# Consumers' Evaluations of Genetically Modified Food Messages

## Introduction

The emergence of genetically modified (GM) crops, the organic food industry, and health concerns have sparked consumer interest in how their food is produced (Funk & Kennedy, 2016). In response to consumer demand for food information, media have increased coverage of food biotechnology processes (International Food Information Council, 2012; Perez & Howard, 2007). While increased news coverage on food biotechnology could lead to increased levels of trust and knowledge regarding issues in science (National Academies of Sciences [NAS], 2016b; Perez & Howard, 2007; Wang, 2017), the information presented has sometimes been sensationalized and focused on scandals and risks opposed to potential benefits (Galata, Karantininis, & Hess, 2014; Jayaraman & Jia, 2012; Mahgoub, 2016). Regarding GM food in particular, the media have focused on environmental and health risks (Ruth & Rumble, 2016), despite decades of research on the safety of the food (NAS, 2016a; Nicolia, Manzo, Veronesi, & Roesllini, 2014).

The Food and Drug Administration (FDA, 2014) defined genetic modification as the intentional alteration of plant or crop DNA to produce desirable traits. This technology has been used in food production to develop products that grow quicker, are pest and drought resistant, and have better taste (FDA, 2015). GM crops have been grown in the US since the 1990s, and nearly 90% of soybeans and corn are genetically modified (FDA, 2015). While most processed foods contain GM ingredients, genetically modified fruits and vegetables have also been available for purchase, including varieties of papaya, potatoes, apples, and squash (FDA, 2015). The majority of GM food has been developed to help farmers not lose yields due to drought, pests, and disease, but new varieties are being developed that can benefit consumers (Wilcox, 2015). However, consumers are concerned about a number of different impacts these products could have on both human health and the environment (Mahgoub, 2016). In fact, the Pew Research Center published a report in 2015 that only 37% of Americans agreed GM food was safe to eat compared to 88% of scientists (Funk & Rainie, 2015). Some researchers have concluded the public's skepticism of GM food was rooted in their intuitive feelings toward the food rather than their knowledge of the technology (Blancke, Van Breusegem, Jeager, Braeckman, & Van Montagu, 2015; Heddy, Danielson, Sinatra, & Graham, 2016; Trevors, Muis, Perkun, Sinatra, & Winne, 2016). However, research has also proposed that consumers' attitudes toward GM food were actually fairly weak and could be influenced by new information (Funk & Kennedy, 2016).

While consumer skepticism toward GM food has been the focus in the media (Galata et al., 2014; Jayaraman & Jia, 2012; Mahgoub, 2016), there are actually an array of opinions across the public. Some consumers have reported not eating GM food due to health and environmental concerns; others have been cautious about GM food but acknowledge its benefits; while a final group has believed the benefits of GM food outweigh any drawbacks (Mahgoub, 2016). In general, consumers have not been familiar with the technology used to develop GM food and have a difficult time finding reliable and neutral sources for information about it (Conko & Prakash, 2004; McHughen, 2013). As a result, consumers are cautious toward the technology and plagued with a social anxiety when purchasing and consuming GM food (Conko & Prakash, 2004; McHughen, 2013).

A systematic review of public opinion research determined consumers were most concerned about GM food causing cancer, not being safe for consumption, and negatively impacting the environment (Runge, Brossard, Scheufele, Rose, & Larson, 2017). Additional research has found Millennial consumers' acceptance of GM food to be most strongly influenced

by their perceptions of GM food impacts on health (Linnhoff, Volovich, Martin, & Smith, 2017). Lu, McComas, and Besley (2017) found consumers responded favorably to messages that framed GM food around food security and climate change, likely due to the moral implications of the message. These findings are not limited to consumers in the United States (US). A study in Trinidad and Tobego found the majority of consumers to be concerned about the health and moral implications of GM food (Varachhia, Badrie, & Singh, 2017), and a study in Australia determined that consumers' attitudes toward GM food and biotechnology have become increasingly negative over the past decade in correlation with negative news coverage of the technology (Marques, Critchley, & Walshe, 2015).

Due to the emotionally charged nature of discussions about GM food (Blancke et al., 2015; Heddy et al., 2016; Trevors et al., 2016), there is a need to understand how to best communicate information about GM food to equip consumers with information needed to make decisions based on facts and not fear (Linnhoff et al., 2017). Agricultural communicators can help to alleviate and address some of these fears. While the food industry has the monetary resources available to communicate about GM food to the masses, consumers often perceive their messages to be biased (Ruth, Gay, Rumble, & Rodriguez, 2016). Agricultural communicators can serve as knowledgeable sources of research-based information for consumers. The purpose of this study was to evaluate Florida consumers' latitudes of acceptance, rejection, and noncommitment when presented with messages about GM food. This research will be valuable to agricultural communicators, Extension agents, agricultural educators, and practitioners in the food industry when developing communication or informational campaigns about GM food.

## Theoretical Framework

Social judgement theory was used to guide this research. Consumers have been found to not evaluate communication messages on quality alone and instead draw upon a variety of judgements, experiences, and attitudes when assessing communication (Sherif & Sherif, 1967). Social judgement theory proposed that people will compare their own attitude against the perceived attitude portrayed in a message (Sherif & Sherif, 1967). If the message presented does not resonate with consumers or presents ideas that contrast too strongly with their present attitudes and beliefs, communicators will have a difficult time delivering messages to help address consumer concerns (Sherif & Sherif, 1967). This theory described latitudes of acceptance, rejection, and noncommitment; assimilation and contrast; and ego evolvement to understand how people make judgements toward communication (Sherif & Sherif, 1967).

