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Evaluating the Impact of the Film "Food Evolution" on Attitudes Towards Genetically Modified Food Crops

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Abstract

This study aimed to evaluate the effects of film intervention on consumer opinion and behaviors regarding genetically modified (GM) foods. Students, faculty, and community members attended a viewing of the documentary *Food Evolution* at the University of Scranton and were surveyed pre- and post-viewing. Results show participants who completed the survey after watching the film perceive GM foods as more likely to increase the global food supply and less likely to cause problems for health and the environment compared to those who completed the survey prior to watching the film. Participants were more likely to agree there is a scientific consensus about the safety of GM foods after viewing the film, compared to those answering the question before the film. Participants are more willing to support use of genetic modification in agriculture and food post-viewing. As climate change threatens the stability of our food systems, genetic modification technology (GMT) can provide scientists with additional tools for adapting, to continue to feed the world population. The study suggests the documentary, *Food Evolution*, is an effective tool for helping viewers understand the potential benefits of GM foods and gaining support of using genetic modification in food production.

Keywords: genetically modified organisms, public opinion, film intervention, climate change

Evaluating the Impact of the Film “Food Evolution” on Attitudes Towards Genetically Modified Food Crops

Genetically Modified Organisms (GMOs) have been the subject of controversy for more than three decades. A recent poll concludes that while many scientists agree genetically modified plants are safe for consumption, consumers are less certain (Funk & Kennedy, 2016). As the effects of global climate change place increased burdens on farmers, GMOs may need to play a larger role in sustaining our food systems. The purpose of the present study was to investigate the impact of the film *Food Evolution* on viewers’ attitudes towards GMOs. *Food Evolution* highlights the benefits of genetically modified (GM) foods, works to discredit skeptics, and appeal to viewers’ emotions by showcasing farmers who would have lost their crops; thus, their livelihoods without the intervention of genetic modification technology (GMT).

Genetically Modified Organisms

Genetically Modified Organisms (GMOs) are plants or animals that have undergone the insertion of DNA from another organism into its own (Aleksejeva & Sloka, 2015). This procedure allows scientists to make food items to their exact liking, incorporating possible beneficial traits to make plants less susceptible to disease and decrease the use pesticides (Bawa & Anilakumar, 2013; Brady & Brady, 2003). However, with GMO’s potential benefits come concern for horizontal gene transfer. Gene transfer is the transferring of genetic material from one organism to another by means other than parent to offspring. Concerns include impacts on the environment (e.g., disease resistant pests, soil erosion), dependency of developing countries on industrialized countries, and long-term human health effects, which are largely unknown (Bawa & Anilakumar, 2013; Ervin & Jussaume, 2014; Santis et al., 2017).

Public Opinion on GM Foods

Public opinion on GM foods has been an area of interest and debate for the last three decades. A recent report by the Pew Research Center shows more than half of all Americans are either unsure about the health risks associated with GM foods or believe they are worse for people's health (Funk & Kennedy, 2016). While one-in-six Americans care "a great deal" about the issue of GM foods, most Americans state they only know a slight amount of information regarding the issue (Funk & Kennedy, 2016). Among those who report knowing a lot about GM foods, attitudes tend to be more negative, with about half (50%) claiming GM foods are worse for one's health. Americans with an interest in GMOs, when asked, reported they believe the media does a poor job of covering the issue of GM foods. Also, many state they do not follow news on this subject matter very closely (Funk & Kennedy, 2016). The same individuals discuss that they believe the health risks of GMOs are often underplayed and GMO skeptics are not given equal coverage by the media. On the other hand, those with more education, particularly science backgrounds, are more likely to be supportive of the role of GMOs in food. Consumers with more education are more likely to be knowledgeable about and claim they would purchase GM food (Brady & Brady, 2003).

