The Effect of Genetically Modified Labeling of Plant and Animal Products on Consumer Perceptions

Emily Yeh, Roslyn High School

eyeh22@roslynschools.org

Abstract

Genetically modified organisms help provide food for the growing world population, however, research has shown that many people fear GMO technology, despite scientists agreeing that it is safe (Public opinion about genetically modified foods, 2016). The present study examined the effect of label and product type on participants' willingness to consume a product and their perceived risk of doing so. Participants (N=159) were randomly assigned to view an advertisement for a product (rice or chicken), and this product either had no label, a non-GMO label, or a GMO label. Data analysis revealed that people perceived the non-GMO labeled products to be less risky than the GMO labeled products. Additionally, women reported the greatest willingness to consume products with non-GMO labels, while men reported the greatest willingness to consume GMO labeled products. This difference suggests that attitudes about GMOs differ based on the type of label and gender and suggests that there is still work to be done in order to improve GMO perceptions.

Keywords: GMO, GMO labels, GMO products, Non-GMOs, Non-GMO labels

Introduction

In recent years, GMOs (genetically modified organisms) have gained a large amount of attention, as shown by the number of searches more than tripling for the term GMO between 2012 and 2015 (Rangel, 2015). A GMO is defined as any organism or microorganism whose genes have been altered in a laboratory through genetic engineering or transgenic technology. This process leads to gene combinations that do not occur in nature (What is a GMO, n.d.). GMOs have increased the supply and reduced the costs of food for many, and scientists agree that GMO foods are safe (Genetically engineered foods, 2018). Nonetheless, people tend to have negative attitudes towards GMOs and their safety (Public opinion about genetically modified foods, 2016), something that is commonly seen in reactions to many new technologies involving genetics and organisms such as vaccines. As an issue that threatens to alter our food security, these negative attitudes must be addressed and resolved. This study looked at the effect of the type of GMO (plant or animal) and type of labels (no label, non-GMO label, and GMO label) on participants' willingness to consume a product and people's perceived risk towards GMOs.

Over the years, research has revealed that there are mixed feelings regarding the topic of GMOs. One study conducted in Chengdu, China in 2011 showed that 34% of respondents supported GMOs, 24.3% opposed them, and 41.7% were neutral (Cui & Shoemaker, 2018). These differing attitudes are due to the perceptions of both risks and benefits related to GMOs. Some of the benefits include an increase in agricultural productivity and a reduced need for pesticides;

however, some people believe that GMOs may also pose health risks and increase rates of allergies (Qaim, 2010). Another benefit to GMO food could be added nutrients such as vitamin B and a higher shelf life as well as possible medicinal qualities added in (Genetically engineered foods, 2018).

Research has shown more positive opinions have been found toward using GMOs to create medicine as opposed to food. In a UK study that surveyed over 16,000 people, the average rating of the morality of using GM for medicine was over 3.0 on a scale of 1.0-4.0, which is higher compared to food which was closer to the midpoint of 2.5 on the same scale (Europe ambivalent on biotechnology, 1997). Another study showed that out of 964 respondents, the highest percentages of acceptance for the usage of GMOs were for medicinal (62%) and health (68%) purposes (Widmar et al., 2017). Likewise, in a Malaysian study of 550 respondents, GM insulin was perceived to be more beneficial and more supported than GM soybean (Amin, Jahi, & Nor, 2013).

Research suggests that GMO labeling can have various effects on how willing someone is to consume that product. Most commonly, people tend to prefer a non-GMO labeled product or one with no label over a GMO labeled product. For example, in the United States, an experiment saw that participants were 12.2% more likely to say they would purchase produce (strawberries, apples, and potatoes) without a GMO label after being shown a labeled version (Yeh, Gomez, & Kaiser, 2019). The researchers found that 50% of participants were more willing to buy a product with no label as opposed to a GMO label (Bansal, Chakravarty, & Ramaswami, 2013). This study reasoned that the greater aversion to foods with a GMO label could be caused by a thought process where consumers believe it to be riskier, due to the need to label it (Bansal et al., 2013). Another study that looks at GMO perception in college students have also compared a non-GMO label to a GMO label; however, they found that there was no significant difference between the perceptions of those that received either condition (Oselinsky, Johnson, Lundeberg, Holm, Mueller, & Graham, 2021).

People's attitudes towards GMOs may also depend on the type of organism being modified. For example, a study in Australia showed that participants were more comfortable with GMO foods derived from plants than ones from animals (Marques, Critchley, & Walshe, 2015). Due to how animals are closer to humans than plants are, this result suggests that as technology advances, one may feel like modifying humans would be more likely than before, this is something that many may fear (Simmons, D., 2008). In addition, although the comfort level with plants was higher, comfort levels were still relatively low with numbers around 3 and 4 on a 10-point scale. This further points to how consumers are hesitant towards GMO foods overall.

