OPINIONS OF GM FOOD AND FOOD GROWN WITH PESTICIDES IN HEALTH AND NON-HEALTH MAJOR UNDERGRADUATE STUDENTS

By

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Opinions of GM Foods and Food Grown with Pesticides in Health and Non-Health Major Undergraduate Students

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Abstract

The purpose of this study was to examine the opinions of genetically modified (GM) foods and food grown with pesticides in health and non-health majors before and after taking an introductory nutrition class (NSC 170). Undergraduate students enrolled in the NSC 170 were given a pre-survey at the beginning of the semester (n=364) and a post-survey at the end of the semester (n=281). Students (aged 18.6 ± 1.3 years, 60.4% white, 18.7% black, 13.8% Hispanic, and 7.1% Asians) were asked about concern with consumption of GM foods and foods grown using pesticides, and frequency of buying organic produce. The data was analyzed with descriptive statistics and multiple linear regressions. Major types were divided into nutrition, non-health, health, and undecided majors. There was moderate amount of concern about consuming GM food and foods using pesticides in all major types, but there was not a significant interaction between major types before and after the completion of course (P>0.05). Frequency of buying organic produce was not significantly different between major types. Finally, there was a significant correlation between concern with GM foods and pesticides, and purchasing of organic foods (P<0.05). This was not changed before or after taking NSC 170.
Introduction

Nutrition education is important in shaping the opinions and viewpoints of food and topics of nutrition. A recent study at the University of Arizona found that nutritional science major undergraduates progressively eat healthier throughout their 4-year curriculum\(^1\). Senior (or fourth year) nutritional science students had more conscience eating behaviors compared to freshman (or first year) nutritional science students. Conscience eating behaviors in the study was defined as “behaviors that are healthy and promote optimal health in individuals”. Senior nutritional science students had completed more nutrition classes and were more educated on food groups, vitamins, minerals, micro and macro nutrients, disease prevention, healthy food choices, and proper portion sizes compared to freshman nutritional science students. This may be resulted in more conscience eating behaviors from senior nutritional science students\(^1\).

It has been demonstrated that nutrition education can change the behaviors and opinions of nutritional science students over a four-year course of time. With this in mind, the objective of this thesis was to determine if conscious eating behaviors, specifically opinions of genetically modified (GM) food and foods grown with pesticides, change in undergraduate students after completion of the elective nutrition class. In this case, students across all major types were observed, not only nutritional science students. Also, students in the study received only one semester of a general education nutrition course, not a four-year nutritional science plan. The study focused on a specific aspect of opinion change in students- opinions of GM food and foods grown with the use of pesticides. The study was also interested in how frequently students bought
organic produce before and after taking the introductory nutrition class (NSC 170-Introductory Nutrition Class).

**Opinions of GM Food and Pesticides**

This study focused specifically on tracking the changes of opinions of GM food and pesticides because the opinions of these topics tend to vary and be controversial. They may also pose as a great area of uncertainty for some people. People in favor of genetically modified organisms (GMOs), claim that genetic engineering could bring positive effects like decreasing world hunger due to bigger, fresher, longer lasting produce. Opponents of GM food argue that GMOs could cause adverse side effects such as releasing harmful toxins into the body causing allergens, gastro-intestinal issues and diseases. Also, there are economic and environmental concerns surrounding genetic engineering.

In a 2014 study, adolescents graduating from secondary schools showed to have little understanding about GM foods and were overall against the cultivation of GM produce and farming of GM animals. They also failed to believe that GM foods may play a role in alleviating hunger and famine in the world. In another study, it was found that millennials tend to be somewhat skeptical about GM food. The authors of this study suggested that in order to alleviate these concerns in millennials, more research and information would need to be provided to the public to demonstrate the safety of GM foods.

In American culture, weariness and concern about GM food are present. Non-profit organizations, such as the *Non-GMO Project*, aim to provide non-GMO labeling for products produced without GMOs. Restaurant chains, such as *Chipotle Mexican*
Grill, cook with non-GMO ingredients and use this as a marketing tool to draw in customers concerned with consuming GMOs. Grocery stores, like *Natural Grocers*, advertise and sell only organic, non-GMO produce. It is clear that the reputation of GM food in America may be tainted by uncertainty, doubt, and fear.

