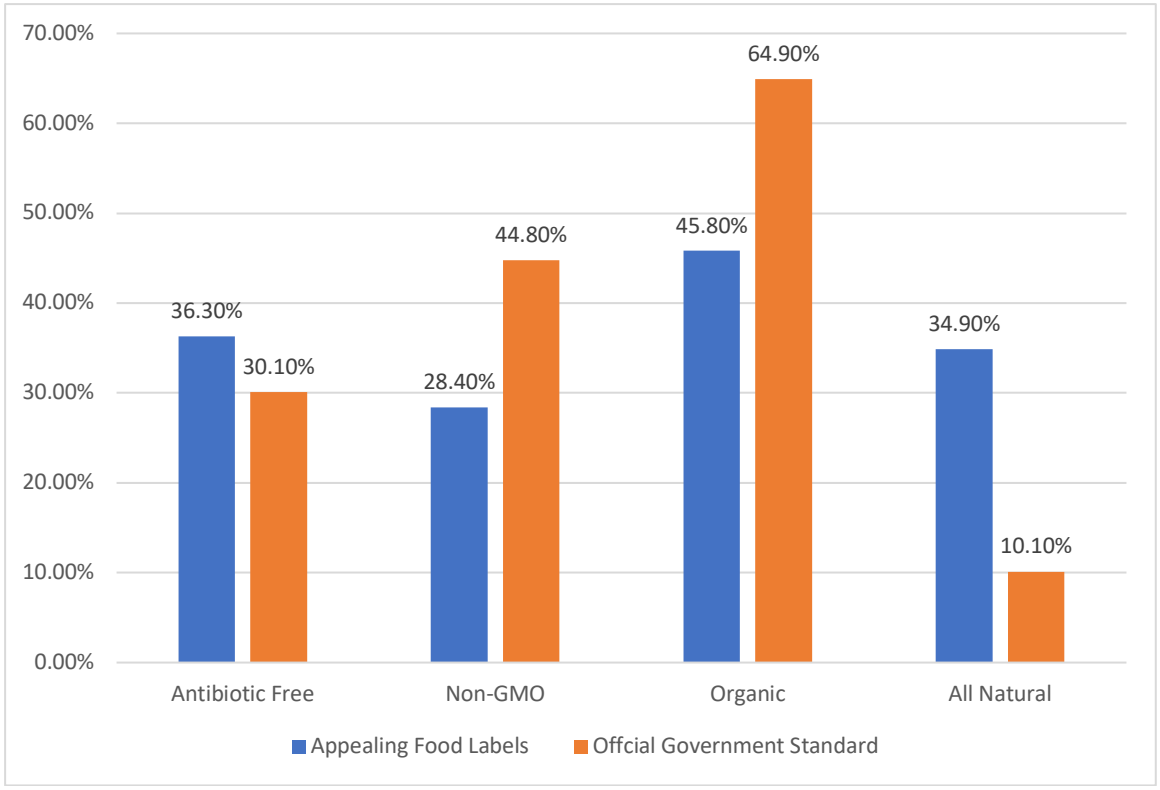

Figure 6. Appeal of food labels compared to the belief that the label has an official government standard

A chi-square analysis was used to determine whether there was a significant relationship between whether respondents believed a label had an official government standard and whether

or not they found the same label appealing. The null hypothesis was that there would be no significant relationship. The alternative hypothesis was that a significant relationship would exist between the two variables. The null hypothesis was rejected because $p<0.05$, proving the alternative hypothesis to be accepted and establishing that there was a significant relationship between the two variables (refer to Appendix F).

Performing a cross tabulation revealed that of the 45.8% of respondents that find the organic food label appealing, 72.7% believe the label has an official government standard. Of the 28.4% of the respondents who find the non-GMO label appealing, 62.7% believe the label has an official government standard. Of the 10.1% of respondents who find the all natural food label appealing, 14.3% believe it has an official government standard. Of the 36.3% of respondents who find the antibiotic free label appealing, 38.9% believe it has an official government standard (refer to Appendix G).

Respondents were also asked to select which sources of information are used to gain understanding of food labels to determine the sources of information consumers rely on to make food purchasing decisions. Forty one point three percent of respondents said that they do not research food and food labels before making food purchasing decisions, as seen in Figure 7. Scientific research studies are a source of information for 33.4% of respondents, and 30.2% of respondents said that nutritionists and/or medical professionals provided them with information used in food purchasing decisions. Consumer blogs are a source of information for 24.2% of respondents. Less than 20% of respondents indicated food companies, farmers, or regulatory agencies as a source of information.