There is a moral component to the debate about GM foods. Many consumers believe that hunger is a result of an inadequate food supply, and some see GMT as the solution to this food shortage problem (Bratspies, 2014). For those who hold this viewpoint, opposition to GMOs is perceived as a moral failure. On the other hand, certain consumers are disgusted by the prospect of genetic modifications and are not influenced by arguments about the cost-benefit analysis of using GMOs (i.e., evidence insensitivity; Scott et al., 2016). In addition, there are also cross-cultural differences in the acceptance of GMOs. A meta-analysis revealed Europeans perceive GMOs to pose more risks compared to North Americans or Asians (Frewer et al., 2013). The

more negative attitudes of Europeans were attributed to more widespread negative coverage of GMOs in the European media compared to North America and Asia. Other factors may also contribute to more negative attitudes in Europe, including reduced access to GM foods compared to North America and less trust in regulatory officials (Zhang et al., 2017).

In the United States, the public underestimates the extent to which there is a scientific consensus on the safety of GM foods (Funk & Kennedy, 2016). Unlike the American public, majority of scientists agree that GM foods are safe for human consumption (Funk & Kennedy, 2016). There is a discrepancy between the scientific community and Europe's public, as 88% of scientists claim they approve of GM foods, while only 37% of the public approve (Aleksejeva & Sloka, 2015). Experts acknowledge the need to reassess consumer education around the topic of GM foods (Wong & Chan 2016; Brady & Brady 2003). According to Aleksejeva and Sloka (2015), European experts in genetic modification believe there is a sufficient quantity of information available to consumers. However, the public has a limited capacity to understand these resources. Therefore, one option for closing the gap between public opinion and scientific consensus might be to make technical information about GMOs more accessible to the public.

Concerns with Government

Trust in governing and regulatory bodies regarding GM foods can influence consumers' perceived risks or benefits associated with such food; in turn these perceived risks and benefits influence actual purchase habits (Zhang, 2017). A lack of trust in authorities making GMO policies and regulations makes consumers less likely to act in accordance with official recommendations. Funk and Kennedy (2016) found that among individuals who cared a great deal about GM foods, their trust in governing bodies was low. These consumers were also more likely to buy organic food and avoid GMOs when purchasing food. Many consumers believe that

the small farmer should have a larger influence on policies regarding GMOs (Funk & Kennedy, 2016). Others have noted that members of the public perceive outside interests are overtaking the food regulatory system. Thus, has driven the consumer to seek information from other sources, including mass media (Aleksejeva & Sloka, 2015). A possible resource for educating consumers about GM foods and other contentious issues, is through documentary films.

Changing Attitudes with Film

Film has been a medium previously utilized to reduce stigma and educate individuals on controversial topics such as climate change (Bilandzic & Sukalla, 2019; Nolan, 2010). For example, *An Inconvenient Truth*, has been used in classrooms all over the world to educate individuals on climate change and stress its importance while attempting to change behavior (Nolan, 2010). Such films have been used successfully to increase feelings of personal obligation to act on climate change (Bilandzic & Sukalla, 2019) and the perceived risk of environmental problems such as air pollution (Huang & Yang, 2020). Also, films addressing schizophrenia are another example of a type of intervention for reducing stigma. Studies regarding schizophrenia concluded that film intervention is successful at decreasing prejudice, social distance, and negative emotion aspects of stigma (Brown et al., 2010, Walachowska et al., 2009). While films may succeed in increasing knowledge and changing attitudes, they may not prompt changes in behavior quite as easily (Dunn et al., 2020). A study by Nolan (2010) found that after watching the film *An Inconvenient Truth*, it impacted individuals' ability to spark desire and take action. Thus, this desire did not always result in action being taken one month following the viewing (Nolan, 2010).

