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Testing Public Policy Concepts to Inform Consumers about Genetically Engineered Foods

by J. Lynne Brown and Wei Qin

Current Situation

Although U.S. farmers have rapidly adopted genetically engineered (GE) soybeans, corn, and cotton over the last decade, American consumers remain relatively unaware that ingredients derived from these GE crops are in over 70% of the processed foods they buy. Surveys indicate that consumers are more concerned about GE applications in animals than in plants and that presence of a consumer benefit is likely to increase acceptance (Hallman et al., 2003; PEW, 2002). Despite incidents (Monarch butterflies, Starlink, Prodigene) that reveal weaknesses in managing and regulating GE crops and the Food and Drug Administration's (FDA) use of voluntary rather than mandatory regulatory review of GE food products, the public seems open to more applications of genetic engineering entering the food system. A test case is on the horizon.

In 2000, AQUA Bounty (now called AQUA Bounty Technologies, Inc.) submitted a petition to the FDA to permit its GE fast growing Atlantic salmon to enter the U.S. food system. This salmon was genetically engineered to enable the continuous production of growth hormone, instead of seasonal production as in conventional salmon. The resulting GE Atlantic salmon reaches market weight in roughly half the time required for conventional Atlantic salmon used in fish farming. Using focus groups in 2003-2004, we discovered that consumers could envision a range of consequences resulting from approval of this 'animal' application. They expressed great concern about impacts on human health and the environment, indicating a situation where outrage could drive public opinion (Qin & Brown, submitted). Consumer response will determine the success or failure of this GE salmon if approved by the FDA. One antidote to opinions driven by outrage is balanced information, which might support more informed opinions.

However, most readily available information presents, at best, one perspective on the issue of use of GE foods in the U.S. food system. Information from the biotechnology industry offers arguments and data in support of adoption, while that from some environmental and consumer groups raises concerns and supports a ban until certain conditions are met. Information from scientific academies and organizations is harder to find and, once located, is often difficult to understand and represents only the scientific perspective, giving little recognition to the values and social norms that also contribute to opinions. Readily available media reports also tend to be biased to whatever view makes the story newsworthy. We sought a framework for presenting print information about GE fast growing Atlantic salmon that would provide a balanced view on the issue of FDA approval.

Public Policy Education

Alan Hahn (1988) pulled several decades of work into a model for educators interested in resolving public issues through policy education. Although the model emphasizes the process used by an educator to help a group inform itself, some key concepts could be applied to written communications about an issue. Once the issue is clearly identified, these include a) understanding the perspectives of all the stakeholders in the issue; b) considering alternative solutions to the issue including the 'do nothing' option; and c) examining the consequences of each solution. Only when this is worked through, would citizens have sufficient data with which to make an informed choice of solution to the issue in question. In particular, gathering information on stakeholder perspectives and generating all the

possible consequences of a solution are difficult for an individual to do. For that reason, most efforts at public policy education rely on working with a group of people over time. Indeed, Cooperative Extension has been involved in public policy education with groups for many years around issues of river basin management, farmland protection, land use planning, intensive livestock operations, water quality, and municipal governance.

However, the introduction and regulation of GE foods has primarily occurred at the national level. Less regulatory debate has occurred at the state, regional, or county level, although an Oregon initiative to introduce mandatory labeling failed, as have recent efforts to limit GE crop use in certain counties in California (Clapp, 2004). Concerned citizens may be unable to find or form groups to investigate the issues surrounding introduction of GE foods into the food system. We felt that print fact sheets were an economical method of providing information on GE foods for literate citizens. However, we wanted to organize the information in a manner reflecting the concepts of public policy education, but were unsure what format would have the most impact on understanding an issue. To resolve this, we decided to compare the effect of two ways of organizing print information about the impacts of introducing GE fast growing Atlantic salmon (called GE salmon hereafter) into the food system.

Information Format

As FDA reviews GE salmon, the major issue is whether to approve or disapprove its entry into the food system. For our study we chose to consider the solution of FDA approval. Our information sheets contained two sections, one of invariant background and the second that differed. In the invariant section, we presented factual data comparing traditional selective breeding and genetic engineering and then described how GE salmon was created, how fish farming is done, and the current status of FDA review of GE salmon. The second section presented either viewpoints of various stakeholders on or the consequences of FDA approval of GE salmon. We will use 'perspectives' and 'consequences' to distinguish these two approaches for the second section in the rest of this paper.

We developed the second section by gathering information about GE salmon provided by various stakeholder organizations. Using this, we wrote summaries that we felt represented the perspectives of regulatory agencies, AQUA Bounty, the fishing industry, scientific review panels, environmental groups, consumer groups, and international agencies on approval of this GE application. The stakeholder group, along with various members (regulatory agencies such as FDA, EPA, and USDA), was listed at the top of the summary and all the summaries linked together became the 'perspectives' approach. We then identified consequences that were embedded in these viewpoints and used verbatim sentences and paragraphs from the perspective summaries to organize explanations of each of the consequences. Stakeholders were not identified by name in these 'consequence' summaries. For instance, "Some government commissioned reports" was used in consequences while "the National Research Council" was cited in perspectives. This list of consequences and their explanations became the 'consequences' approach. An example of each approach is shown in Table 1. The resulting 'perspectives' and 'consequences' sections shared 96% of the same sentences and phrases, differing only in omission of agency names and addition of a consequence statement (for example, regulation of fish farming may change) to introduce each consequence's section. These information sheets were reviewed by an expert in fish genetics for accuracy and in policy education for bias. Little bias was detected and a few inaccuracies were corrected in both information sheets.