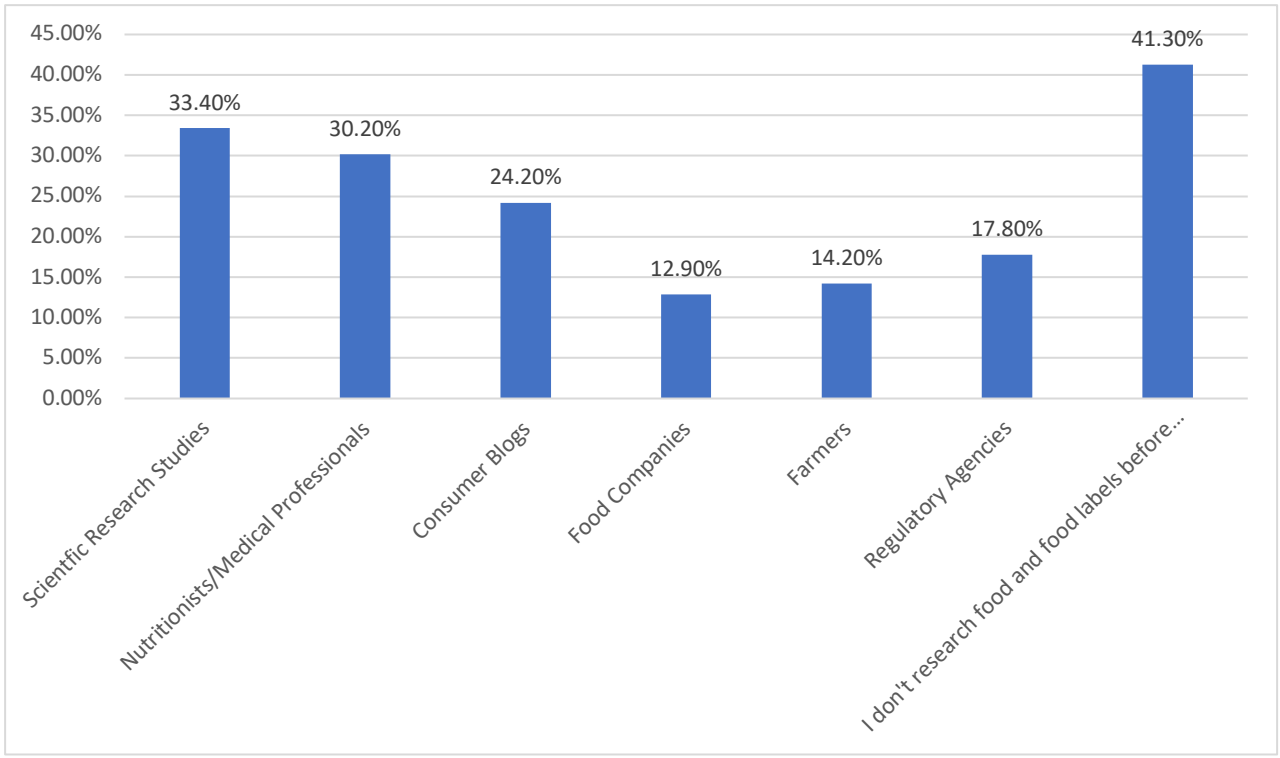

Figure 7. Sources of information used to make food purchasing decisions

A chi-squared analysis was used to determine whether there was a significant relationship between which labels consumers found appealing and their sources of information for purchasing decisions. A significant relationship was found between consumer blogs as source of information and the appeal of all four labels (organic, non-GMO, antibiotic free, and all natural). The null hypothesis was that label appeal is independent from consumer blogs as a source of information. The alternative hypothesis that label appeal is not independent of consumer blogs as a source of information was proven to be true for each label. For each chi-square analysis, a sample size of 1104 and 1 degree of freedom was used. Since $p > .05$ in each relationship, the null hypothesis is rejected (refer to Appendix F).

Chapter 5: Conclusions

The purpose of this study was to determine the factors and values that influence consumer food purchasing decisions. Three main objectives were identified in order to accomplish this purpose. The first was to establish if consumers could define terms and labels on food packaging such as GMO, organic, and antibiotic free. The 4 major aspects of a certified organic product are that they are produced without GMOs or synthetic pesticides, were grown in a way that contributes to the conservation of biodiversity, and are certified by the USDA. Less than 10% of respondents included one of any of those terms in their definition of organic, and only 1 respondent specified the label required conservation of biodiversity. Organic products are also able to be grown using certain approved pesticides, but only 33% of respondents disagreed with the statement that organic products were produced without pesticides. In defining the term organic, 39.5% of respondents also stated that they thought this meant a product was grown without pesticides and 20.8% believed the label meant the product was grown without chemicals. These results would indicate the majority of consumers do not fully understand all the aspects of an organic food label.