**NSC 170- Introductory Nutrition Class**

*Food, Nutrition, and You* (NSC 170) is an elective tier 1 general education class offered to students at the University of Arizona across all major types. This class was the area of focus for the research conducted in the study. This class was offered as an elective course to the students interested in taking a nutrition class. The class did not exclude nutritional science students. The course covered the principles of human nutrition. It discussed topics in regard to digestion, absorption, metabolism, vitamins, minerals, life cycle nutrition, and food safety. In the food safety area of the course, students were presented information about GM food and pesticides. In this lecture, students were first introduced to potential harmful effects of pesticides and how it depends on variables such as concentration, vulnerability, and life stage of a person. Biotechnology was introduced to students as well as genetic modification. Students learned that genetic engineering can produce more and better foods such as corn crops containing the Bt (bacillus thuringiensis) gene which allows for a protein in corn to be present poisonous to the corn worm. Also, students were lectured on Golden Rice, which is an example of how genetic modification can increase the nutritional value of a food.

Based on what students learned in class lecture about GM food and pesticides, it was hypothesized in this study that upon the completion of NSC 170, students would
decrease their concern with GM food and increase their concern with pesticides. It was also hypothesized that nutrition and health related students would increase their concern about foods grown with pesticides more than undecided and non-health related major types. This hypothesis was made because overall, it was felt as though nutrition and health related students would be more concerned with pesticides and health outcomes compared to the other major types.

**Methods**

**Pre-survey**

Pre-surveys were administered to 364 NSC 170 undergraduate students at the beginning to the Fall 2016 semester. The pre-survey was given at the beginning of the semester when students were exposed to no or very limited nutrition education from the class at that point in time. Researchers approached students at the start of the class period and informed students of the option or not to participate in the survey. Researchers also mentioned that the survey will not affect their coursework or grade in the class. The survey given was approved by the University of Arizona Institutional Review Board (IRB). The survey was three pages long and consisted of 18 questions. The last three questions were in regard to frequency of buying organic produce, concern with consuming genetically modified foods, and concern with consuming food grown with the use of pesticides (See Appendix A). In this study, only three numbers of the questions were used. In comparing the importance of GM foods and pesticides between majors, the Kruskal-Wallis test (or non-parametric analog of ANOVA) was used to analyze the data gathered from the pre-survey.
Post-survey

Post-surveys were administered to the same sample group with 281 NSC 170 undergraduate students. The surveys were given at the end of the Fall 2016 semester, upon completion of the NSC 170 curriculum. The surveys were administered on the review day offered to students for the final exam. The post-survey contained the same three questions from the pre-survey in regard to pesticides, GM food, and frequency in buying organic produce. Again, researchers entered the classroom at the beginning of the class period and students were notified that their participation would not affect their coursework or overall grade. Once our data was gathered from the post-surveys, to compare the importance of GM foods between pre and post-surveys, the Wilcoxon Rank-Sum test was used. To check interaction between pre and post-surveys and major type, multiple linear regression was used. The level of significance was set to P<0.05.

Results

Pre-survey

Demographic of participants. The majority of pre-survey participants were freshmen \(n=252\) health related students \(n=177\). Sophomores were the second largest group of participants \(n=78\), followed by juniors \(n=27\) and finally, seniors \(n=7\) \((\text{Table 1})\). Non-health related majors were the second largest participant group for major type \(n=121\), followed by nutritional science students \(n=36\) and lastly, undecided major participants \(n=29\) \((\text{Table 1})\).
Concern with GM food. It was found that most students across all four major types were moderately concerned with GM food prior to taking NSC 170 (Figure 1). There was a significant correlation between concern with GM foods, pesticides, and purchase of organic produce (p<0.0001). Nutrition students were more ‘very much’ concerned with GM food compared to the other three major types but undecided students were more uncertain about GM food when compared to nutrition, health, and non-health majors (Figure 1).

Figure 1. Pre-survey frequencies concerning GM foods among four major types.
Concern with food grown with pesticides. After analyzing the pre-survey data, it was found that most students across all four majors were moderately concerned with consuming foods grown with pesticides before completing the NSC 170 curriculum. Undecided major type students were more uncertain about pesticides, or they answered ‘I don’t know’ more frequently in comparison to the other three major types (Figure 2).

![Chart](chart.png)

Figure 2. Frequencies concerning foods grown with pesticides among four major types.