Perloff (2014) described attitudes as a learned evaluation of an object that affects thoughts and actions, and Sherif and Sherif (1967) further described the characteristics of attitude. The first criterion was that individual attitudes develop within a social environment. Additionally, attitudes typically will not change much once they have formed. Attitudes also reflect a relationship with a person, place, or thing (Sherif & Sherif, 1967) and consists of a continuum of positions (Perloff, 2014). People will determine what evaluations are acceptable and unacceptable in accordance with their own attitude (Sherif & Sherif, 1967). A *latitude of acceptance* includes the individual's most acceptable position along with all other positions he or she finds acceptable. The *latitude of rejection* is simply the opposite. Positions where individuals are noncommittal, they neither agree nor disagree, are defined as the *latitude of noncommitment.*

The concepts of assimilation and contrast further explained how people make judgements toward communication. These judgments are typically subjective rather than objective, and people will use their personal attitude as a reference point for comparison (Granberg, 1993). Individuals may

assume that a message is more similar to their attitude than it actually is during *assimilation*. Sometimes, people will also *contrast* the message and believe it more different from their own position than it really is (Granberg, 1993). While assimilation and contrast help people to handle daily exposure to persuasion, it can hinder areas of potential agreement and curtail exposure to potential alternative views (Perloff, 2014). Early research has also found that people with extreme views had large latitudes of rejection (Sherif, Sherif, & Nebergall, 1965).

The final concept of social judgement theory, ego-involvement, described when people are exposed to messages they believed addressed or affected their core values (Sherif et al., 1965). High levels of ego-involvement are associated with large latitudes of rejection. These individuals are often difficult to persuade because they typically reject any messages that do not align with their values; however, they will assimilate messages that appear mostly congruent with their attitudes (Sherif et al.,1965). Another characteristic of individuals who are ego-involved with an issue is their selective perception. Essentially, these individuals will interpret events or communication to align with their own attitudes and beliefs about the issue despite how they objectively align with their attitude (Edwards & Smith, 1996; Hastorf & Cantril, 1954; Hovland, Harvey & Sherif, 1957).

The social judgement theory indicated that it was difficult to change the minds of people with strong attitudes toward an issue (Sherif & Sherif, 1967). While people can have strong attitudes toward mundane topics like reality television or sports, most people associate strong attitudes with topics like politics, global warming, animal welfare, and GM food (Andenoro, Stedman, Baker, & Weeks, 2016; Perloff, 2014). Because attitudes toward GM food have been rooted in emotions (Heddy et al., 2017) there is a need to understand how to deliver fact-based messages to consumers that will not be outright rejected. Rodriguez and Lee (2016) recommended GM food communication efforts should focus on moving consumer attitudes from negative to neutral and utilize concepts from the social judgement theory.

Frewer, Howard, and Shepherd (1998) used the social judgement theory to understand British consumers' trust and perceptions of risk uncertainty toward GM food. The researchers found prior attitudes had the most impact on final attitude toward GM food. Additionally, admittance of some risk uncertainty for GM food influenced attitudes for respondents who had negative initial attitudes (Frewer et al., 1998). In another study using social judgment theory, Knight, Mather, and Holdsworth (2005) found New Zealand consumers were more likely to purchase GM food if the labels were framed as offering benefits directly to the consumer.

McFadden and Lusk (2014) conducted a study to determine how cognitive biases influenced the assimilation of messages about GM food. The researchers found that prior beliefs impacted assimilation of messages. Confirmation bias was also found to skew the interpretation of messages and lead to failure to assimilate (McFadden & Lusk, 2014). Research has also investigated differences in latitudes of acceptance related to demographics and GM food. Females have been found to have smaller latitudes of acceptance toward GM food communication compared to men, but some latitudes of acceptance were broad across multiple statements for both genders (Rumble, Lundy, Martin, & Anderson, 2017). Ballmer (2018) explored how Millennial agriculturalists' ego-involvement influenced latitudes of acceptance, rejection, and noncommitment. The majority of Millennials in the study had favorable attitudes toward GM food, and high ego-involvement unexpectedly led to changes in attitude (Ballmer, 2018). While the previously described studies investigated influences on the latitudes of acceptance, rejection, and noncommitment, there have been limited studies exploring what these latitudes actually are

regarding GM food messages. This study explored this concept and provided a framework for future research utilizing the social judgment theory.

## Purpose & Objectives

The purpose of this study was to explore Florida residents' latitudes of acceptance, rejection, and noncommitment for GM food messages. The objectives for this study were as follows:

1) Describe Florida residents' evaluation of messages related to GM food in relation to their own attitudes.
2) Describe the latitudes of acceptance, rejection, and noncommitment for Florida residents who hold positive and negative attitudes toward GM food.

## Methods

This study used quantitative methods to fulfill the purpose of the research. A survey was distributed to Florida residents in the fall of 2015. The convenience sample of Florida residents was appropriate due to Florida's large agricultural production (National Agricultural Statistic Service [NASS], 2016). It should be noted the data collected for this study was prior to the federal mandate to label all GM food that passed in 2016 (Popken, 2016). The timing of the data collection could cause some concern for a history effect if the respondents had been exposed to increased GM food coverage in the media leading up to the federal mandate (Ary, Jacobs, & Sorenson, 2010); however, the GM food messages presented in this study did not include statements about labeling or regulation. Additionally, the attitudes formed during the years leading up to the federal mandate have likely not changed without exposure to new information (Sherif & Sherif, 1967), and consumers will need to continue making purchasing and policy decisions related to GM food in the future. Understanding the messages this population will accept and reject in communication about GM food will be instrumental in communication and education campaigns in the future.