GMO as defined by the USDA is a genetically modified organism produced with genetic modification (USDA, n.d.). Related terms include biotechnology and genetic engineering. Biotechnology is defined as "breeding tools, such has genetic engineering, that are used to alter and improve organisms or products" (USDA, 2015). Genetic engineering is defined as "the process of changing an organism's DNA using techniques called recombinant DNA techniques" (USDA, n.d). While the majority of respondents, 70.6%, were able to identify that GMO meant a product was genetically modified, only 5.3% identified the label as having something to do with DNA or the organism's traits. Furthermore, 61% of consumers were admittedly unsure of how

many GMO products exist. Despite the fact that there is not an official government standard for non-GMO products, 44.8% of consumers believe that there is. While the majority of respondents do seem to be able to identify what GMO stands for, there are still a large number of consumers who don't fully understand what the term means.

In reference to antibiotic free and raised with antibiotic labels, about a quarter of consumers admit to being unsure of whether or not harmful antibiotic residue is present in products without a label stating antibiotics weren't used in production, and about quarter of consumers also admit they are unsure of why farmers use antibiotics. The real idea behind the antibiotic label is not a concern with antibiotic residue, but a concern regarding antibiotic resistant bacteria that can develop as result of an animal being administered antibiotics. It is clear that there are still many consumers who do not fully understand the meaning of the labels on their food.

The second objective was to determine the values driving consumer purchasing decisions. The research determined that price and nutritional value were two of the most important values influencing consumer purchasing decisions. The research also determine that organic food labels were found to be most appealing by consumers. The percentage of consumers who found a label to be appealing was also proven to be significantly affected by whether or not consumers believed the label had an official government standard. The gender, age, and child status of consumers did not seem to play a role in their purchasing decisions or food values.

The last objective was to determine the sources of information consumers rely on to make decisions. It was clear that the most significant source of information for food purchasing decisions was consumer blogs. While only a little less than 25% of consumers indicated this as a

source of information for food purchasing decisions, consumer blogs were the only source of information to have a significant relationship with the labels consumers found to be appealing.

It has been concluded that may consumers are unable to define the labels on their food, but most consider with the price and nutritional value of their food. While the largest number of consumers do not research their food purchasing decisions, the most significant source of information are consumer blogs. For this reason, a website that has consumer blog qualities, providing information that is easy to digest, navigate, and interpret. However, this website references a variety of research and regulatory information, taking the burden off the consumer of having to visit multiple websites that can be dry and hard to interpret. The focus of information on this site will be on the meanings of labels, with a specific focus on how this relates to the nutritional value of food and its price.

A recommendation for future research would be to find a specific population that has no agricultural connection. While this study did use purposive sampling that targeted consumers who are responsible for food shopping and would have strong food values, this population did include those who are involved in the agriculture industry. Additionally, a question related to whether a not a person has a connection to the agriculture industry could be added. Given the recent political activity surrounding the movements such as the Green New Deal and the growing popularity of alternative meat products, it would be interesting to see if there is now a more significant concern with sustainability and animal welfare.

References

Baker, G.A., & Burnham, T.A. (2001). Consumer response to genetically modified foods: market segment analysis and implications for producers and policy makers. *Journal of Agriculture and Resource Economics, (26)*2, 387-403.

Bonroy, O. & Constantos, C. (2014). On the economics of labels: How their introduction affects the functioning of markets and the welfare of all participants. *American Journal of Agriculture Economics, 97*(1), 239-259.

Bureau of Labor Statistics (2013). International Comparisons of Annual Labor Force Statistics, 1970-2012. *United States Department of Labor*. Retrieved from https://www.bls.gov/fls/flscomparelf.htm#table06

Dimitri, C., Effland, A., & Conklin, N. (2005) The 20th Century Transformation of U.S. Agriculture and Farm Policy. *United States Department of Agriculture*. Retrieved from https://www.ers.usda.gov/webdocs/publications/44197/13566_eib3_1_.pdf?v=41055

Ellison, B., Brooks, K., & Mieno, T. (2017). Which livestock production claims matter most to consumers. *Agriculture and Human Values, 34*(4), 819-831.

Evans, R.R., Burnett, D.O., Kendrick, O.W., Macrina, D.M., Snyder, S.W., Roy, J.P.L., & Stephens, B.C. (n.d.) Developing Valid and Reliable Online Survey Instruments Using Commercial Software Programs. *Journal of Consumer Health on the Internet, (13)*1.

Haroldson, A. & Yen, C. (2016). Consumer understanding of nutrition marketing terms: a pilot study. *Journal of Family & Consumer Sciences, 108*(3), 24-31.

Kuchler, F., Green, C., Bowman, M., Marshall, K.K., Bovay, J., & Lycnh, L. (2017). Beyond nutrition and organic labels- 30 years of experience with intervening in food label. *United*

States Department of Agriculture Economic Research Service. Retrieved from https://www.ers.usda.gov/publications/pub-details/?pubid=85686

Levins, Richard A. 2002. "Collective Bargaining by Farmer's: Time for a Fresh Look?" Choices, Agricultural and Applied Economics Association, 16(4)

Lusk, J.L. & Briggeman, B.C. (2009). Food Values. *American Journal of Agriculture Economics, 91*(1), 184-196.