Film Overview

According to its filmmakers, *Food Evolution* was designed to be an independent investigation into the safety of GMOs. The film's goal is to emphasize current scientific evidence and expert opinion, while exploring concerns of non-scientist citizens (Food Evolution, 2021). *Food Evolution* highlights the benefits of GMOs, particularly GM plant crops. The movie showcases several crop populations that have been saved using genetic modification, beginning with the Hawaiian papaya, then later focusing on banana crops in Africa. Diseases to both fruits were plaguing the crops and leaving the farmers in financial crisis. Creating genetically engineered strains of papaya and banana resistant to the targeted diseases revitalized and saved these crops. Without the use of genetic modification, the banana and papaya crops would have crumbled, along with the primary source of income for the farmers. The success stories of the Hawaiian papaya and African banana crops portrayed genetic modification technology as having a positive impact on the global food supply as well as local economies.

Food Evolution highlights Monsanto, one of the first companies to experiment with genetic modification of plants and a major producer of genetically engineered crops (Editors of Encyclopedia Britannica, 2022). Monsanto affiliates are repeatedly interviewed regarding the safety of GM foods for consumers. In addition, the arguments of skeptics and past studies asserting the dangers of GMOs are dissected and refuted. A study conducted by Seralini and colleagues (2012) claimed to find tumors in GMO fed rats but was retracted shortly after publishing in response to a concern regarding the study's peer review process and use of a sample of tumor-prone rats. The film also questions the potential conflict of interest for GMO researchers funded by the organic food lobby including but not limited to Whole Foods, Stonyfield Farm, and Organic Valley. The credibility and public appeal of the film is greatly enhanced by using a well-known American Physicist, Neil DeGrasse Tyson, as the film's narrator

and recognizable faces such as Bill Nye. Additional details about the film can be found at the website listed in Appendix A.

The purpose of the present study is to investigate if and how consumer opinion regarding GM foods was influenced pre- and post- viewing of the film *Food Evolution*. This line of research is primarily exploratory; we expect viewers to have more favorable attitudes towards GM foods as a result of watching the film.

Methods

Participants

Participants for this study was a combination of students, staff, faculty, and community members, totaling 58 individuals ($N = 58$); consisting of 78% female, 18% male, and 4% unspecified. The participants attended a free showing of the film *Food Evolution* and agreed to complete a survey. Of the sample, 83% percent of the attendees who took the survey were students. Participants ages ranged between 18 to 54 ($M = 21.83$, $SD = 8.31$).

Materials

Participants completed a 17-item postcard-sized survey. The surveys were designed for all participants to answer questions regarding their personal concern(s) for the issue of GM foods. An example question participants would see is, “how much do you, personally, care about the issue of genetically modified (GM) foods” with responses ranging on a 4-point scale (1 = not at all and 4 = a great deal). An example of a question regarding participant’s past behavior prior to watching the film is, “thinking about the past 30 days, how often did you or someone in your household buy GMO-free food, which is food labeled as having no genetically modified ingredients” with responses ranging on a 3-point scale (1= never, 2 = about once, 3 = several times; Funk & Kennedy, 2016). After watching the film, all participants answered a question

about future intentions: “Thinking about the next 30 days, how often will you or someone in your household buy GMO-free food, which is food labeled as having no genetically modified ingredients” with responses ranging on the same 3-point scale as for past behavior (Funk & Kennedy, 2016). Participants were asked demographic information about their age, gender, and role at the University (i.e., student, staff member, faculty member, community member). The remaining questions were split into two sets and rotated; approximately half of the participants answered set A before the film and set B after, while the other half answered in reverse. Questions were drawn from previous research (Finke & Kim, 2003; Funk & Kennedy, 2016).

Set A measured concern for health risks, support for genetic modification in food production, and perception that GM foods will lead to problems for health and the environment, as well as increase the global food supply. To measure concern for health risks from GM foods, participants were asked, “how concerned are you about health risks from genetically modified foods” with responses ranging on a 4-point scale (1 = not at all concerned, and 4 = very concerned; Finke & Kim, 2003). To measure support for genetic modification in food production, participants were asked, “do you support the use of genetic modification in agriculture and food” with responses ranging on a 3-point scale (1= not sure, 2 = no, 3 = yes; Funk & Kennedy, 2016). To measure concern about GMOs causing health problems, creating environmental problems, and increasing the global food supply, participants were asked, “how likely is it that genetically modified foods will: lead to health problems for the population as a whole, create problems for the environment, and increase the global food supply” with responses ranging on a 4-point scale (1 = not at all likely, and 4 = very likely; Funk & Kennedy, 2016).