The survey research company Qualtrics delivered the survey questionnaire online to a non-probability, opt-in panel of Florida residents 18 years and older. Non-probability sampling can lead to selection, exclusion, and non-participation biases (Baker et al., 2013). To alleviate issues associated with non-probability sampling, the respondents' demographics were weighted to match the 2010 Florida Census. Age, sex, race, ethnicity, and urban-rural continuum of each respondent were weighted so the overall sample matched Florida's demographics, which helped to increase the generalizability of the sample to the population (Baker et al., 2013). Some issues can occur when underrepresented respondents hold too much weight in the sample, which can skew the results (Baker et al., 2013). However, analysis for the current study did not require comparison between demographic groups, so this threat was limited.

Even though non-probability sampling does not allow for each member of the population to have equal chance of selection, it is commonly used in social science research (Baker et al., 2013) and has been found to be just as good, if not better than, probability sampling methods (Twyman, 2008; Vavreck & River, 2008). The survey was distributed to 1,154 potential respondents, and there were 500 complete and usable responses (43.3% participation rate). The data used in this study were part of a larger data set that previously applied latitudes of acceptance, rejection, and non-commitment to similar but different GM food statements and compared those latitudes between males and females (Rumble et al., 2017). The unweighted and weighted demographics of the sample are provided in Table 1.

Table 1

*Description of Unweighted and Weighted Demographic Characteristics (n = 500)*

| Category | Unweighted | | Weighted | |
|---|---|---|---|---|
| | *n* | *%* | *n* | *%* |
| Age | | | | |
| 18-29 | 107 | 21.4 | 98 | 19.8 |
| 30-49 | 193 | 38.6 | 166 | 33.4 |
| 50-69 | 164 | 32.8 | 157 | 31.4 |
| 70+ | 36 | 7.2 | 78 | 15.6 |
| Gender | | | | |
| Female | 250 | 50.0 | 259 | 51.7 |
| Male | 250 | 50.0 | 241 | 48.3 |
| Education | | | | |
| High School or less | 113 | 22.6 | 126 | 25.3 |
| Some College | 135 | 27.0 | 132 | 26.5 |
| 2-year College Degree | 74 | 14.8 | 66 | 13.2 |
| 4-year College Degree | 139 | 27.8 | 129 | 25.8 |
| Graduate or Professional School | 39 | 7.8 | 47 | 9.3 |
| Income | | | | |
| $25,000 > | 116 | 23.2 | 116 | 23.3 |
| $25,000 -$49,999 | 156 | 31.2 | 140 | 28.0 |
| $50,000 -$74,999 | 105 | 21.0 | 99 | 19.8 |
| $75,000 - $149,999 | 99 | 19.8 | 122 | 24.5 |
| $150,000 or more | 24 | 4.8 | 22 | 4.5 |
| Race | | | | |
| White | 423 | 84.6 | 388 | 77.6 |
| African American | 33 | 6.6 | 72 | 14.4 |
| Asian | 15 | 3.0 | 12 | 2.5 |
| Native American | 2 | 0.4 | 2 | 0.4 |
| Multiracial | 10 | 2.0 | 9 | 1.9 |
| Other | 17 | 3.4 | 16 | 3.2 |
| Hispanic | 75 | 15.0 | 105 | 21.1 |

The survey questionnaire gathered information on consumers' perceptions of food safety, food waste, food policy, and GM food. From this questionnaire, two questions were analyzed to fulfill the purpose of the study. The questionnaire was reviewed by a panel of experts prior to distribution to account for face validity that consisted of an Assistant Professor with expertise in survey design and public opinion research and an Assistant Professor with expertise in survey design, food messaging, and public opinion research. Prior to seeing questions about GM food, the respondents were given the following researcher-adapted definition from the FDA (2014):

"Genetic modification refers to the use of the newest technologies used by seed breeders/scientists to make an intentional change to an organism's DNA in order to promote a desired trait."

The first question asked respondents to read over a list of eight messages about GM food. Respondents were then asked to indicate *one message that most aligned with their own view* and *one message that most opposed their view* on GM food. These messages represented common consumer perspectives of GM food as identified by Mahgoub (2016). The messages were meant to reflect a range of views toward GM food from extremely negative (causes cancer) to extremely positive (increased safety). The researchers followed Hovland et al.'s (1957) research design of eight messages without a neutral statement. The panel of experts also reviewed these messages to determine if they accurately captured the range of opinions regarding GM food. The messages were as follows: 1) GM food can cause cancer in humans; 2) GM food contributes to the prevalence of antibiotic resistant bacteria; 3) Potential risks of GM food related to health have not been adequately investigated; 4) GM foods might be riskier to consume than traditional food; 5) GM foods are safe for human consumption; 6) GM food has increased the food available for me to purchase; 7) GM food can provide me with improved nutrition compared to traditional food (e.g. increased vitamin C); and 8) GM food can be used to increase the safety of certain foods (e.g. remove toxins or allergens).