Orquin, J.L., & Scholderer, J. (2015) Consumer Judgements of explicit and implied health claims on foods: misguided but not misled. *Food Policy, 51(*February 2015), 144-157

Funk, C., Rainie, L., Smith, A., Olmstead, K., Duggan, M., & Page, D. (2015). Public and Scientists' Views on Science and Society. *Pew Research Center*. Retrieved from http://www.pewinternet.org/files/2015/01/PI_ScienceandSociety_Report_012915.pdf

School-Grissemann, Ursula. (2017). Do consumers care about the massage a claim conveys? The magic bullet effect of organic and domestic claims on food products. *Journal of Consumer Behaviour, 17*(1), e21-e28.

Song, M.R., & Im, M. (2017) Moderating effects of food type and consumers' attitude on the evaluation of food items labeled "additive free". *Journal of Consumer Behaviour*. *17*(1), e1-e12.

USDA (2015) Meat and Poultry Labeling Terms. *United States Department of Agriculture Food Safety and Inspection Service*. Retrieved from https://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/food-labeling/meat-and-poultry-labeling-terms/meat-and-poultry-labeling-terms

USDA (2018). Farming and Farm Income. *United States Department of Agriculture Economic Research Service*. Retrieved from https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/farming-and-farm-income/

van Dijk, H., van Kleef, E., Owen, H., Frewer, L.J. (2012) Consumer preferences regarding food-related risk-benefit messages. *British Food Journal*. *114*(3), 387-399.

Vecchione, M., Feldman, C., & Wunderlich, S. (2015) Consumer knowledge and attitudes about genetically modified food products and labelling policy. *International Journal of Food Sciences and Nutrition*. *66*(3), 329-335.

Wolf, C.A., Tonsor, G.T., & Olynk, N.J. (2011). Understanding U.S. consumer demand for milk production attributes. *Journal of Agricultural and Resource Economics*. *36*(2), 326-324.

Appendices

Appendix A: Research Participation Consent Form

Study Title: Consumer Understanding of Food Labels and Claims
Primary Investigator: Molly Gildea, Graduate Student, Hutson School of Agriculture

You are being invited to participate in a research study conducted through Murray State University. This form contains information you will need to help you decide whether to be in this research study or not. You must be at least 18 years old to participate. Please read the form carefully and ask the study team member questions about anything that is not clear. You will be given a copy of this form to keep.

1. **Nature and Purpose of Project:** The purpose of this study is to research the rate of consumer understanding of food labels and claims the relationship with consumer values.

2. **Participant Selection: Any person who purchases food and places value on the labels and claims regarding attributes associated with that food is encouraged to participate.**

3. **Explanation of Procedures:** The study activities include a short survey that should take approximately 10 minutes to complete.

4. **Discomforts and Risks:** There are no anticipated risks and/or discomforts for participants.

5. **Benefits:** This study is not designed to benefit you directly. However, your participation may help to increase our understanding of consumer food values and purchasing habits.

6. **Confidentiality**: Your participation in this study is anonymous. Neither the researcher(s) nor anyone else will know if you have participated or how you responded.

7. **Refusal/Withdrawal:** Your participation is strictly voluntary and you are free to withdraw/stop participating at any time with absolutely no penalty. It is, however, critical that you complete the full survey in order for your responses to be used.

8. **Contact Information:** Any questions about the procedures or conduct of this research should be brought to the attention of Molly Gildea at (603) 370-7438 or mgildea@murraystate.edu. {If you would like to know the results of this study, please contact Molly Gildea.

Your completion of this survey **indicates that this study has been explained to you, that your questions have been answered, and that you agree to take part in this study.**

The dated approval stamp on this document indicates that this project has been reviewed and approved by the Murray State University Institutional Review Board (IRB) for the Protection of Human Subjects. If you have any questions about your rights as a research participant, you should contact the MSU IRB Coordinator at (270) 809-2916 or msu.irb@murraystate.edu.

Appendix B: Survey Questions

What is your age?

- ☐ 18-26
- ☐ 27-33
- ☐ 34- 40
- ☐ 41- 47
- ☐ over 47

What is your gender?

- ☐ Male
- ☐ Female
- ☐ Other
- ☐ N/A

Do you have children?

