

Testing Consumer Knowledge and Opinion of Transgenic Foods in Alameda County**Kingman Lim**

Abstract Genetically Engineered (GE) food has come under harsh criticism. GE opponents point out possible adverse health effects, environmental and ecological damage from industrial monoculture farming, how biotechnology corporations are controlling the global food market and how government agencies are not sufficiently regulating GE foods. In response to the corporate assault on food security, activist groups are mounting public education campaigns and introducing ballot measures to ban GE foods from their communities. To assist the community organization GMO-Free-Alameda-County in their efforts to ban local GE crop cultivation, a survey was conducted to assess public awareness and opinion of GE foods. Because of conflicting discourse and a lack of unbiased information sources, it is important to assess the knowledge, opinion, and concerns local residents have about genetic engineering. Subjects were surveyed in Berkeley, Oakland, Hayward, Fremont, and Castro Valley, near food shopping areas, cafes, and restaurants. Results show that Alameda county consumers who know more about GE foods are generally more opposed to them, implying that educating uninformed consumers in Alameda will improve the chances of passing anti-GE legislation. Participants who relied on television and newspaper as their main sources of information had the lowest knowledge scores, suggesting that these channels do not sufficiently educate the public about GE food issues. These results can be used to help GMO-Free-Alameda-County plan educational strategies for Alameda County consumers prior to the proposal of a ballot initiative, as well as assist other communities in their efforts to ban GE crops.

Introduction

While biotechnology corporations like Monsanto praise genetic engineering for boosting crop yields, reducing chemical inputs, and enhancing food flavor and nutrition (Monsanto 2004), genetically engineered (GE, GMO, Transgenic) foods have come under harsh criticism by environmental and health activists. Some criticisms include the possible adverse health effects (Lueck & Kilman 2000; Ewen & Puzstai 1999), genetic contamination of native crops (Yoon 2001, Barboza 2001), the lack of understanding of cellular ecology (Capra 2002), and corporate monopolizing of the food market by patenting crop strains (OCA 2003). Yet the biotechnology industry claims GE foods are safe (Monsanto 2004) and U.S. regulatory agencies apparently agree by allowing GE foods into the food supply (FDA 1992). In response, anti-GE activists are protecting their communities from being contaminated with GE foods by banning their cultivation at the local level. GMO-Free-Alameda-County (GMO-Free-AC) is an affinity group of local anti-GE activists, who are proposing a ballot initiative banning the cultivation of GE crops in Alameda County. Before the initiative is introduced, GMO-Free-AC will do community outreach to educate consumers about issues surrounding genetic engineering. **This purpose of this study is to assess how well informed Alameda county consumers are about GE foods, and to test if consumer knowledge of GE foods is correlated to their opinion.** Results are expected to show that consumers who are more knowledgeable about GE foods will more likely be opposed to them. This study could help GMO-Free-AC activists strategize their community outreach efforts, improving the chances of passing a GE ban measure.

There is a lot of confusion surrounding GE, due in part to conflicting discourse and the lack of unbiased information. Some scientists believe the general public is too naive regarding GE science and that public opposition to GE foods is based entirely on this ignorance (Cook et. al. 2004). Another study claims that because media emphasizes negative information about GE foods, consumers remain uninformed and will not spend the time to become well informed about the benefits of biotechnology (McCluskey & Swinnen 2002). However, these studies contradict an Italian study that found public concerns about GE are not due to ignorance and media misinformation, but instead come from a public perception that scientific research has "lost its air of impartiality" (Bucchi & Neresini 2003). One example of "not impartial" research is an economic study done at the University of Wyoming that states "there is a public good value of GE information from agribusiness, although it disappears in the presence of independent third-

party information" (Huffman et. al. 2003). The study cites the economic benefits "through the eyes of agribusiness" of providing consumers with pro-GE information and does not address the social or environmental costs surrounding GE food production. Such pro-industry studies could contribute to why the public perceives scientific research to be "loaded with interests" (Bucchi & Neresini 2003). In terms of policy-making, scientific "experts" tend to think that the public is too uninformed about GE science to participate in the decision making process, but public trust in honest science has been deteriorating (Cook et. al. 2004). If the public is involved in political decisions about GE foods, such as voting on a ballot initiative, it is important for them to be knowledgeable enough to make informed decisions. The Alameda county survey contributes to this field by sampling the knowledge, opinions, and concerns of Alameda county consumers about GE foods and what their main source(s) of information are. The data collected should help to answer the following questions:

- 1) Does knowledge predict how people vote?
- 2) How does knowledge predict purchasing habits?
- 3) How does knowledge predict types of concerns people have?

Results are expected to show that people who are more knowledgeable about GE foods will:

- 1) More likely vote to ban GE crop cultivation,
- 2) Avoid consuming foods that contain GE ingredients,
- 3) Have more concerns about genetic engineering.