Set B measured perception of scientific consensus on GMO safety and trust in different groups. To measure perception of scientific consensus on GMO safety, participants were asked,

“As far as you know, how many scientists say that genetically modified foods are safe to eat?” with responses ranging on a 5-point scale (1 = almost none and 5 = almost all; Funk & Kennedy, 2016). To measure trust participants were asked, “how much, if at all, do you trust each of the following groups (elected officials, scientists, food industry leaders, the news media, and small farm owners) to give full and accurate information about the health risks and benefits of eating genetically modified foods” with responses ranging on a 4-point scale (1= not at all and 4 = a lot; Funk & Kennedy, 2016). Participants gave each group a rating. See Appendix B for survey instrument.

Procedure

Prior to the start of the film attendees were invited to participate in the study and were provided with background information on the project. Participants that provided informed consent were asked to complete side 1 of the postcard survey (side 1 contained all the “before” questions and either set A or B of the additional questions). At the end of the film, participants were invited to complete side 2 of the postcard (side 2 contained all the “after” questions and the remaining set of questions, A or B). The study had two versions of the survey. In version A, participants saw set A questions before the film and set B after. In version B, participants saw set B questions before the film and set A after. The two versions of the survey were distributed randomly to participants as they arrived at the film.

Results

Between-subjects *t*-tests were used to test for significant differences between the means of the two groups. There was no significant difference in participants’ personal concern for the issue of GM foods across the two versions of the survey $t(55) = .41, p = .68$, (Version A: $M = 2.48, SD = .98$; Version B: $M = 2.58, SD = .94$). This is important as it shows that personal

concern cannot explain any differences observed between those who answered a given question before versus after watching the movie.

The results suggest the film decreased perceived risks associated with GM foods. After watching the film, participants reported a lower likelihood of GM foods creating problems for the environment or leading to health problems for the population as a whole, compared to those answering the question before watching the film, $t(53) = 4.11, p = .00$, and $t(55) = 2.62, p = .01$ (See Table 1 for means and standard deviations). After watching the film, participants also perceived GM foods as being more likely to increase the global food supply ($M = 3.62, SD = .67$), compared to those who answered the question before the film ($M = 3.17, SD = .81$), $t(55) = -2.16, p = .04$.

More than twice as many participants were willing to support the use of genetic modification in agriculture and food after watching *Food Evolution* (71.43%) compared to those who were asked about support before watching the film (30.56%), $\chi^2(2) = 8.93^a, p = .01$. The film also increased participants' belief about the scientific consensus about the safety of consuming GM foods. Those who answered the question about how many scientists say genetically modified foods are safe to eat after watching the film, scored significantly higher ($M = 4.11, SD = .93$) compared to those who answered the question before the film ($M = 2.76, SD = .1.34$), $t(54) = 4.45, p < .001$.

The film did not seem to have an impact on participants' concern about health risks associated with GM foods, $t(55) = 1.25, p = .22$, intentions to buy GMO-free food, or their trust in various groups. A paired-samples t-test showed that there was no difference between participants' past behavior ($M = 2.07, SD = .86$) and their future intentions to buy GMO-free food ($M = 2.05, SD .83$), $t(54) = .19, p = .85$. When we compared those answering the questions

about trust before versus after the film, no differences were found with respect to how much they trusted elected officials, $t(52) = .22, p = .83, (M = 2.38, M = 2.42)$ scientists, $t(51) = -.20, p = .84, (M = 3.70, M = 3.67)$, food industry leaders, $t(50) = -.01, p = .99, (M = 2.58, M = 2.58)$, news media, $t(49) = -.72, p = .48, (M = 2.22, M = 2.06)$, and small farm owners, $t(51) = -.89, p = .38, (M = 3.30, M = 3.12)$ to provide complete and accurate information about the health risks and benefits associated with GM foods.