The messages were presented in random order to each respondent to lessen potential bias in answers. For analysis and discussion, messages one though four were considered *negative* because they discussed potential risks related to GM food. Messages five through eight were considered *positive* because they described positive impacts GM foods can have for consumers. Messages that were not selected by the individual respondents as being most aligned or most opposed to his or her view were carried forward to the second question. This question displayed the six remaining messages and asked respondents if they *agreed*, *disagreed*, or *neither agreed nor disagreed* with the messages on a three-point Likert-type scale. The category labels represent acceptance, rejection, and noncommitment respectively. The survey procedures for this study followed the procedures in Hovland et al.'s (1957) seminal piece.

Data were analyzed in SPSS, and analysis was adapted from Hovland et al. (1957). Descriptive statistics were used to address objectives one and two to describe the latitudes of acceptance, rejection, and noncommitment of Florida consumers' attitudes toward GM food. For objective one, the frequency of respondents who most opposed or aligned with the original set of messages was reported. The frequencies for responses to the messages that were carried forward to the second question were also reported. Agreement was considered *acceptance*, disagreement was considered *rejection*, and neither agree nor disagree was considered *noncommitment.* To describe the latitudes of rejection, acceptance, and noncommitment, the data file was first split into eight different segments that contained respondents who most aligned with each of the individual eight messages. Frequencies were run to understand how people who most aligned with each message viewed the remaining messages. For each message group, the highest frequency for accept, reject, or noncommitment is reported for the remaining messages they viewed. This data were used to create the latitudes of acceptance, rejection, and noncommitment.

## Results

### Describe Florida Residents' Evaluation of Messages Related to GM Food in Relation to Their Own Attitudes.

Respondents were asked to select which of the presented messages most aligned and opposed their views toward GM food (Figure 1). The message, "Potential risks of GM food related to health have not been adequately investigated" had the highest frequency of respondents who indicated it most aligned with their views about GM food (34.3%, *n* = 172). The message with the second largest percent of respondents who said it aligned with their views (18.4%, *n* = 92) was, "GM food might be riskier to consume than traditional food." The remaining six messages had 8.9% of respondents at most indicating alignment with their views.

"GM food are safe for human consumption" and "GM food can cause cancer in humans" had the largest percentage of respondents who reported the messages most opposed their views (27.4%, *n* = 137 and 25.2%, *n* = 126 respectively). The rest of the messages had 10.9% of respondents or less indicating the messages opposed their views.

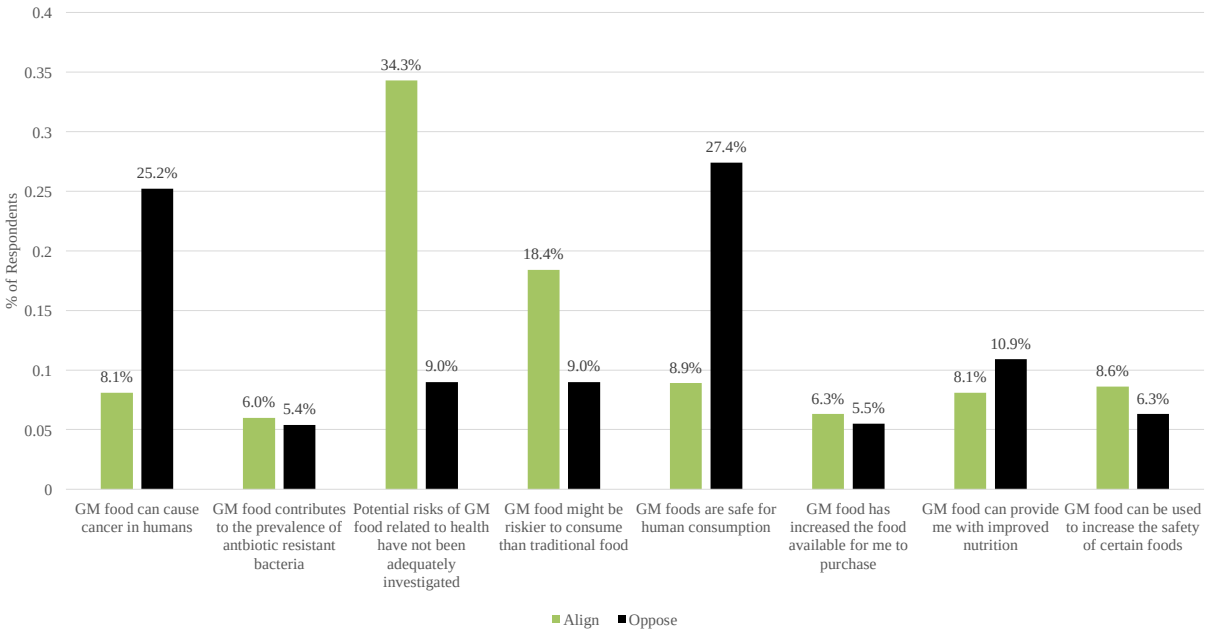


*Figure 1*. Messages that most align or oppose respondents' view of GM food.

The six messages that were not selected as most aligned or most opposed to the respondents' view were carried forward to the next question (messages selected from initial question were not provided as an option). Respondents were asked to indicate if they accepted, rejected, or felt noncommitment toward each of the remaining messages (Figures 2 and 3). While up to 23% of respondents rejected each of the messages, this was not the largest group for any message. In fact, the noncommitment category had the largest percentage of respondents for most of the messages. The two messages that had the largest percentage of respondents agreeing they were acceptable were "Potential risks of GM food related to health have not been adequately investigated" and "GM food might be riskier to consume than traditional food" (48.6%, *n* = 211 and 49.7%, *n* = 178 respectively).