- ☐ Yes
- ☐ No

Please define the term “organic” as you would interpret it on a food label:

Please define the term “genetically modified organism” as you would interpret it on a food label:

Please rank in order of most important to least important the values that drive your food purchasing decisions:

- ___ Price
- ___ Food Safety
- ___ Environmental Impact
- ___ Ethics/Welfare of people and animals involved in production
- ___ Nutritional value

Which of the following food labels are appealing to you? Select all that apply

- ☐ Raised without antibiotics
- ☐ Non-GMO
- ☐ Organic
- ☐ All Natural
- ☐ None of these
- ☐ Other

Which of the following food labels do you believe have an official standard set by the government or a regulatory agency? Select all that apply

- ☐ Organic
- ☐ Non-GMO
- ☐ Anti-biotic free
- ☐ Raised without antibiotics
- ☐ All natural

Where do you find information about food labels or other factors that influence your purchasing decisions? Select all that apply

- ☐ Scientific research
- ☐ Nutritionists
- ☐ Consumer blogs
- ☐ Food companies
- ☐ Farmers
- ☐ Regulatory agencies
- ☐ I don't research food and food labels before purchasing

Please state whether you agree or disagree with the following statements:

1. Organic food has more nutritional value than conventionally produced food.

☐ Agree
☐ Unsure
☐ Disagree

2. Organic food is lower in calories than conventionally produced foods.

☐ Agree
☐ Unsure
☐ Disagree

3. Foods labeled non-GMO are safer than those foods that do not hold that label.

☐ Agree
☐ Unsure
☐ Disagree

4. Meats and animal products not labeled "raised without antibiotics" may contain antibiotics that are harmful to people.

☐ Agree
☐ Unsure
☐ Disagree

5. Foods can be genetically engineered to contain certain nutrients and survival traits.

☐ Agree
☐ Unsure
☐ Disagree

6. There are currently only 10 genetically modified crops available commercially in the U.S.

☐ Agree
☐ Unsure
☐ Disagree

7. Certified organic foods are produced without the use of any pesticides.

☐ Agree
☐ Unsure

☐ Disagree

8. Organic and "sustainably sourced" foods are the only foods produced using sustainable farming practices.

☐ Agree
☐ Unsure
☐ Disagree

9. Genetically modified foods provide no environmental benefits.

☐ Agree
☐ Unsure
☐ Disagree

10. Most farmers use anti-biotics to increase their animals' production.

☐ Agree
☐ Unsure
☐ Disagree

Appendix C: Frequency Tables of Responses

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-26	399	36.1	36.3	36.3
	27-33	276	25.0	25.1	61.4
	34-40	153	13.9	13.9	75.3
	41-47	58	5.3	5.3	80.5
	over 47	214	19.4	19.5	100.0
	Total	1100	99.6	100.0	
Missing	System	4	.4		
Total		1104	100.0		

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	297	26.9	27.0	27.0
	female	799	72.4	72.6	99.5
	3	1	.1	.1	99.6
	4	4	.4	.4	100.0
	Total	1101	99.7	100.0	
Missing	System	3	.3		
Total		1104	100.0		

Children

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	384	34.8	34.8	34.8
	no	718	65.0	65.2	100.0
	Total	1102	99.8	100.0	
Missing	System	2	.2		
Total		1104	100.0		

Price

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	most important	306	27.7	28.4	28.4
	2	321	29.1	29.8	58.3
	3	224	20.3	20.8	79.1
	4	94	8.5	8.7	87.8
	least important	131	11.9	12.2	100.0
	Total	1076	97.5	100.0	
Missing	System	28	2.5		
Total		1104	100.0		

Food Safety

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	most important	216	19.6	20.2	20.2
	2	218	19.7	20.4	40.6
	3	369	33.4	34.5	75.1
	4	129	11.7	12.1	87.2
	least important	137	12.4	12.8	100.0
	Total	1069	96.8	100.0	
Missing	System	35	3.2		
Total		1104	100.0		

Environmental impact

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	most important	35	3.2	3.3	3.3
	2	83	7.5	7.7	11.0
	3	172	15.6	16.0	27.0
	4	422	38.2	39.3	66.2
	least important	363	32.9	33.8	100.0
	Total	1075	97.4	100.0	
Missing	System	29	2.6		
Total		1104	100.0		

Ethics

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	most important	64	5.8	5.9	5.9
	2	104	9.4	9.5	15.4
	3	188	17.0	17.2	32.7
	4	371	33.6	34.0	66.7
	least important	363	32.9	33.3	100.0
	Total	1090	98.7	100.0	
Missing	System	14	1.3		
Total		1104	100.0		

Nutrition

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	most important	452	40.9	41.1	41.1
	2	354	32.1	32.2	73.2
	3	138	12.5	12.5	85.7
	4	66	6.0	6.0	91.7
	least important	91	8.2	8.3	100.0
	Total	1101	99.7	100.0	
Missing	System	3	.3		
Total		1104	100.0		

Anti-biotic free

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no preference given	703	63.7	63.7	63.7
	appealing	401	36.3	36.3	100.0
	Total	1104	100.0	100.0	