Discussion

The purpose of this study was to assess the efficacy of a film intervention with respect to changing consumer opinions on GM food. Overall, the film *Food Evolution* influenced viewers' beliefs about GMOs causing health problems, creating problems for the environment, and impacting the global food supply, as well as increased viewers' perception that there is a scientific consensus on the safety of GMOs. The positive effects of the film on viewers' beliefs and opinions are not surprising given the thesis of the film. As previously mentioned in the overview of *Food Evolution*, the film highlights banana and papaya crops that would have perished without the intervention of GMT. Seeing these crops flourishing as a result of genetic modification may have led to an association of GMOs and more abundant healthy foods on the earth.

There were several viewer opinions that were unaffected by the film. First, the film did not affect intentions to purchase GMO-free foods. On average, viewers reported they had purchased GMO-free food about once in the past 30 days and intended to continue the same frequency within the next 30 days. An informal analysis of the intention data showed that intentions stayed the same for about 56% of viewers. Among the remaining viewers, they were just as likely to increase their frequency of purchasing GMO-free foods just as they would

decrease. Moreover, it is possible that intentions were unaffected due to most viewers being uninvolved with the issue of GMO food. As stated in the results, most viewers ranked their level of personal care about the issue as “not too much” to “some” on average. Although the film may have made viewers beliefs more positive, changing behavior is more difficult and unlikely to occur when viewers are not invested in the issue to begin with (Kokkinaki & Lunt, 1997). Also, the film did not affect viewers’ trust in various stakeholder groups. By including then discrediting scientists and elected officials opposed to GMOs along with those who supported genetic modification technology, the film may have made it difficult for viewers to determine if these groups could be trusted.

Limitations

This study had limitations that need to be addressed. First, our sample size of 58 individuals is relatively small. Thus, limiting the generalizability of the results. Another limitation of the study is the lack of diversity, as the sample was predominantly female students. Although, the study did include some non-students, which is an improvement over many psychology studies that rely solely on student samples (Reis & Gosling, 2010). Also, this study only looked at viewers’ change in beliefs immediately following the film. It is unclear if the observed effects of viewing *Food Evolution* would persist over time.

In addition, simplifying the story for film and pushing back against extreme ideas on one side, the filmmakers made several key mistakes. First, they failed to make a distinction between the few well-studied GM crops and genetic modification as a technology. This generalization also appears in the 2016 Pew poll (Funk & Kennedy, 2016) supporting scientific consensus in favor of GMO safety. While there is almost certainly a scientific consensus that GMOs *can* be safe, there is also a consensus that they are *not necessarily* safe (i.e., each individual modified

organism). The result of any new modification must be studied independently to understand its effects (Hilbeck et al., 2015). Unclear survey questions may thus explain why even defining the scientific consensus on GMOs is difficult.

Another limitation of the study is that the film only briefly acknowledges the potentially dangerous indirect effects of GM crop use, particularly crops engineered to resist pesticide application. The film highlights the relative safety of the herbicide glyphosate (Duke & Powles, 2008) and the relatively small number of weed species known at the time to have evolved resistance. More recent data suggest at least 38 plant species have now evolved resistance (Heap & Duke, 2017). By so doing, the narrative ignores that the number of resistant weed species is growing (Duke & Powles, 2008). Additionally, the film ignores that a few species represent an enormous number of individual plants, creating new agricultural crises (Heap & Duke, 2018). The genetic modification approach to this problem – currently being carried out by Monsanto – is to develop new GM crops resistant to herbicides (e.g., dicamba). Dicamba resistant crops, under development by Monsanto for years (Behrens et al., 2007), have recently been released to U.S. farmers. The crops may be safe for human consumption, but the herbicides have already been reported to have negative effects on the ecology of the areas they are applied, and the livelihood of nearby farms that choose not to use them (Charles, 2017). The push to develop and release new crops resistant to increasingly unsafe herbicides will inevitably follow as new resistant weeds evolve.