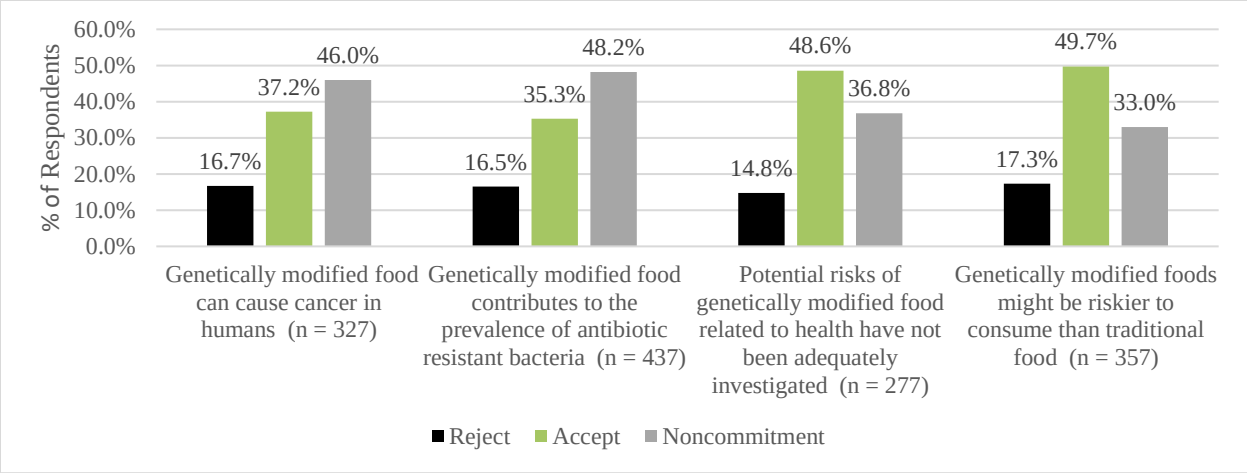


*Figure 2.* Acceptance, rejection, and noncommitment for negative messages about GM food.

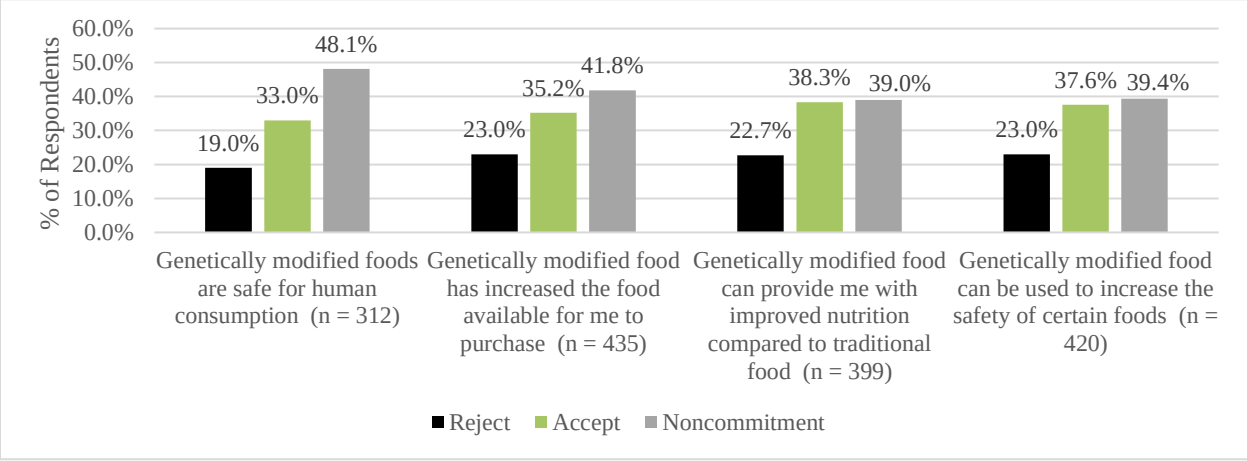


*Figure 3.* Acceptance, rejection, and noncommitment for positive messages about GM food.

**Describe the latitudes of acceptance, rejection, and noncommitment for Florida residents who hold positive and negative attitudes toward GM food.**

To fulfill objective two, the data file was separated into eight different groups for each of the messages presented; each group consisted of *respondents who selected the corresponding message as most aligned with their views*. For each group, frequencies of acceptance, rejection, and noncommitment were measured for the remaining messages. To understand and visualize acceptance, rejection, and noncommitment for each group, the response with the highest frequency for each message have been reported in Figure 4 and Figure 5. Because respondents were not shown the message they indicated most aligned with their view in the second question, there is no percentage in those boxes (represented by a dark green color). Light green boxes represent acceptance, red represents rejection, and gray represents noncommitment.

Figure 4 described and visualized the latitudes of acceptance, rejection, and noncommitment for respondents whose views align with negative messages toward GM food. For the most part, respondents with negative views toward GM food accepted negative messages toward GM food. The exception was that respondents who most aligned with the message that GM food's potential risk as not being adequately investigated ($n$ = 172) expressed noncommitment toward the message "GM food can cause cancer in humans" (46.3%, $n$ = 60). Additionally,

respondents who most aligned with the message that GM food might be riskier to consume than other foods ($n$ = 92) indicated noncommitment toward the message, "GM food contributes to the prevalence of antibiotic resistant bacteria" (52.5%, $n$ = 47).