Non-GMO

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no preference given	790	71.6	71.6	71.6
	appealing	314	28.4	28.4	100.0
	Total	1104	100.0	100.0	

Organic

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no preference given	598	54.2	54.2	54.2
	appealing	506	45.8	45.8	100.0
	Total	1104	100.0	100.0	

All natural

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no preference given	719	65.1	65.1	65.1
	appealing	385	34.9	34.9	100.0
	Total	1104	100.0	100.0	

None of these

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not identified	783	70.9	70.9	70.9
	none	321	29.1	29.1	100.0
	Total	1104	100.0	100.0	

Organic

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not identified	387	35.1	35.1	35.1

	has standard	717	64.9	64.9	100.0
	Total	1104	100.0	100.0	

Non-GMO

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not identified	609	55.2	55.2	55.2
	has standard	495	44.8	44.8	100.0
	Total	1104	100.0	100.0	

Anti-biotic free

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not identified	772	69.9	69.9	69.9
	has standard	332	30.1	30.1	100.0
	Total	1104	100.0	100.0	

Raised without antibiotics

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not identified	756	68.5	68.5	68.5
	has standard	348	31.5	31.5	100.0
	Total	1104	100.0	100.0	

All natural

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not identified	992	89.9	89.9	89.9
	has standard	112	10.1	10.1	100.0
	Total	1104	100.0	100.0	

Scientific research studies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not identified	735	66.6	66.6	66.6
	source	369	33.4	33.4	100.0
	Total	1104	100.0	100.0	

Nutritionists/Medical Professionals

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not identified	771	69.8	69.8	69.8
	source	333	30.2	30.2	100.0
	Total	1104	100.0	100.0	

Consumer blogs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not identified	837	75.8	75.8	75.8
	source	267	24.2	24.2	100.0
	Total	1104	100.0	100.0	

Food companies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not identified	962	87.1	87.1	87.1
	source	142	12.9	12.9	100.0
	Total	1104	100.0	100.0	

Farmers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not identified	947	85.8	85.8	85.8

	source	157	14.2	14.2	100.0
	Total	1104	100.0	100.0	

Regulatory agencies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not identified	908	82.2	82.2	82.2
	source	196	17.8	17.8	100.0
	Total	1104	100.0	100.0	

I don’t research food and food labels before purchasing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not identified	648	58.7	58.7	58.7
	source	456	41.3	41.3	100.0
	Total	1104	100.0	100.0	

Organic Nutrition

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	agree	193	17.5	17.5	17.5
	disagree	736	66.7	66.8	84.3
	unsure	173	15.7	15.7	100.0
	Total	1102	99.8	100.0	
Missing	System	2	.2		
Total		1104	100.0		

Organic Calorie

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	agree	31	2.8	2.8	2.8
	disagree	979	88.7	88.8	91.6

	unsure	93	8.4	8.4	100.0
	Total	1103	99.9	100.0	
Missing	System	1	.1		
Total		1104	100.0		

Gmo Safety

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	agree	227	20.6	20.6	20.6
	disagree	686	62.1	62.3	82.8
	unsure	189	17.1	17.2	100.0
	Total	1102	99.8	100.0	
Missing	System	2	.2		
Total		1104	100.0		

RWA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	agree	500	45.3	45.3	45.3
	disagree	322	29.2	29.2	74.5
	unsure	282	25.5	25.5	100.0
	Total	1104	100.0	100.0	

GE traits

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	agree	1007	91.2	91.4	91.4
	disagree	31	2.8	2.8	94.2
	unsure	64	5.8	5.8	100.0
	Total	1102	99.8	100.0	
Missing	System	2	.2		
Total		1104	100.0		

10 GMOs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	agree	161	14.6	14.6	14.6
	disagree	265	24.0	24.0	38.7
	unsure	676	61.2	61.3	100.0
	Total	1102	99.8	100.0	
Missing	System	2	.2		
Total		1104	100.0		

Pesticides

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	agree	587	53.2	53.3	53.3
	disagree	357	32.3	32.4	85.7
	unsure	157	14.2	14.3	100.0
	Total	1101	99.7	100.0	
Missing	System	3	.3		
Total		1104	100.0		

Sustainability

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	agree	141	12.8	12.8	12.8
	disagree	693	62.8	62.8	75.6
	unsure	269	24.4	24.4	100.0
	Total	1103	99.9	100.0	
Missing	System	1	.1		
Total		1104	100.0		

GMO environment

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	agree	103	9.3	9.3	9.3
	disagree	727	65.9	66.0	75.3
	unsure	272	24.6	24.7	100.0
	Total	1102	99.8	100.0	
Missing	System	2	.2		
Total		1104	100.0		

