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Extension Biotechnology Education: Impact on Consumer Action

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Abstract

Extension faculty developed a biotechnology lesson for statewide use by Family Community Education groups. The evaluation showed that 476 participants in 12 counties had increased their knowledge/awareness of the pros and cons of biotechnology, foods produced using this technology, regulatory safeguards, and biotechnology legislation. A sub-sample of 61 older women completed a follow-up evaluation after the November 2002 election, which included a ballot measure on labeling genetically engineered food. Of the 93 percent of respondents who had voted, 30 percent favored labeling, 59 percent were against, and 11 percent did not reveal their vote. Forty-two percent indicated that the lesson had influenced how they voted. If the ballot measure had passed, 30 percent would have been "very likely" to purchase food labeled "modified by genetic engineering;" 33 percent reported "somewhat likely."

Key words: biotechnology, genetically engineered, food labeling, public policy, consumers, Extension clientele

Consumers determine the success or failure of products of biotechnology through their market behavior (Zimmerman et al. 1994). Will U.S. consumers accept genetically engineered foods? Despite the potential for biotechnology to increase food production and food quality, most research suggests that consumers remain skeptical of the technology (Lusk and Sullivan 2002). By providing pros and cons about this technology, the Extension Service can help consumers make informed choices that potentially influence public policy**.**

Biotechnology is the process of modifying genes. Traditional cross-breeding results in a random combination of genes. Genetic engineering now makes it possible to modify individual genes to change traits of an organism such as pesticide-resistant soybeans and insect-resistant corn (Institute of Food Technologists 2000). These foods began to appear in the marketplace in the

mid-1990s. By 2002, three-fourths of the soybeans and more than one-third of the corn crop were projected to be grown with bioengineered seeds (Hollingsworth 2002). Seventy percent of manufactured foods now contain ingredients derived from genetically engineered soybeans or corn (Brown and Ping 2003). Surveys indicate that many consumers are unaware that these foods produced with biotechnology are in the grocery store (Heffernan and Hillers 2002; Pew 2001).

While many Europeans have been strongly opposed to genetically engineered foods (Brown and Ping 2003; Hollingsworth 2002), the response of U.S. consumers has been mixed. In Washington state, 46 percent of survey respondents reported that they "strongly support"/"support" the use of biotechnology in agriculture and food production; 36 percent responded "don't know" (Hefferan and Hillers 2002). In a Pew Initiative on Food and Biotechnology survey (2001), 25 percent of respondents were "very favorable"/"somewhat favorable" to biotechnology used in food production; 25 percent "don't know" and 19 percent had "never heard" of it. The high level of uncertainty indicates a need for consumer education about biotechnology (Hefferan and Hillers 2002).

Although many consumers know little about biotechnology/genetic engineering (Brown and Ping 2003; Hoban 2001), they have indicated an interest in being informed (Zimmerman et al. 1994). Talking about issues related to biotechnology or learning more about it may have an effect on participants' attitudes. Pew (2001) survey respondents' views on safety of genetically modified foods increased from 29 percent "strongly safe"/"not so strongly safe" to 48 percent "strongly safe"/"not so strongly safe" after they learned that more than half of products at the grocery store are produced using some form of biotechnology or genetic modification**.**

Consumers who seek information may find it difficult to obtain materials that present a balanced view (Hefferan and Hillers 2002). A two-sided educational approach may be appropriate to expose consumers to opposing viewpoints about biotechnology issues (Zimmerman et al. 1994). Programs should provide scientifically sound information about biotechnology and its uses, provide answers to frequently asked questions, and provide unbiased educational materials (Fraser 2001.)

Consumer desires to make informed decisions about their food purchases have made the biotechnology food labeling issue an important public policy concern (Tegene et al. 2003). Labeling of genetically modified food is required in the European Union and in several other countries (Jaeger 2002). Most surveys have found that U.S. consumers want genetically engineered food to be labeled (Brown and Ping 2003). Labeling can increase consumer confidence in product quality (Tegene et al. 2003). The U.S. Food and Drug Administration does not require labeling of foods derived from genetically engineered plants unless they differ significantly from their traditional counterparts.

If labeled, consumers' likelihood of eating genetically engineered food is mixed. Their willingness to pay has been shown to decrease when labeling reveals that a food has been produced with modern biotechnology (Tegene et al. 2003). The Pew survey (2001) showed that 38 percent of respondents would be "very likely"/"somewhat likely" to eat genetically modified food.