The reading level for both information sheets was twelfth grade.

Experimental Design

We tested each information sheet with a randomly assigned group of consumers. We developed two questionnaires, one containing the consequences and the other the perspectives information. In each, prior to reading the information sheet, the subject was asked a) how they felt about the use of fast growing GE salmon in fish farming to produce fish for human consumption using an approval/disapproval scale; b) how interested they were in information about GE salmon; and c) how much factual information they could tell someone wanting a verbal explanation of development and use of GE salmon in the food system. After reading the information sheet, they were asked these three questions again, as well as how confident they felt in their understanding of some of the questions surrounding the introduction of GE salmon into the food system (for example: How might GE salmon affect consumer choice?). They were also asked a series of questions about ability (readability, ease of understanding) and information quality (how interesting, factual, biased, and desirable length). Finally,

Table 1. Illustrations of perspectives and consequences.

Perspectives example	Related consequence example
The **National Fisheries Institute,** representing the fishing industry, feels that *farming of Atlantic salmon replaces a diminishing natural resource, helps conserve wild salmon populations and produces protein efficiently. It take less than two pounds of feed to produce one pound of farmed salmon compared to five pounds of wild feed to produce one pound of wild salmon.* They ***acknowledge that salmon do escape from ocean pens, and some escapees have spawned in nearby rivers and interbred with wild salmon. However, fish farmers are improving containment systems. In addition, farmers must protect the local environment or their fish will die. Advancements in technology have reduced the amount of salmon excrement and areas around farms are routinely monitored for pollution effects. Fish farmers keep the use of therapeutics (antibiotics) as low as possible.*** ***Environmental Defense*** (ED) *recognizes that aquaculture is the only available means to significantly supplement fish catches in a hungry worl,d but feels that aquaculture must be done in an environmentally sustainable manner. They recommend that EPA strengthen its oversight of fish farms and improve salmon farming practices.* Approval of GE fish for commercial sale should require evidence of ecological, as well as food safety, and the approval process should be open to the public (transparent).	**• Production of GE salmon may spare wild fish populations.** *Farming of Atlantic salmon replaces a diminishing natural resource, helps conserve wild salmon populations, and produces protein efficiently. It take less than two pounds of feed to produce one pound of farmed salmon compared to five pounds of wild feed to produce one pound of wild salmon.* **• Regulation of fish farming may change.** Fish farmers ***acknowledge that salmon do escape from ocean pens, and some escapees have spawned in nearby rivers and interbred with wild salmon. However, fish farmers are improving containment systems. In addition, farmers must protect the local environment or their fish will die. Advancements in technology have reduced the amount of salmon excrement and areas around farms are routinely monitored for pollution effects. Fish farmers keep the use of therapeutics (antibiotics) as low as possible.*** Other groups *recognize that aquaculture is the only available means to significantly supplement fish catches in a hungry world, but feel that aquaculture must be done in an environmentally sustainable manner. They recommend that EPA strengthen its oversight of fish farms and improve salmon farming practices.* Monitoring and enforcement actions to detect noncompliance should be increased to provide stronger environmental regulation of fish farming.

Note: Italic and bold italic text in the perspectives section matches the respective section in consequences. The remainder of the consequences text on regulation of fish farming came from other group perspectives and the remainder of the perspectives text for Environmental Defense became part of a different consequence not shown.

they rated the necessity of each section in the information sheet to be well informed on the issue.

Subjects were recruited at an art festival in a small college town who met the criteria a) being 21-65 years old; b) ate fish at least once a month; and c) not a college student from the local college. The sample was stratified by age and gender and assigned one version of the questionnaire to complete within two-hour time blocks. The questionnaires were alternated by time blocks so that half the sample completed the perspectives questionnaire and half the consequences questionnaire. Data checking, entry, and analysis followed.

Influence of Information Format on Knowledge and Perceptions

Participants reading either information sheet did not differ in demographic characteristics, except those who read the consequences sheet ate salmon significantly more often than those reading the perspectives sheet (32 vs. 23 times a year). They were middle-aged, Caucasian (90%), mostly college educated (74%), with median household incomes of $60,000. About two-thirds were not aware of GE salmon development.

The two groups of participants did not differ significantly in baseline measures (prior to reading either information sheet) of approval of GE salmon, self-assessed knowledge, or interest in learning about genetic engineering (See Table 2). There were also no significant differences in ratings of ability or information quality between groups. Both groups rated the information as moderately easy to read and understand. Both groups also found the information sheets moderately to rather interesting, rather factual, and just about right to provide the information necessary to reach an informed opinion. Both groups felt the information sheets exhibited little bias about introducing GE salmon into the food system.