Genetically engineered crops could be in Alameda before the end of the year. Alfalfa farmers in Alameda could soon be allowed to plant Roundup-Ready Alfalfa, if Monsanto and Forage Genetics Inc. succeed in their plans to make it available by 2006 (Wilkins, 2005). This poses ecological dangers to the local watersheds as well as extreme biological risks for amphibian residents in particular (Rick Relyea 2005), such as the Arboreal and the California Tiger Salamander.

Methods

The survey was administered verbally to subjects in Berkeley, Oakland, Hayward, Fremont, and Castro Valley, outside of restaurants, cafes, and other food service businesses. Subjects were greeted and asked if they could participate in a short research survey about genetically engineered foods. The survey tested consumer knowledge, opinion, and concerns about GE

foods, and also recorded what their main sources of information were. The methods for testing knowledge and opinion are described below:

I. Knowledge (*k*)

The knowledge section asked if the consumer knows:

- 1) What a genetically engineered food is. A consumer who defines GE food as "cross-breeding", "hybridized", or other traditional, non-transgenic method of plant breeding earns 0.5 *k* points and are then told that for remainder of the survey, "GE" or "GMO" shall be defined as "transgenic" (any organism into which humans have inserted genes from another species). The consumer earns 1.0 *k* point if they correctly define "transgenic." [1.0 *k* point maximum]
- 2) The main GE crops grown in the U.S. [corn, soy, canola, cotton] Each main crop mentioned earns 0.5 *k* point. Other GE crops mentioned such as potatoes or tomatoes earn 0.25 *k* point, but 0.5 *k* will be awarded if the subject shows exceptional knowledge about how they are genetically modified, such as Roundup-Ready or altered ripening. [2.0 *k* point maximum]
- 3) Any food processed food item, product, or brand name containing GE ingredients. [1.0 *k* point]
- 4) How to avoid buying foods that contain GE ingredients (e.g., buying foods certified "organic"). [1.0 *k* point]
- 5) A biotechnology company invested in genetic engineering (e.g., Monsanto, Novartis). [1.0 *k* point]

II. Opinion

The opinion section tested:

- 1) If the consumer would buy foods if they were labeled "Genetically Engineered" and
- 2) If they would vote to ban the cultivation of GE crops in Alameda county

III. Concerns

Subjects were asked what concerns they had about genetic engineering. Concerns fell into the following categories:

- 1) Health, "lack of testing" (e.g., potential increased risk of cancer, lower food quality and nutrition)
- 2) Ecological/environmental (e.g., potential genetic contamination or mutation of native strains, pollution associated with industrial agriculture)
- 3) Economic (e.g., concentration of wealth in the hands of a few biotech/agriculture companies controlling the global food market, life being patented and treated as a commodity, farmers losing their jobs and livelihood)

IV. Information sources

Subjects were asked what their main sources of information were, which fell into the following categories: Television, newspaper, radio, the Internet, "independent" media, and word of mouth.

Table 1. Survey location, sample size, and date:

Berkeley

Whole Foods Market, Telegraph Ave. (9)	Friday Apr. 8
* [Farmers Market, Center St./Milvia St. (14)]	[Saturday Apr. 9]
Downtown Berkeley, Shattuck Ave./ Center St. (21)	Saturday Apr. 9
Cafe Strada, College Ave./Bancroft Ave. (11)	Saturday Apr. 9

Hayward

Food Shopping Area, Mission St./B St. (19)	Sunday Apr. 10
BART train/station, between Rockridge/Hayward (5)	Sunday Apr. 10

Oakland

Rockridge District, College Ave. (11)	Sunday Apr. 17
Safeway, Broadway @ Pleasant Valley (10)	Sunday Apr. 17

Fremont

Shopping Mall Area, Fremont Blvd./Mowry Ave. (19)	Saturday Apr. 30
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Castro Valley

Redwood Rd./CastroValley Blvd. (13)	Sunday May 1
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* Samples from the Berkeley farmers market are not included in the data analysis unless otherwise noted because of probable anti-GE bias.

Total subjects surveyed: 118 (132 including Berkeley farmers market)

Results

Eighty-nine people (75%) said they would not buy (WNB) a food product if it were labeled GE, but only sixty-four (54%) said they would vote to ban (VTB) GE crop cultivation in Alameda. This is consistent with the assumption that voting to ban GE cultivation is a stronger statement against GE foods than simply avoiding them. The data shown in Table 2 predicts people with higher levels of knowledge have stronger negative opinions of GE foods. For example, 87% of people who scored above average k said they would vote to ban, compared to the 28% who scored below average.