Although previous studies have observed the effect of no label and a GMO label on consumer willingness to buy, the present study adds a non-GMO label condition. Previous studies have assumed that the no label condition would be seen as a non-GMO product by consumers; however, this study looks at whether consumers' perception of a non-GMO label differs from their perception of no label. Additionally, while many previous studies report perceptions of GMO products based on surveys, this study used an experimental design to hopefully show more realistic results. Asked how safe GMO bananas are, people may assume they are being asked because the bananas are unsafe. Shown an advertisement for a banana that may indicate it is GMO or not may elicit a response more similar to how people would react when buying groceries. This experiment explored the effect of the type of GMO (plant or animal) and types of labels (no label, non-GMO label, and GMO label) on the willingness to consume and perceived risk.

In order to determine the effect of these factors, the following hypotheses were tested: 1) Compared to a genetically modified animal product, a genetically modified plant product will a) have a higher intention to be consumed and b) will be seen as less risky; 2) Compared to products with a GMO label, products with a non-GMO label will a) have a higher intention to be consumed, b) will be seen as less risky.

Method

Design

The design of this study was a 2 (rice vs. chicken) x 3 (no label vs. non-GMO label vs. GMO label) between-participants design. Rice and chicken were chosen because they are commonly consumed foods in the United States (Shahbandeh, 2021a; Shahbandeh, 2021b). Participants were presented with a consent form and then viewed an advertisement for a product. Participants were randomly assigned to view one of six advertisements: a GMO labeled chicken, a GMO labeled rice, a non-GMO labeled chicken, a non-GMO labeled rice, a chicken with no label, and rice with no label.

Procedure

Participants then completed a survey that evaluated their willingness to consume the product and their perceived risks of GMOs concerning the product shown. Before completing the survey, participants also answered a manipulation check to confirm that they saw the label type and product. Finally, they reported their demographics which included items such as their age and ethnicity.

Participants

Participants were recruited through Amazon Mechanical Turk, an online system where people perform tasks for a small amount of money. Samples of participants that are acquired from Mechanical Turk have been shown to be closely representative of the U.S. population (Moss & Litman, 2021). All participants in this study were adults living in the United States. In this study, 69.6% of participants identified as White, 11.8% as Asian, 8.7% as Black, 5.6% as Hispanic/Latinx, 1.2% as American Indian or Alaska Native, and 3.1% identified as “other”. The mean age of the participants was 37.2 and the range was 56 with the youngest participant being 18 and the oldest being 74. Of these participants, 85 were male making up 53.8% of the sample and 73 were female making up 46.2% of the sample.

Experimental Stimuli

Six versions of advertisements for a product were created for this study (see appendix). These advertisements could either feature rice or chicken products. To manipulate the product to have different label types, a sticker was created based on actual existing GMO labels and modified to say GMO or non-GMO was placed on the product, and on some of the conditions, no label was added. In addition, a sentence was added to the nutrition facts if it was a GMO that read “Produced with genetic engineering”. This can be seen in the appendix under the experimental stimuli.

Dependent Measures

For this experiment, there were two dependent variables measured with a survey. To measure the willingness to consume variable, two items were used that stated “I would consume this product” and “I would buy this product”. Additionally, for the perceived risks variable there were five items taken from previous studies (Kikulwe, Wesseler, & Falck-Zepeda, 2011; Zhang, Jing, Bai, Shao, Feng, Yin, & Zhang, 2018); all items can be seen in the appendix. All the items were measured with a 6 point Likert scale and there was also an option where the participants could choose not to answer. The scales were all reliable with a Cronbach’s alpha coefficient of .89 for the willingness to consume

scale and a coefficient of .78 for the perceived risk scale.

Data Analysis

An analysis of variance (ANOVAs) was conducted to quantify the effect of GMO labels and type of the organism (plant or animal) on participants' willingness to consume and their perceived risks of GMOs. The analyses showed that men and women responded differently to the stimulus so gender was included as a third independent variable. Tukey post hoc tests were then used to determine the differences between pairs of groups. To test the second hypothesis two independent t-tests were also run to compare the non-GMO labeled conditions to the GMO labeled conditions.

Results

Data Analysis

GMO labels had a significant effect on perceived risk, $F(2, 159)=3.76$, $p< .05$, $\eta_p^2=.05$. As hypothesized, the post hoc tests showed participants perceived the GMO labeled conditions to be riskier than the non-GMO labeled conditions; however, the no label condition did not differ significantly from either the non-GMO or the GMO label.

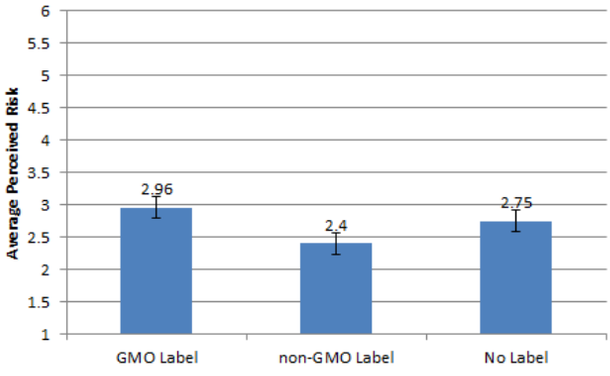

Figure 1. The Effect of Labels on Perceived Risk

Labels and Willingness to Consume

The hypothesis that GMO labeling would have an effect on the willingness to consume was not supported, $F(2, 157)=0.07$, $p=.94$, $\eta_p^2= 001$.