In November 2002, Oregon voters had an opportunity to influence public policy when a measure on labeling genetically engineered foods was placed on the ballot. A vote in favor would have required labeling of genetically engineered foods sold or distributed in or from Oregon. The measure defined genetically engineered foods as *"grown, manufactured, processed or otherwise produced or altered with techniques that change the molecular or cell biology of an organism by means or in a manner not possible under natural conditions or processes, including but not limited to recombinant DNA techniques, cell fusion, micro and macro encapsulation, gene deletion and doubling, introducing a foreign gene, and changing the positions of genes."*

The ballot measure was widely debated, with proponents arguing for the consumers' right to know and opponents raising cost issues. Voters needed to decide whether Oregon should be the first state to require genetically modified labeling, whether the time was right, and whether the ballot measure was the best way to go about doing this (Jaeger 2002).

The Oregon State University Extension Service developed a biotechnology lesson for consumers and assessed its impact on their knowledge and behavior. The lesson was used by Family and Community Education (FCE) groups, a traditional Extension Service audience. FCE is a national nonprofit volunteer organization that focuses on strengthening individuals and families through continuing education programs, leadership development, and community service. At the county level, members belong to local "study groups" that provide monthly educational lessons on a variety of topics. County Extension Family and Community Development faculty deliver many of these lessons using a train-the-trainer format.

FCE group members share Extension's educational messages in their communities, both formally and informally. The biotechnology lesson prepared them to participate in public policy decision making. As the lesson was being developed, an initiative petition on labeling of genetically engineered foods was being circulated among registered voters in Oregon. When enough signatures were gathered to put the initiative on the November ballot, we capitalized on this opportunity to gain insight into the impact of the lesson on voters' by planning a post-post lesson evaluation after the election.

Lesson material

An Extension Foods and Nutrition Specialist and a county Extension Family and Community Development faculty member collaborated on the development of the "Biotechnology: Designer Genes for Familiar Foods" lesson. A teacher guide, participant handout, and post-training (day-of-the-lesson) evaluation form were developed. The lesson had four objectives. Participants would (1) become aware of foods that are produced using biotechnology, (2) be able to identify pros and cons of food biotechnology, (3) become aware of agencies that safeguard foods produced using this technology and (4) become informed about biotechnology legislation in Oregon. The lesson included a short biotechnology quiz as well as instructions for a mock legislative hearing.

The hearing was designed to present a variety of viewpoints about genetically modified foods. Participants role-played by reading short "testimony" scripts representing a consumer, an environmental activist, an organic farmer, a social activist, a physician and a scientist. Listeners recorded pros and cons that they heard. In some county settings, a straw vote on the upcoming labeling ballot measure was then taken.

A 12-minute videotape was recorded in a classroom television setting to ensure that all FCE groups received a reliable overview of technical information. The PowerPoint presentation was made by a scientist with Oregon State University's Program for the Analysis of Biotechnology Issues (http://oregonstate.edu/extension/pabi). The content covered these questions: What is genetic engineering? How is it done? Why is it done? What crops are genetically engineered? What does the future hold?

Evaluation questionnaires

A four-question post-training evaluation questionnaire template was used to assess changes in knowledge/awareness as well as behavioral intentions after the lesson. The one-page questionnaire could be completed in 5 to 10 minutes. Respondents rated increases in their knowledge/awareness for each of the four lesson objectives on a 5-point scale from 1 (not at all) to 5 (a lot). They also checked boxes to rate how regularly they did each of three behaviors before the lesson (on a "did regularly," "did not do regularly," "didn't do" scale): staying abreast of biotechnology issues in the news, discussing biotechnology pros and cons with others, and tracking legislation related to biotechnology. Their intentions to do these same behaviors after the lesson were also rated (on a "will do regularly," "won't do regularly," "won't do" scale). The final question provided space for listing other things that they planned to do differently after the lesson. Open-ended responses were hand-tallied into categories. Human subjects approval was obtained for this as well as a post-post evaluation.