Anti-biotics

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	agree	587	53.2	53.2	53.2
	disagree	285	25.8	25.8	79.1
	unsure	231	20.9	20.9	100.0
	Total	1103	99.9	100.0	
Missing	System	1	.1		
Total		1104	100.0		

Organic Synthetic Pesticide Use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	identified with organic	71	6.4	100.0	100.0
Missing	System	1033	93.6		
Total		1104	100.0		

Organic nonGMO

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	identified with organic	62	5.6	100.0	100.0
Missing	System	1042	94.4		
Total		1104	100.0		

Organic USDa certified

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	identified with organic	27	2.4	100.0	100.0
Missing	System	1077	97.6		
Total		1104	100.0		

Organic Conservation of biodiversity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	identified with organic	1	.1	100.0	100.0
Missing	System	1103	99.9		
Total		1104	100.0		

Organic no pesticide

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	identified with organic	436	39.5	100.0	100.0
Missing	System	668	60.5		
Total		1104	100.0		

Organic IDK

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	identified with organic	14	1.3	100.0	100.0
Missing	System	1090	98.7		
Total		1104	100.0		

Organic Chemicals

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	identified with organic	230	20.8	100.0	100.0
Missing	System	874	79.2		

Total		1104	100.0		

Organic Cruelty

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	identified with organic	6	.5	100.0	100.0
Missing	System	1098	99.5		
Total		1104	100.0		

GMO genetically modified

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	identified with GMO	779	70.6	100.0	100.0
Missing	System	325	29.4		
Total		1104	100.0		

GMO DNA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	identified with GMO	58	5.3	100.0	100.0
Missing	System	1046	94.7		
Total		1104	100.0		

GMO Traits

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	identified with GMO	58	5.3	100.0	100.0
Missing	System	1046	94.7		
Total		1104	100.0		

GMO Hormones

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	identified with GMO	17	1.5	100.0	100.0
Missing	System	1087	98.5		
Total		1104	100.0		

GMO Chemicals

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	identified with GMO	21	1.9	100.0	100.0
Missing	System	1083	98.1		
Total		1104	100.0		

GMO IDK

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	identified with GMO	87	7.9	100.0	100.0
Missing	System	1017	92.1		
Total		1104	100.0		

Appendix D: IRB Application

Murray State University

Institutional Review Board (IRB)
Application for Approval of Investigations Involving Human Participants

This form is the official documentation of the formal design or plan of a research activity submitted to the IRB for review. Failure to provide all required information will result in return of your application for correction prior to review. It is to be filled out on-line and then the appropriate parts are to be printed for submission. Do not submit pages that do not apply to your research protocol and do not submit your protocol answers as an attachment (the only attachments should be supporting documents). **NOTE: You must submit the signed form as a pdf document and the appropriate materials that support that request as editable *Word* documents to msu.irb@murraystate.edu.**

PART A

I. Project Title: Consumer Understanding of Food Labels

Principal Investigator(s): Molly Gildea

Department: Agricultural Science Telephone: 603-370-7438

Campus Address: N/A Email address: mgildea@murraystate.edu

Status: ☐ Undergraduate Student ☒ Graduate Student ☐ Faculty ☐ Other (Specify:

If PI is an Undergraduate or Graduate Student, applications must be submitted by the faculty mentor and all IRB communications will be sent to the faculty mentor:

Faculty Mentor: Dr. Alyx Shultz Telephone: (270) 809-6925 Email address: ashultz@murraystate.edu

Department: Agricultural Science Campus Address: 216 S. Oakley Applied Science Building

Will any other university personnel or students be assisting with this data collection?
☐Yes ☒ No
If yes, who are they and what position do they hold at the university?

Please check which is appropriate: ☐Class Project ☒Research Project ☐Thesis (or Doctoral project)

If this research is for a thesis or senior project, who are the faculty members on your thesis or project committee?
Dr. Naveen Musunuru, Dr. Yana Andonova

Project Period (mm/dd/yyyy) From: 6/20/2018 To: 5/1/2019

The designated project period must include all project activities involving humans, with the start date no earlier than the date of IRB approval. The IRB can approve a project for a maximum of 12 months. However, the IRB may decide that more frequent review is necessary. Protocols with project periods longer than 12 months or those that the IRB feels necessitate more frequent review will require a continuing review (use the Project Update and Closure form).