Assessments of knowledge and interest after reading an information sheet did differ. Although both groups showed significant increases in knowledge and interest, those reading the consequences information reported greater gain in knowledge and more interest in learning about GE salmon than those reading the perspectives information.

The effect on approval was more complex. Prior to reading the information, both groups slightly disapproved of GE salmon. While the difference was not significant, those in the perspectives group were initially somewhat less negative about GE salmon than those in the consequences group. After reading the information, the assessment of both groups shifted upward slightly and significantly for the perspectives group. However, approval of both groups still hovered in the neutral range (half a unit on either side of zero in our scale). Further analysis revealed that the consequences group

Table 2. Effect of information on participants' views.

Viewpoint	Perspectives N= 103	Consequences N = 102
Approval of GE salmon[a]		
Pre-approval	-0.11[a]±1.60	-0.45[a]±1.75
Post-approval	0.16[b]±1.66	-0.36[a]±1.77
Self-assessed knowledge[b]		
Pre-knowledge	1.69[a]±1.03	1.96[a]±1.19
Post-knowledge	3.7[b]±1.18*	4.2[b]±1.17*
Interest in learning about GE salmon[c]		
Pre-interest	4.07[a]±1.48	4.39[a]±1.76
Post-interest	4.30[b]±1.28*	4.80[b]±1.59*
Confidence in understanding[d]		
How GE salmon are made	3.63±1.34	3.92±1.42
How they will be regulated	3.33±1.21	3.61±1.50
Effect on the environment	3.94±1.49	4.27±1.54
Effect on consumer choice	3.77±1.47*	4.29±1.39*
Effect on consumer health	2.87±1.43**	3.48±1.81**

Notes: Different superscripts indicate significant differences in pre vs. post values for each information sheet. Effect of information on approval, knowledge, and interest was compared when controlling for salmon consumption and respective pre-values. Effect on confidence was compared controlling for salmon consumption only. Significant differences between information formats is indicated as *p<0.05, ** p<0.01.

[a]7-point scale where -3 = strongly disapprove, 0 = neutral, and 3 = strongly approve

[b]7-point scale where 1 = nothing at all and 7 = a great deal

[c]7-point scale where 1 = not interested at all and 7 = extremely interested

[d]7-point scale where 1 = not at all confident and 7 = extremely confident

included a greater number who initially strongly disapproved of GE salmon than in the perspectives group (14 vs. 3, respectively). Despite these negative initial attitudes, exposure to the consequences information shifted their approval ratings the same degree of magnitude upward (toward approval) as those reading perspectives information. We interpret this finding to mean that neither consequences nor perspectives information changed approval ratings to any meaningful degree.

Participants indicated their degree of confidence in understanding some of the questions about introducing GE salmon into the food system (Table 2). Both groups indicated they were somewhat to moderately confident in understanding how GE salmon was made and will be regulated and they were moderately confident in understanding the effects on the environment. However, those reading consequences information were more confident than those reading perspectives information about understanding the effects on consumer health and consumer choice.

Finally participants rated the necessity of the components in both sections of the information sheet they read. Regardless of format read, participants felt that four of the five topics covered in the invariant background section were rather necessary (5 on a scale of 7). Selective breeding was considered moderately necessary (4 on a scale of 7). However, those reading consequences information rated background information on fish farming as more necessary than those reading perspectives information. Turning to the second section, both groups rated the various summaries presented in either the perspectives or consequences section as at least rather necessary (5 on a scale of 7) except for one section. Those reading perspectives information felt viewpoints of Canadian and British scientists were only moderately necessary (4 on a scale of 7).

Implications

If professionals want to encourage formation of informed opinions on an issue through the presentation of balanced information, the use of a consequences format would appear to help do this. Our experiment indicated that participants reading consequences information reported more interest in learning about GE salmon, as well as a higher self-assessment of their ability to verbally explain the development and use of GE salmon in the food system compared to those reading perspectives information. Participants viewed both formats as non-biased and factual, characteristics important for communicator credibility. However, each information sheet presented conflicting viewpoints or outcomes. Perhaps as a result, neither format led to changes in approval of GE salmon use in the food system that had much real life significance. Perhaps of most importance, participants reading the consequences information reported greater confidence in understanding some of the questions surrounding the entry of GE salmon into the food system.

One drawback to our information was the reading level. It was difficult to lower the level because a

breadth of topics was covered, from science to regulation. Plus, further simplification could easily result in bias. Although not intentional, our volunteer sample was well educated, which enabled them to understand the information. Perhaps only those who are better educated will form the informed citizenry needed for resolving public policy issues. This may be particularly true for issues that are not locally driven. Finally, our randomization process may not have evenly distributed all differences between the groups.

For More Information

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J. Lynne Brown (f9a@psu.edu) is an Associate Professor, and Wei Qin is a Ph.D. student, respectively, Department of Food Science, Penn State University, University Park, PA.

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