A two-page post-post evaluation questionnaire was developed by the Extension Foods and Nutrition Specialist and reviewed by two county Family and Community Development faculty for face validity. It could be completed in about 10 minutes. Participants were asked to indicate how well informed they were about food biotechnology before the lesson (on a scale from 1 "not at all informed" to 5 "very well informed") and their level of concern about biotechnology ("concerned," "not concerned," or "not sure"). They indicated their views about biotechnology both before and after the lesson (on a scale from 1 "oppose" to 5 "support"). They were asked whether they had stayed abreast of biotechnology issues in the news or discussed biotechnology pros and cons with others as a result of participating in the lesson. Questions about the ballot measure were also included. Respondents reported whether they had voted in the November 2002 election and, if yes, whether they voted in favor of or against labeling of genetically engineered foods in Oregon. Questions also assessed whether the biotechnology lesson had influenced the way that they voted and whether they would have been likely to purchase labeled foods if the labeling measure had passed. Demographic questions assessed gender, age, and education.

Methods

The biotechnology lesson was pilot-tested by an Extension Family and Community Development faculty member who presented the lesson to FCE groups in her county. Eleven additional counties then voluntarily scheduled the lesson during the three months preceding the November 2002 election. All 12 counties (one-third of Oregon counties) were in the western part of the state and represented both urban and rural areas.

Extension Family and Community Development faculty taught the lesson to small groups of FCE members in the 11 counties. The trained FCE members in turn taught the lesson to their respective "study groups." Time spent teaching the lesson was about one hour.

All participants completed the post-training (day-of-the-lesson) evaluation form immediately following the lesson. Faculty or the volunteer teachers collected the forms and forwarded them to the Extension Foods and Nutrition Specialist. Frequencies and mean knowledge/awareness changes were analyzed using the Statistical Package for the Social Sciences (version 10.1).

The post-post lesson evaluation was distributed in January 2003 to FCE members who had attended a faculty-taught biotechnology program in eight counties. (The assumption was made that faculty delivery of the lesson would be a more standardized approach for the purpose of evaluation. Volunteer delivery of lessons might be influenced by their teaching ability and comfort with the subject matter.) The faculty member in the pilot county distributed the evaluations directly during FCE group visits. Seven other counties were able to provide names

and addresses of 52 FCE members who had attended faculty-taught programs. The post-post questionnaire was mailed to them.

Questionnaires were returned to the Extension Foods and Nutrition Specialist. Frequencies were analyzed using the Statistical Package for the Social Sciences (version 10.1). Chi-squares were computed to analyze relationships between voting patterns and other variables, with $p < .05$ for significance.

Post-training evaluation findings

Evaluation forms were received from 476 lesson participants in 12 counties. Thirty-one percent of the respondents had attended a faculty-taught lesson; 69 percent had been volunteer-taught. Respondents reported that the lesson had increased their knowledge/awareness related to lesson objectives (Table 1). They reported low involvement in biotechnology-related behaviors before the lesson (i.e., staying abreast, discussing pros and cons, and tracking legislation.) Their intentions to engage in these behaviors after the lesson were much higher (Table 2).

Twenty-five percent of evaluation survey respondents listed a variety of other things that they would do differently after the lesson. Becoming more informed about the issues was mentioned by about 19 percent. About 16 percent mentioned paying more attention to labeling. Comments related to voting on the labeling ballot measure or legislative involvement were listed by about 12 percent. About 6 percent mentioned buying organic food. (The lesson had pointed out that, as a result of the Organic Food Protection Act, foods labeled "organic" may not be bioengineered [http://www.ams.usda.gov/nop]).

Post-post evaluation findings

Sixty-one usable post-post evaluation surveys were received. Twenty-seven questionnaires were received from the pilot-test county (100 percent of those in attendance who had participated in the previously taught biotechnology lesson). Thirty-four questionnaires were received from the seven other counties that received mailed questionnaires (67 percent response rate). All respondents were female and over age 30. Seventy-two percent were 65 or more years of age. Educational level was fairly evenly split among high school graduates (35 percent), some college (33 percent), and college graduates (27 percent). Twenty-five percent indicated that they were from farming families; another 10 percent indicated that they "used to be."

Respondents' mean rating of how well informed they were about biotechnology before the lesson was 2.3 + 1.1 on a scale from 1 "not at all" to 5 "very well". Fifty-six percent were "concerned about biotechnology" (16 percent "very concerned," 40 percent "somewhat concerned"). Sixteen percent were "not concerned" and 28 percent were "not sure."