Is a proposal for funding support being submitted? ☒ No ☐ Yes
If *yes*: ☐ Internal ☐ External

Agency or Sponsor: Deadline:

Will this protocol require review by another IRB? ☒ No ☐ Yes

Appendix E: CITI Program Certification

CITI PROGRAM

Completion Date 03-Jul-2018
Expiration Date 02-Jul-2021
Record ID 27582930

This is to certify that:

Molly Gildea

Has completed the following CITI Program course:

Students conducting no more than minimal risk research (Curriculum Group)
Students - Class projects (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

Murray State University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w2258479c-b90d-4a68-b443-5f2ad00dd772-27582930

Appendix F: Chi-Square Analysis

non-GMO label appeal * non-GMO label standard

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	56.857[a]	1	.000		
Continuity Correction[b]	55.850	1	.000		
Likelihood Ratio	56.947	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	56.806	1	.000		
N of Valid Cases	1104				

antibiotic free label appeal * antibiotic free label standard

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	23.350[a]	1	.000		
Continuity Correction[b]	22.695	1	.000		
Likelihood Ratio	22.964	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	23.329	1	.000		
N of Valid Cases	1104				

Organic label appeal * organic label standard

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	24.847[a]	1	.000		
Continuity Correction[b]	24.220	1	.000		
Likelihood Ratio	25.117	1	.000		
Fisher's Exact Test				.000	.000

Linear-by-Linear Association	24.824	1	.000		
N of Valid Cases	1104				

all natural label appeal * all natural label standard

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	11.119[a]	1	.001		
Continuity Correction[b]	10.433	1	.001		
Likelihood Ratio	10.674	1	.001		
Fisher's Exact Test				.001	.001
Linear-by-Linear Association	11.109	1	.001		
N of Valid Cases	1104				

antibiotic free label appeal * consumer blog information source

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	11.317[a]	1	.001		
Continuity Correction[b]	10.831	1	.001		
Likelihood Ratio	11.113	1	.001		
Fisher's Exact Test				.001	.001
Linear-by-Linear Association	11.307	1	.001		
N of Valid Cases	1104				

non-GMO label appeal * consumer blogs information source

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	11.812[a]	1	.001		

Continuity Correction[b]	11.282	1	.001		
Likelihood Ratio	11.429	1	.001		
Fisher's Exact Test				.001	.000
Linear-by-Linear Association	11.801	1	.001		
N of Valid Cases	1104				

organic label appeal * consumer blog information source

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	31.243[a]	1	.000		
Continuity Correction[b]	30.460	1	.000		
Likelihood Ratio	31.254	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	31.215	1	.000		
N of Valid Cases	1104				

all natural label appeal * consumer blog information source

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.204[a]	1	.013		
Continuity Correction[b]	5.842	1	.016		
Likelihood Ratio	6.104	1	.013		
Fisher's Exact Test				.015	.008
Linear-by-Linear Association	6.198	1	.013		
N of Valid Cases	1104				

Appendix G: Crosstabulations

Anti-biotic free label appeal * Anti-biotic free official standard

			Anti-biotic free		
			not identified	has standard	Total
Anti-biotic free	no preference given	Count	527	176	703
		% within Anti-biotic free	75.0%	25.0%	100.0%
		% within Anti-biotic free	68.3%	53.0%	63.7%
	appealing	Count	245	156	401
		% within Anti-biotic free	61.1%	38.9%	100.0%
		% within Anti-biotic free	31.7%	47.0%	36.3%
Total		Count	772	332	1104
		% within Anti-biotic free	69.9%	30.1%	100.0%
		% within Anti-biotic free	100.0%	100.0%	100.0%

Organic label appeal * Organic official standard

			Organic		
			not identified	has standard	Total
Organic	no preference given	Count	249	349	598
		% within Organic	41.6%	58.4%	100.0%
		% within Organic	64.3%	48.7%	54.2%
	appealing	Count	138	368	506
		% within Organic	27.3%	72.7%	100.0%
		% within Organic	35.7%	51.3%	45.8%

Total		Count	387	717	1104
		% within Organic	35.1%	64.9%	100.0%
		% within Organic	100.0%	100.0%	100.0%

Non-GMO label appeal * Non-GMO official standard

			Non-GMO		
			not identified	has standard	Total
Non-GMO	no preference given	Count	492	298	790
		% within Non-GMO	62.3%	37.7%	100.0%
		% within Non-GMO	80.8%	60.2%	71.6%
	appealing	Count	117	197	314
		% within Non-GMO	37.3%	62.7%	100.0%
		% within Non-GMO	19.2%	39.8%	28.4%
Total		Count	609	495	1104
		% within Non-GMO	55.2%	44.8%	100.0%
		% within Non-GMO	100.0%	100.0%	100.0%

All natural label appeal * All natural official standard

			All natural		
			not identified	has standard	Total
All natural	no preference given	Count	662	57	719
		% within All natural	92.1%	7.9%	100.0%
		% within All natural	66.7%	50.9%	65.1%

	appealing	Count	330	55	385
		% within All natural	85.7%	14.3%	100.0%
		% within All natural	33.3%	49.1%	34.9%
Total		Count	992	112	1104
		% within All natural	89.9%	10.1%	100.0%
		% within All natural	100.0%	100.0%	100.0%