The respondents who most aligned with negative messages about GM food reported noncommitment toward the positive messages with the exception of respondents who most aligned with "GM food can cause cancer in humans" ($n$ = 41). These respondents rejected that "GM food are safe for human consumption" (56.3%, $n$ = 13); "GM food has increased the food available for me to purchase" (36.8%, $n$ = 13); and "GM food can provide me with improved nutrition compared to traditional food" (52.5%, $n$ = 18).

| **Statement that Most Aligned with Personal View** | **Accept, Reject, Noncommit to the Following Statements** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Genetically modified food can cause cancer in humans. | Genetically modified food contributes to the prevalence of antibiotic resistant bacteria. | Potential risks of genetically modified food related to health have not been adequately investigated. | Genetically modified foods might be riskier to consume than traditional food. | Genetically modified foods are safe for human consumption. | Genetically modified food has increased the food available for me to purchase. | Genetically modified food can provide me with improved nutrition compared to traditional food. | Genetically modified food can be used to increase the safety of certain foods. |
| Genetically modified food can cause cancer in humans. ($n$ = 41) | ✓✓ | ✓ 49.8% | ✓ 60.1% | ✓ 71.8% | X 56.3% | X 36.8% | X 52.5% | 46.2% |
| Genetically modified food contributes to the prevalence of antibiotic resistant bacteria.($n$ = 30) | ✓ 49.2% | ✓✓ | ✓ 57.2% | ✓ 55.1% | 37.8% | 52.8% | 47.7% | 44.6% |
| Potential risks of genetically modified food related to health have not been adequately investigated. ($n$ = 172) | 46.3% | ✓ 43.7% | ✓✓ | ✓ 67.7% | 53.5% | 39.7% | 39.9% | 42.2% |
| Genetically modified foods might be riskier to consume than traditional food. ($n$ = 92) | ✓ 46.2% | 53.5% | ✓ 63.3% | ✓✓ | 58.6% | 52.4% | 54.1% | 51.4% |

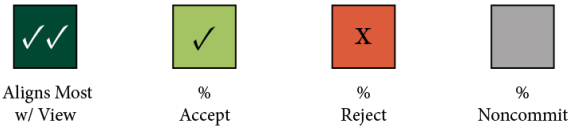


*Figure 4*. Latitudes of acceptance, rejection, and noncommitment for respondents with negative views toward GM food

*Note.* Only the response with the largest percentage for each message is presented.

Figure 5 illustrated the latitudes of acceptance, rejection, and noncommitment for respondents whose views most aligned with positive messages toward GM food. All respondents whose views most aligned with positive messages accepted the other positive messages. These respondents mostly reported noncommitment toward the negative messages. One exception was that respondents who aligned with the message that GM foods are safe for human consumption ($n$ = 45). These respondents rejected that GM food could cause cancer (48.3%, $n$ = 9) or might be

risker to consume than traditional food (41.5%, *n* = 14). Also, respondents who viewed GM food as increasing food available to them rejected the message that GM food caused cancer in humans (40.6%, *n* = 8).

| Statement that Most Aligned with Personal View | Accept, Reject, Noncommit to the Following Statements | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Genetically modified food can cause cancer in humans. | Genetically modified food contributes to the prevalence of antibiotic resistant bacteria. | Potential risks of genetically modified food related to health have not been adequately investigated. | Genetically modified foods might be riskier to consume than traditional food. | Genetically modified foods are safe for human consumption. | Genetically modified food has increased the food available for me to purchase. | Genetically modified food can provide me with improved nutrition compared to traditional food. | Genetically modified food can be used to increase the safety of certain foods. |
| Genetically modified foods are safe for human consumption. (*n* = 45) | X 48.3% | 51.6% | 52.4% | X 31.8% | ✓✓ | ✓ 69.4% | ✓ 72.8% | ✓ 75.4% |
| Genetically modified food has increased the food available for me to purchase. (*n* = 32) | X 40.6% | 68.2% | 43.2% | 37.4% | ✓ 51.3% | ✓✓ | ✓ 68.4% | ✓ 66.4% |
| Genetically modified food can provide me with improved nutrition compared to traditional food. (*n* = 41) | 44.9% | 44.7% | 51.9% | 54.1% | ✓ 55.6% | ✓ 51.4% | ✓✓ | ✓ 70.4% |
| Genetically modified food can be used to increase the safety of certain foods. (*n* = 43) | 57.6% | 58.3% | 48.3% | 57.8% | ✓ 53.5% | ✓ 48.7% | ✓ 56.5% | ✓✓ |

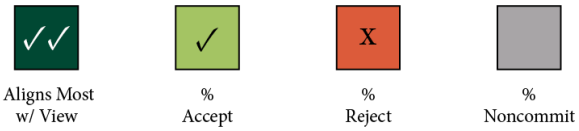


*Figure 5*. Latitudes of acceptance, rejection, and noncommitment for respondents with positive views toward GM food

*Note.* Only the response with the largest percentage for each message is presented.