	VTB	WNB
above avg k	0.87	0.82
below avg k	0.28	0.69
avg k score	2.77	1.1

Table 2. Percentage of people who scored above/below average k who would VTB/WNB
Average k score of people who would VTB and WNB

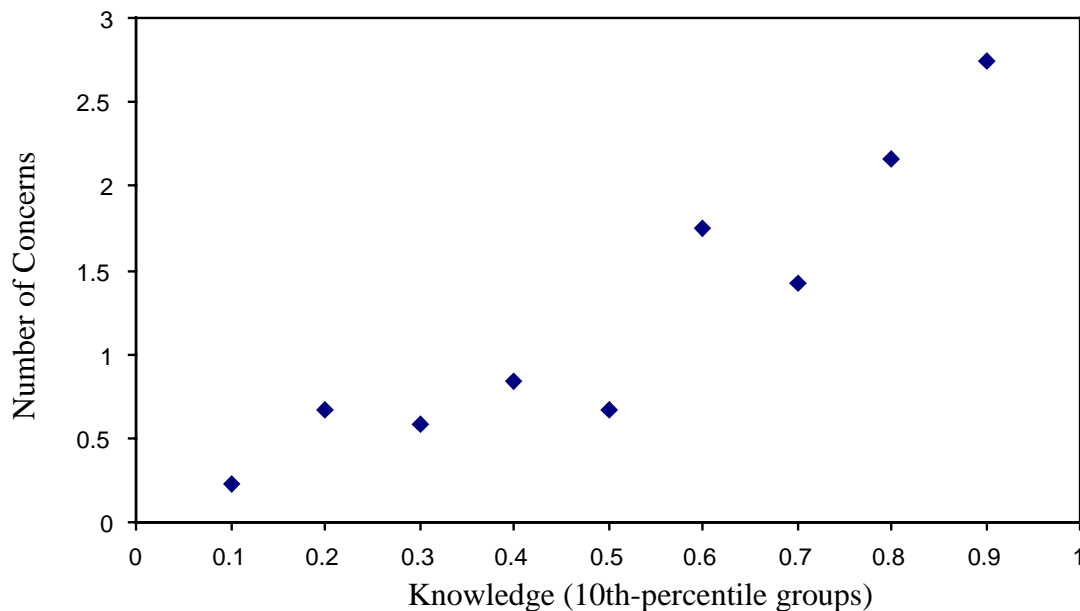


Figure 1. Subjects who scored k amongst the top 20th percentile have more concerns.

Knowledge (k) is also correlated to the number and type of concerns consumers have about GE foods. Out of 119 surveys there were 65 health concerns, 50 environmental concerns, and 26 economic concerns. Nineteen people who had all three concerns had a high average $k=4.53$, twenty-six people who had any two concerns averaged $k=3.10$, and people who had no concerns averaged $k=0.95$, showing that people who have more concerns are generally more knowledgeable about them. Figure 1 shows the average number of concerns from each 10th-percentile group of knowledge scores, revealing the correlation between knowledge and number of concerns.

There were more "health" and "environmental" concerns than "economic" concerns, but the VTB:WNB ratio (Fig. 2) illuminates the degree of opposition that each concern represents. For example, the twenty-six people who had expressed all three concerns show strong opposition to both the cultivation and consumption of GE food (VTB:WNB ratio = 0.96:0.96). The VTB:WNB ratios are consistent with the idea that people with environmental concerns (0.75:0.58) do not want GE foods in their community but might not mind eating them, whereas people with health concerns (0.44:0.69) might not mind GE foods in their community as long as they are not eating them. Besides people who had all three concerns, those with economic concerns expressed the strongest opposition to GE foods.