However, the ANOVA revealed that gender and label type had a significant interaction that affected the willingness to consume a product, $F(2, 154)=4.51$, $p<.05$, $\eta_p^2=.06$ As shown in Figure 2, female participants reported that they were more likely to consume a product that had no label or a non-GMO label, while male participants reported that they were most likely to consume a product with a GMO label.

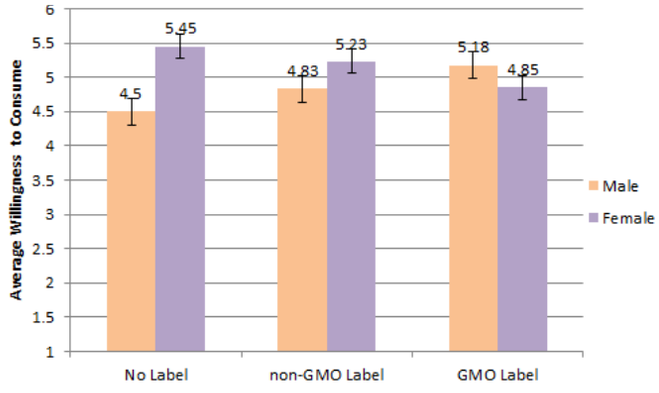

Figure 2. The Effect of Gender and Label Type on Willingness to Consume

Discussion

Perception of Risk

The data supported the hypothesis that people will view products with GMO labels as riskier compared to products with non-GMO labels. This result is understandable when looking at how consumers perceive new technologies. One example could be seen recently where people are refusing the COVID-19 vaccines because of the new mRNA vaccine technologies that they implement. The Lancet, reports that many people tend to avoid new information that challenges their beliefs (Adhikari & Cheah, 2021). To combat the issue of hesitancy and prolonged refusal of beneficial technologies, one has first to identify the reason behind the negative reactions. For humans who fear the uncertain (Rietzler, 1944), being hesitant is not uncommon; however, when it begins to affect the progress that could be made, steps should be taken to educate and help the

public in understanding these technologies especially for GMO foods.

Willingness to Consume

On the other hand, the hypothesis that participants would be more willing to consume the non-GMO labeled products as opposed to the GMO products was not supported. However, the results showed that women are more willing to consume an unlabeled product and a non-GMO labeled product than a GMO-labeled product. On the other hand, men reported they were more willing to consume a GMO-labeled product and less willing to consume a product that had a non-GMO label or was not labeled. The pattern shown by the female participants matches the findings of previous studies (e.g., Cui & Shoemaker, 2018), and raises the question of why men reacted differently. It may be that men simply pay less attention to labels than women or less attention to whether or not a product is modified. Another possibility is that men are not as concerned about GMOs and do not see them as a serious threat. In addition, women tend to do more of the grocery shopping for their families with a survey revealing that 80% of women do the shopping compared to 20% of men (Among U.S. couples, women do more, 2019), and may feel more responsible for providing healthy products. Men may also be less sensitive to risk (Melore, 2021)thus, they may be more willing to consume GMO foods..

Type of Product

The hypothesis that people would be more accepting of GMO plants than animals was not supported. Previous research has shown that many people view plant and animal products in a different way and are more willing to consume GMO plants as opposed to animals (Marques et al., 2015). One explanation for these different results could be due to the different methodologies used. The Marques et al. (2015) study was a survey that directly asked consumers how comfortable they were with genetically modified plants, while the present study's experimental approach might provide a more accurate picture of how people would actually react when they encounter GMO labels in a store.

Limitations and Future Study

The present study's addition of a non-GMO label adds a new perspective to the studies of GMO food hesitancy. This study also approaches the topic of GMO hesitancy in a different light when compared to most other studies which feature surveys. Additionally, the difference in findings between women and men in this study with women being more hesitant towards GMO products may help pave the way for future research which can mostly target women when looking to improve GMO views. In a world where food is a pressing issue, GMOs are one of the best solutions: with their environmental benefits as well as health and cost benefits, improving GMO views would mean providing more food security to everyone and taking less of a toll on the environment, something that is becoming increasingly important.

For this study, there were only two products which were chicken and rice; however, GMO attitudes could differ depending on the product and therefore including more products could lead to more in-depth research. For future research, including fresh produce such as fruit and vegetables as well as other meats could be helpful.

Given that all the participants in this study were from the United States, the findings cannot be generalized to other nations. Since the issue of hesitancy towards GMOs is something that is seen worldwide, studying other areas and comparing them could help with determining which places to focus on when trying to improve the views on GMOs.

With the increasing amount of food insecurity in the world with our growing populations, GMO food is a promising way to accumulate a larger food supply to feed everyone (Genetically engineered foods, 2018). The

progress that could be made, however, is being held back by those skeptical about this technology. The results of this study have many interesting implications and could be used to help with further research in an impactful way. The finding that women were less willing to consume GMO products suggests that there is more work to be done among females in terms of lowering risk. As our need for a consistent and reliable food supply increases, GMO food remains the best option that can also be better for the environment.

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