## Conclusions & Recommendations

The purpose of this study was to describe Florida residents' latitudes of acceptance, rejection, and noncommitment for GM food messages. The findings provided insight into consumers' attitudes and can help provide guidance for communication and education campaigns about GM food that would resonate with consumers. The greatest number of respondents indicated their personal views most aligned with the message about how GM foods have not been adequately investigated. The next largest group had only about half as many respondents reporting they aligned with a similar message that GM food might be riskier to consume than traditional food. The rest of the messages, which dealt with specific scenarios like GM food causing antibiotic resistance or improved nutrition, had less than 10% of respondent agreeing they aligned with their own attitudes. This finding supported prior research that consumers may not be familiar with GM food technology

(Conko & Prakash, 2004; McHughen, 2013) and find it difficult to make evaluations of specific information. Additionally, this finding reflected Mahgoub's (2016) description of concerned and skeptical consumers regarding issues with GM food and Pew Research Center's findings that consumers did not believe GM food was safe to eat (Funk & Rainie, 2015). This skepticism may reflect negative coverage of biotechnology shown in the news during the time the data were collected (Marques et al., 2015; Rodriguez & Lee, 2016; Ruth & Rumble, 2016); however, the respondents did not have strong attitudes toward the specific negative messages either.

Respondents were also asked about what messages least aligned with their current attitude toward GM food. The largest groups of respondents rejected that GM foods were safe for consumption, which aligned with prior research (Funk & Rainie, 2015), and the second largest group, which trailed by 2%, rejected that GM food can cause cancer in humans. These messages are extremely different from one another and indicated Florida consumers have polarized views toward the safety of GM food. These results also somewhat conflicted with Runge et al.'s (2017) systematic review of literature that concluded consumers' were most concerned about if GM foods caused cancer and if they were safe to eat. The differences between conclusions may be due to population or how the data were collected and treated. Consumers' may be concerned about GM food causing cancer (Runge et al., 2017), but they may not feel confident in that opinion and agree more with statements related to the uncertainty of GM foods' safety. Additionally, both of these statements the respondents least aligned with directly dealt with their health and safety, which could invoke feelings of ego-involvement (Sherif et al., 1965). This high ego-involvement likely influenced these respondents' rejection of the statements (Sherif et al., 1965).

A review of the acceptance, rejection, and noncommitment of the remaining messages provides similar conclusions that respondents were unsure about the safety and risks associated with GM food. Fewer than a quarter of respondents rejected each of the presented messages, but the highest percentage of respondents rejected the positive messages. The only two messages the majority of respondents accepted were also the two messages that respondents indicated most aligned with their personal views toward GM food. These messages claimed GM food might be riskier to consume than other foods and the health impacts have not been adequately investigated. Noncommitment was higher for the remainder of the messages that presented specific information, like GM food caused cancer or led to antibiotic resistance. Overall, these findings diverge from the conclusions of Knight et al. (2005) that consumers were more accepting of messages describing the benefits of GM food to consumers. However, the lack of commitment toward the safety of GM food supports more recent research conclusions that Americans attitudes toward GM food were weak (Funk & Kennedy, 2016).

The results from this analysis supported that Florida consumers were overall unsure about the effects of GM food, but they tended to accept or not commit to messages rather than reject them, regardless of them being positive or negative. There are pockets of Florida consumers who hold negative attitudes toward GM food and believe they cause cancer and antibiotic resistance, but an even larger group is unsure about these risks. Similarly, they are unsure about the benefits. These consumers' attitudes were likley not strong (Funk & Kennedy, 2016) and were not reflective of the media's coverage of GM technology (Galata, Karantininis, & Hess, 2014; Jayaraman & Jia, 2012; Mahgoub, 2016; Ruth & Rumble, 2016). These respondents represent a "moveable middle" that could be influenced after exposure to additional information (Funk & Kennedy, 2016). Agricultural communicators should serve as a source of research-based information for these consumers to help them form stronger attitudes toward GM food.

When developing messages or educational information about GM food, agricultural communicators, educators, and Extension professionals should consider the previously described findings. If the communication campaigns' intent is to present research-based information to allow consumers to make informed decisions about GM food, starting the conversation by assuring complete safety will likely lead to a rejection of the message because the position is unacceptable to nearly one-third of the population (Sherif & Sherif, 1967). Because more than half of the respondents' attitudes most aligned with messages about the risk or uncertainty involved in the consumption of GM food, similar messages should be included in campaigns to help increase the acceptance of the communication. Admitting uncertainty related to GM food could help to address the concerns of consumers (Frewer et al., 1998), make the subsequent messages more acceptable, and encourage message assimilation (Granberg, 1993). Messages presented to consumers should focus on the research that has been conducted to investigate health risks associated with GM food (NAS, 2016a; Nicolia et al., 2014) and present reliable sources consumers can use to find the most current research on the health effects of GM food. Messages should also consider acknowledging consumers' feelings toward GM food to draw upon their ego-involvement (Ballmer, 2018) and encourage message assimilation.

The analysis of the latitudes of acceptance, rejection, and noncommitment for GM food messages in objective two provided helpful information for communication professionals to develop audience-centered communication. The latitudes of acceptance and noncommitment were approximately equal for each message. This findings indicated messages shared with the majority of consumers about GM food, whether positive or negative, would likely not be rejected; however, they will not necessarily be accepted either. This conclusion aligns with the prior finding in this study that most of the respondents did not have strong opinions toward GM food (Funk & Kennedy, 2016). Even though the GM food labeling debate has ended (Poken, 2016), consumers still have to make decisions about GM food related to purchases and policy. If the majority of consumers are unsure about GM food and accepting of any messages they receive, they will likely feel conflicted making these decisions. Agricultural communicators should be a part of these conversations to help provide consumers evidence-based information so they can begin to feel confident in their views and make decisions rooted in science.