Future Directions

The results of the study are in line with previous research showing that films can be used as an effective tool for changing attitudes (e.g., Bilandzic & Sukalla, 2019; Nolan, 2010). The film thoroughly addressed some of the misconceptions about GMOs, primarily the reflexive

assumption held by a subset of individuals opposing the technology that all GMOs are inherently unhealthy and/or dangerous. The film makers chose examples (soy, papaya) that have been relatively thoroughly studied, and presented convincing evidence that these crops are safe for consumption. Future research should replicate the observed results with a larger, more diverse sample. Recruiting a larger sample would also allow researchers to see if the effects of the film differed for those who were more versus less personally concerned about the issue of GMOs. The research design of this study did not allow us to explore within-subjects change. Future research could include a longitudinal component to test if the film produces individual change in knowledge, attitudes and/or behavior and further examine if the effects of the film persist over time.

Conclusion

In conclusion, the documentary *Food Evolution* seems to be an effective tool for helping viewers understand the potential benefits of GM foods and influencing the support of using GMT in food production. As the global climate continues to change, increasing support for GMOs will provide scientists with a larger array of publicly acceptable tools that will allow us to continue to feed the world (Schmidhuber & Tubiello, 2007). Climate change has been predicted to affect food stability through production and trade of food, access to food, stability of food supplies, and food utilization (Schmidhuber & Tubiello, 2007). More research needs to explore GMT, as demonstrated in the film *Food Evolution*, to intervene and improve such factors.

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Table 1

Survey Question	Before Group	After Group
How likely is it that genetically modified foods will lead to health problems for the population as a whole?	2.78 (.90)	2.14 (.85)
How likely is it that genetically modified foods will create problems for the environment?	3.14 (.77)	2.20 (.89)
How likely is it that genetically modified foods will increase the global food supply?	3.17 (.81)	3.62 (.67)
As far as you know, how many scientists say that genetically modified foods are safe to eat?	4.11 (.93)	2.76 (1.34)

Note. Means and standard deviations for knowledge, beliefs, and concerns related to Genetically Modified Foods.

Appendix A

Link to access more information regarding the intervention film, *Food Evolution*.

<https://www.foodevolutionmovie.com/>

Appendix B

Survey Instrument (Version A)

Side 1 (Please complete Side 1 prior to watching the film)

How much do you, personally, care about the issue of genetically modified (GM) foods?

- A great deal
- Some
- Not too much
- Not at all

How concerned are you about health risks from genetically modified foods?

- Very concerned
- Somewhat concerned
- A little concerned
- Not concerned at all

Thinking about the PAST 30 DAYS, how often did you or someone in your household buy GMO-free food, which is food labeled as having no genetically modified ingredients?

- Several times
- About once
- Never

Do you support the use of genetic modification in agriculture and food?

- Yes
- No
- Not sure

How likely is it that genetically modified foods will:

	Very likely	Fairly likely	Not too likely	Not at all likely
Lead to health problems for the population as a whole	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Create problems for the environment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Increase the global food supply	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

STOP!

(Please wait until after the film to complete side 2)

Side 2 (Please complete side 2 AFTER watching the film)

Thinking about the NEXT 30 DAYS, how often will you or someone in your household buy GMO-free food, which is food labeled as having no genetically modified ingredients?

- Several times
- About once
- Never

As far as you know, how many scientists say that genetically modified foods are safe to eat?

- Almost all
- More than half
- About half
- Fewer than half
- Almost none

How much, if at all, do you trust each of the following groups to give full and accurate information about the health risks and benefits of eating genetically modified foods?

	A lot	Some	Not too much	Not at all
Elected officials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scientists	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Food industry leaders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The news media	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Small farm owners	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

What year were you born? _____

What is your gender?

- Male
- Female
- Other/Prefer not to say

I am a:

- Student
- Staff member
- Faculty member
- Community member