Post-survey

Demographic of participants. Most participants who took the post-survey were freshmen (n=198) and health related major types (n=127), which was also true for pre-survey demographics (Table 2). Sophomores (n=58) and non-health related (n=114) participants were the second largest categories of participants followed by juniors (n=22) and nutritional science students (n=21). Finally, there were 18 undecided participants and only 3 seniors who participated in the post-survey (Table 2).
Concern with GM food. After students completed NSC 170, it was found in the post-survey analysis that overall, participants were moderately concerned with GM food (Figure 3). Undecided majors answered ‘I don’t know’ more frequently when asked about concern with the consumption of GM food when compared to the three other major types, indicating uncertainty around GM food (Figure 3). When comparing the pre and post-survey data, there was no significant interaction between major types in regard to GM food (p= 0.1859). The trends for both the pre and post-survey data did not significantly differ from one another.

Figure 3. Post-survey frequencies concerning GM foods among four major types.
**Concern with food grown with pesticides.** Analysis of the post-survey data revealed that non-health, health, and undecided major types were overall moderately concerned with consumption of food grown with pesticides (Figure 4). Nutritional science students answered that they were 'not at all' concerned with pesticides more frequently than any of the other answer choices (Figure 4). In comparing the data for both pre and post-surveys, it was found that again, the trends among major types stayed did not differ significantly. There was also not a significant difference about pesticide concern among pre and post-survey between major types (p= 0.5563 > 0.05).

![Graph showing concern with consumption of food grown with pesticides among four major types.](image)

**Figure 4.** Frequencies concerning foods grown with pesticides among four major types.

**Frequency of buying organic produce.** Most students across all four major types bought organic produce a few times a month (median response= 3). There was not a significant difference found of buying organic produce between major types (p= 0.6726 > 0.05). A significant correlation was found between concern with GM foods, pesticides, and purchase of organic foods (p<0.0001). Finally, the mode response
across all four major types was that respondents bought organic produce a few times a month and did not change from pre to post-survey data.

Discussion

It was determined that participants in the study did not significantly change their opinions about GM food after completing the introductory nutrition class (NSC 170). Participants in all four major types were mostly moderately concerned with consuming GM foods, both before and after the class. The overall median response on both the pre and post-surveys was two, indicative of moderate concern for GM food.

It was also determined that students were mostly moderately concerned with the consumption of foods grown with the use of pesticides for both before and after NSC 170. There was not a significant difference in the trend of data for the pre and post-surveys. This conclusion signifies that the trend in responses for the four major types were similar and did not vary much from the beginning and end of the class.

Overall, the trends when comparing pre and post-survey data were similar. However, there were some differences in participants’ responses that should be noted. Undecided students were more unsure about GM food after taking the nutrition class than before. This conclusion was made because there was an increase in frequency of undecided students that answered ‘I don’t know’ when asked about concern with consumption of GM food after completion of the class. Because the sample size of undecided students was small (n=18) compared to the entire sample of post-survey participants (n=281), the difference was not statistically significant (P>0.05).

Another variance in data findings that may be related to changes in conscience eating behaviors was nutritional science students were more ‘not at all’ and also more
‘very much’ concerned with pesticides after taking the introductory nutrition class than before. Looking at the pre-survey data, most students answered that they were moderately concerned with pesticides. However, the post-survey data revealed that moderate concern in students dramatically dropped with an increase in both ‘very much’ and ‘not at all’ concern. This finding signifies that students demonstrated conflicting viewpoints about pesticides. It should be noted that due to small sample size of post-survey nutritional science students (n=21) in comparison to the overall sample of participants (n=281), the variance was not statistically significant (P>0.05).

Because it was found in the study that nutritional science students had split viewpoints on pesticides and undergraduate students increased their uncertainty about GM food after taking the nutrition class, it is clear that the nutrition class did not draw definitive conclusions from students in regard to GM food and pesticides. It is possible the course curriculum could benefit from a greater amount and more thorough coverage of genetic modification and pesticide usage in foods. It is also possible that available information about GM food and pesticides or the information about such topics presented in the class to students were conflicting, not complete, or not definitive in nature.

When asked about how often students bought organic produce, it was found that the students more frequently bought organic produce a few times a month (or sometimes) both before and after completion of the nutrition class. Participants who were more concerned with GM foods and pesticides more frequently purchased organic produce (P<0.05). Also, all four major types did not differ in how frequently they bought organic produce.
Our study concluded that this specific introductory nutrition class did not significantly change the opinions of GM food and foods grown with pesticides in undergraduates. Although some variances in data were found, such as nutritional science students’ opinions about pesticides and undecided students’ opinions about GM food, the general pattern of our data was representative of moderate concern for GM food and pesticides both before and after NSC 170.