When asked to indicate their views about biotechnology (on a scale from 1 "oppose" to 5 "support"), the mean before the lesson was 2.9 + 0.9 compared to 3.3 + 1.2 after the lesson. This change was not statistically significant.

As a result of the lesson, 52 percent reported staying abreast of biotechnology issues in the news. (This was less than the 74 percent who planned to do so in the post-training evaluation.) Fifty-five percent reported discussing biotechnology with others, the same percentage that planned to do so in the first evaluation.

Ninety-three percent of respondents reported voting in the November election. (Although this is more than the 69 percent statewide turnout, it's possible that non-voters may not have responded to our mailed survey.) Thirty percent of voters reported casting their ballot in favor of labeling genetically engineered food; 59 percent voted against the measure. Although 11 percent reported not remembering how they voted, they perhaps chose not to reveal their vote. Statewide, 30 percent of Oregonians voted in favor of labeling and 70 percent voted against.

Forty-two percent of respondents indicated that the biotechnology lesson influenced the way that they voted on the labeling measure; 35 percent reported no influence and 24 percent were not sure. Of those who indicated that the lesson had influenced their vote, 18 percent voted in favor of labeling and 20 percent were not in favor. There was not a significant relationship between the way that respondents voted on the measure and the effect of the lesson on their vote. Likewise, there were not significant relationships with respondents' age, their county of residence, or their likelihood of purchasing genetically engineered food.

If the ballot measure had passed, 30 percent of respondents indicated that they would have been "very likely" to purchase food labeled "modified by genetic engineering," 33 percent said "somewhat likely," 16 percent said "somewhat unlikely," and 21 percent said "not at all likely." The 63 percent likelihood of purchasing is higher then that reported in the Pew survey (2001). The impact of the biotechnology lesson on their response was not determined.

Conclusions

Many of Oregon's Family and Community Education members have been involved in Extension Service programming for many years. Although they therefore may not represent the typical consumer, our findings reveal viewpoints of these older women who have been a traditional Extension audience in Oregon. Many of the women were not well informed about biotechnology before the lesson, as reported in the post-post test. Some planned to become better informed and did so, as revealed in the post-post evaluation survey. Although the biotechnology views of the women in the post-post evaluation sample had not significantly changed three to four months after the lesson, they did indicate taking action that made them more informed. Almost half (42

percent) indicated that the lesson had influenced their vote on the labeling of genetically engineered food ballot measure.

Preparing Extension clientele to participate in public policy decision making is a good investment of resources. When technical or complex issues like biotechnology appear on the ballot, voters need to take the initiative to locate supplemental resources that will help them make an informed vote. Unfortunately, voters may be apathetic when an issue is not personally relevant — not realizing the impact of their vote until after a measure passes or fails.

Programs such as the "Biotechnology: Designer Genes for Familiar Foods" lesson can engage segments of the public in a meaningful dialogue, not only providing balanced information but also allowing for exploration of personal values. In this case, we used an established network of Family & Community Education study groups to connect with consumers on a topic they maybe knew or cared little about, but one for which they would need to take a stand on when casting their ballot. Using trained volunteers to teach lessons is a familiar and effective format for Extension, particularly for topics that may not be on the public's "radar screen." Many of the lesson participants took action to become more informed on the issue of biotechnology. An informed public makes for well-designed public policy — a good investment for the Extension Service**.**

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Table 1. Perceived mean increase in 476 Family Community Education respondents' awareness/knowledge immediately following the biotechnology lesson*

Mean increase	Awareness/knowledge
4.1 ± 1.0	**Foods that are produced using biotechnology**
4.0 ± 1.0	**Pros and cons of food biotechnology**
3.9 ± 1.1	**Biotechnology legislation in Oregon**
3.8 ± 1.1	**Agencies that safeguard foods produced using biotechnology**

*On a scale from 1 "not at all" to 5 "a lot"

Table 2. Percent of 476 Family Community Education respondents who regularly did behaviors before the lesson and planned to do them after the biotechnology lesson

Lesson-related Behavior	"Did regularly" before the lesson	"Will do regularly" after the lesson
Stay abreast of biotechnology issues in the news	**18%**	**74%**
Discuss biotechnology pros and cons with others	**9%**	**55%**
Track legislation related to biotechnology	**9%**	**60%**

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