While the majority of respondents expressed noncommitment, some respondents did have larger latitudes of rejection compared to the rest. Those who most aligned with the message that GM food can cause cancer in humans rejected the messages that the food is safe for human consumption, increases food available to purchase, and can improve nutritional value compared to other food. This finding supported Sherif et al's (1965) conclusion that people with extreme views had larger latitudes of rejection than those with attitudes that fall toward the middle. Additionally, the role fear plays for those who believe GM food causes cancer may lead to a higher ego-involvement and greater latitude of rejection (Sherif et al., 1965). This finding also indicated it would likely be difficult to share positive messages with consumers who have extreme negative views toward GM food due to confirmation bias (McFadden & Lusk, 2014).

Rodriquez and Lee (2016) recommended communicators focus on moving consumers' attitudes toward GM food from negative to neutral, but this may be easier said than done. Consumers with strong negative attitudes toward GM food may reject any message that conflicts with their views. Effort may be better placed in acknowledging their fears of GM food (Blancke et al., 2015; Heddy et al., 2016; Trevors et al., 2016) and engaging them in a dialogue about their concerns rather than trying to change their minds completely. Because strong attitudes can be difficult to change (Sherif & Sherif, 1967; Perloff, 2013) communication professionals attempting to promote GM food

should consider focusing their efforts on groups of consumers with more neutral or noncommittal attitudes.

Respondents who had attitudes that aligned with the message that GM foods were safe for human consumption rejected the message that GM food could cause cancer and might be riskier to consume than traditional food. Additionally, those who aligned with the message that GM foods increased food available to purchase also rejected that GM food caused cancer. Communication and information shared with audiences who have extreme positive attitudes toward GM food should avoid negative information or examples to avoid rejection of the messages. The latitudes of rejection for consumers with extreme positive views (e.g. increased the safety of food) were smaller compared to those with extreme negative attitudes. This result conflicted with Sherif et al.'s (1965) findings about extreme attitudes. While the respondents' attitude may have been extreme in direction, they may not have been extreme in strength. Additionally, respondents with extreme negative attitudes may have had a stronger ego-involvement compared to those with positive attitudes, which would explain the differences in the latitudes of rejection (Sherif et al., 1965).

Figures 4 and 5 showed that consumers who most align with positive messages or negative messages accept positive or negative messages respectively. The respondents likely assimilated messages that appeared congruent to their attitudes (Sherif et al., 1965); however, the respondents typically displayed noncommitment to the oppositely positioned messages without rejecting them. Overall, this finding reflected consumers' uncertainty toward messages about GM food (Funk & Kennedy, 2016). Discussions about GM food have been strongly influenced by consumers' emotions (Blancke et al., 2015; Heddy et al., 2016; Trevors et al., 2016), and communicators should not expect success in influencing attitudes or informing decisions without acknowledging these feelings. Proactively communicating about uncertainty related to GM food and acknowledging consumers' fears could help build trust, encourage message assimilation, and eventually lessen the latitudes of noncommitment. This communication approach should be used when communicating about GM food products. Similarly, educators and Extension professionals should take a similar approach when developing educational materials for their lectures, webinars, demonstrations etc. by acknowledging the concerns of their learners.

The findings from this study will be useful for messages addressing consumers' concerns about the health risks of GM food. The study did not ask about concerns surrounding the environmental and business impacts GM foods may have on the natural resources and farmers. Future research exploring the latitudes of acceptance, rejection, and noncommitment around these topics could be helpful in developing communication and education campaigns. Additionally, identifying differences in attitudes or latitudes between health, environmental, and economic impacts of GM food will be helpful in guiding message development.

Additional research should also be conducted to understand the roles that ego-involvement, assimilation, and confirmation bias play with the development of latitudes of acceptance and rejection. Because ego-involvement deals with core values of consumers (Sherif et al., 1965), conducting in-depth interviews with consumers who follow certain diets for example (e.g. organic, vegetarian, etc.) could provide needed insight into why they reject and accept different latitudes of messages. Another potential audience to study for ego-involvement could be parents. Consumers with children may have different ego-involvement compared to those without children, which would also influence their acceptance or rejection of messages. A mixed-methods research approach could also be used to conduct follow-up interviews to a similar survey to understand how

the participants assimilated or contrasted the messages in comparison to their own values to guide future message development and understand confirmation bias.

Future research should also examine the role demographics and psychographics play in forming latitudes of acceptance, rejection, and noncommitment. Understanding how gender, education, income, age, political affiliation, need for cognition, and critical thinking influence latitudes could help communicators further segment their audience for targeted communication. Research could also investigate how peripheral cues, like imagery and sources, also influence consumers' latitudes of acceptance, rejection, and noncommitment. This information would be vital to future communication around GM food.

A limitation to this study was it can only be generalized to consumers in Florida. Additionally, the non-probability sample decreases the generalizability of the findings. Replicating the survey with a simple random sample of US residents would increase the generalizability of the findings to consumers across the nation. The year this data was collected could also influence the interpretation of these findings. In 2015, there was still debate about whether or not the government should label GM food (Popken, 2016). Replicating this study in the future may reveal insight into new trends of latitudes or rejection, acceptance, and noncommitment. This study could also be replicated with other topics in the agricultural and natural resources industry to help guide message development for targeted audiences.

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Dr. Taylor Ruth is an Assistant Professor of Agricultural Communications in the Agricultural Communications Program and Department of Food Science and Human Nutrition at the University of Illinois at Urbana-Champaign.

Dr. Joy Rumble is an Assistant Professor of Agricultural Communication in the Department of Agricultural Communication, Education, and Leadership at the Ohio State University.

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