Future studies looking to expand the research done could create a focus group from participants in this study to dive deeper into their explanations. Because a short answered survey was used as the research method of choice in this study, participants were not able to express why they selected the answer choices they did. A focus group interview would allow for students to explain their survey choices which would give researchers more insight into opinions of participants.
References

1. Franklin AM. (2016). Improvements in Conscious Eating Behaviors in Undergraduate Nutritional Science Students. Available at: http://hdl.handle.net/10150/612930


Appendix

**Nutritional Research Survey**

1. What is your age?

2. What is your gender?
   a. Female
   b. Male

3. What is your ethnicity?
   a. White
   b. Hispanic or Latino
   c. Black or African American
   d. Native American or American Indian
   e. Asian / Pacific Islander
   f. Other: ______________

4. What is your academic status within your major?
   a. Freshman
   b. Sophomore
   c. Junior
   d. Senior

5. What is your major and emphasis, if applicable (i.e. Nutrition major with dietetics emphasis, or nutrition major with nutrition emphasis)? Otherwise check “Undecided”.
   Major: ___________________ □ Undecided
   Emphasis: _________________ □ Undecided/None

6. Which of the following best describes your living situation?
   a. Dorm
   b. Apartment, house, condo, etc.
   c. With parents/relatives/spouse
   d. Other: ______________

7. Approximately how many times per week do you purchase and/or consume ready-to-eat food requiring no preparation on your part, for immediate consumption? Examples of where this can occur may include:
   - The Student Union
   - McDonald's
   - Taco Shop
   - Jack in the Box
   - Paradise bakery
   - A food truck or stand
   - Any restaurant or fast food establishment
     I perform this type of activity about _______ times per week.
8. Check all that apply to your dietary habits.

___ Vegetarian (no meat)
___ Pescetarian (no meat except fish)
___ Lacto-Vegetarian (no meat or eggs, but dairy allowed)
___ Ovo-Vegetarian (no meat or dairy, but eggs allowed)
___ Lacto-Ovo-Vegetarian (no meat, dairy and eggs allowed)
___ Vegan (no animal flesh or products - i.e. no milk, honey, eggs, dairy, meat, fish, etc.)
___ Gluten Free
___ Paleo (centered around foods available to human ancestors - nuts, berries, meat, etc.)
___ I do not consume red meat
___ I do not consume dairy products
___ None of these apply to me

Use the table below to help you answer questions 9 -14.

9. How many servings of vegetables do you consume per day? Circle a value below.
   0 1 2 3 4 5+

10. How many servings of fruit do you consume per day? Circle a value below.
    0 1 2 3 4 5+

11. How many servings of grains do you consume per day? Circle a value below.
    0 1 2 3 4 5+

12. How many servings of protein do you consume per day? Circle a value below.
    0 1 2 3 4 5+

13. How many servings of dairy do you consume per day? Circle a value below.
    0 1 2 3 4 5+

14. How many servings of olives, nuts, or seeds do you consume per day? Circle a value below.
    0 1 2 3 4 5+

<table>
<thead>
<tr>
<th>Vegetables</th>
<th>Fruit</th>
<th>Grains</th>
<th>Protein</th>
<th>Dairy</th>
<th>Olives, nuts, seeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cup, chopped</td>
<td>1 cup, chopped</td>
<td>½ bagel</td>
<td>1 ounce</td>
<td>1 cup milk, yogurt,</td>
<td>1 tbsp Peanut Butter</td>
</tr>
<tr>
<td></td>
<td>1 fruit</td>
<td>½ cup</td>
<td>meat</td>
<td>frozen yogurt</td>
<td>½ ounce nuts (12</td>
</tr>
<tr>
<td></td>
<td>(orange, apple)</td>
<td>cooked rice/pasta</td>
<td>1 egg</td>
<td>yogurt</td>
<td>almonds)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 cups cooked</td>
<td>¼ cup</td>
<td>1 ½ oz hard cheese</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>popcorn</td>
<td>cooked beans</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 slice bread</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
15. Do you feel that your diet is healthy?
   a. Yes
   b. No
   c. Yes & No
   d. I don’t know

16. When buying fruits and vegetables, do you buy organic produce?
   a. Always
   b. Most of the time
   c. Sometimes (a few times in a month)
   d. Rarely (a few times in a year)
   e. Never
   f. I don’t know

17. Are you concerned with consuming genetically modified (GM) foods?
   a. Very much
   b. Moderately
   c. Not at all
   d. I don’t know

18. Are you concerned with consuming foods grown with the use of pesticides?
   a. Very much
   b. Moderately
   c. Not at all
   d. I don’t know