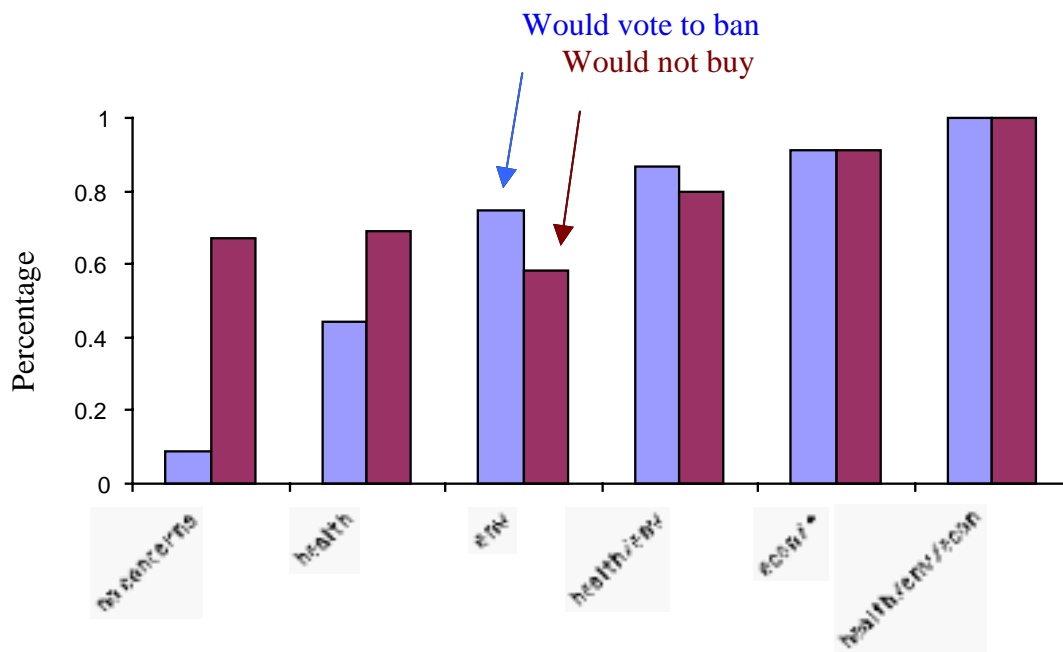


Figure 2. Percentage of people who would VTB and WNB vs. concern type

Knowledge was found to play a role in predicting whether or not someone would vote to ban GE crop cultivation. Of the people whose k scores within the top 20%, all said they would vote to ban and would not buy GE foods (Fig. 3). As knowledge decreases, the likelihood of voting to ban and avoiding GE foods also decreases.

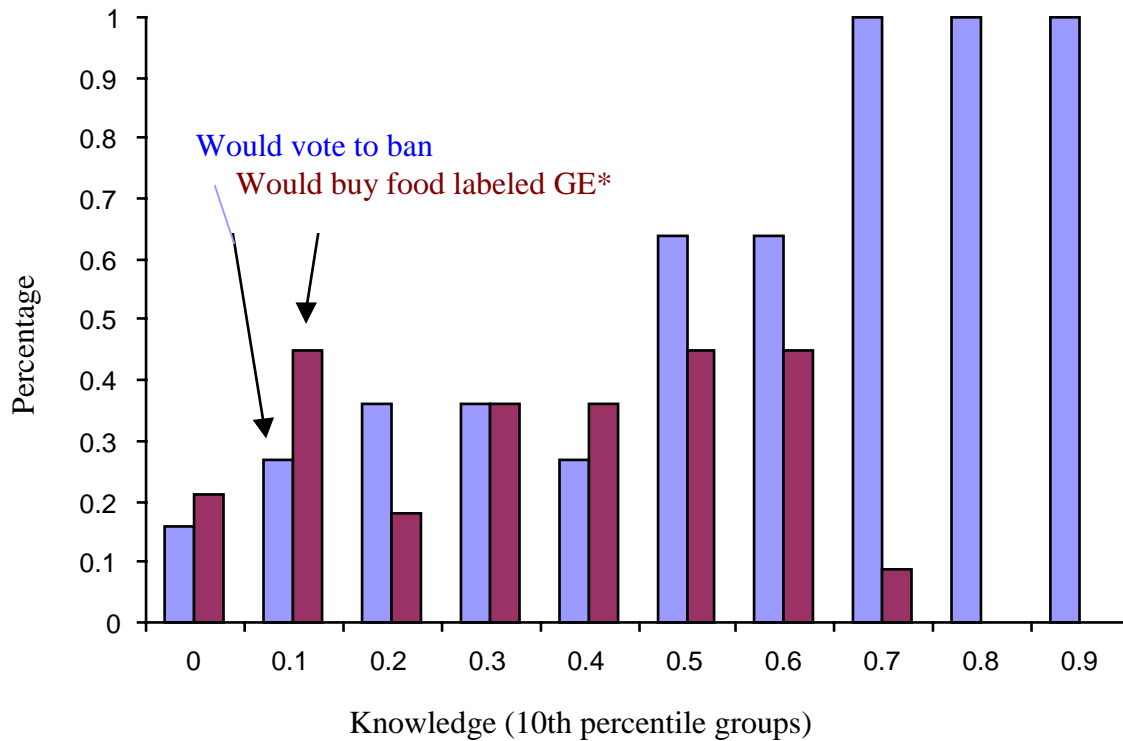


Figure 3. People who were more knowledgeable were more likely to vote to ban and avoid foods labeled GE.
*Unlike Fig. 2, histogram bars in Fig.3 indicate %/people who would buy GE foods

Knowledge, opinion, and concern varied by location. Berkeley and Oakland consumers were more knowledgeable and more opposed to GE foods than those in Hayward, Fremont, or Castro Valley (Table 3). Berkeley and Oakland consumers are also more likely to vote to ban GE foods than the other cities surveyed, but GE food purchasing habits are more varied (Fig. 4).

	k (avg)
Hayward	0.85
Fremont	0.99
CastroV	1.27
Oakland	2.91
Berkeley	3.41

Table 3. Average k by location

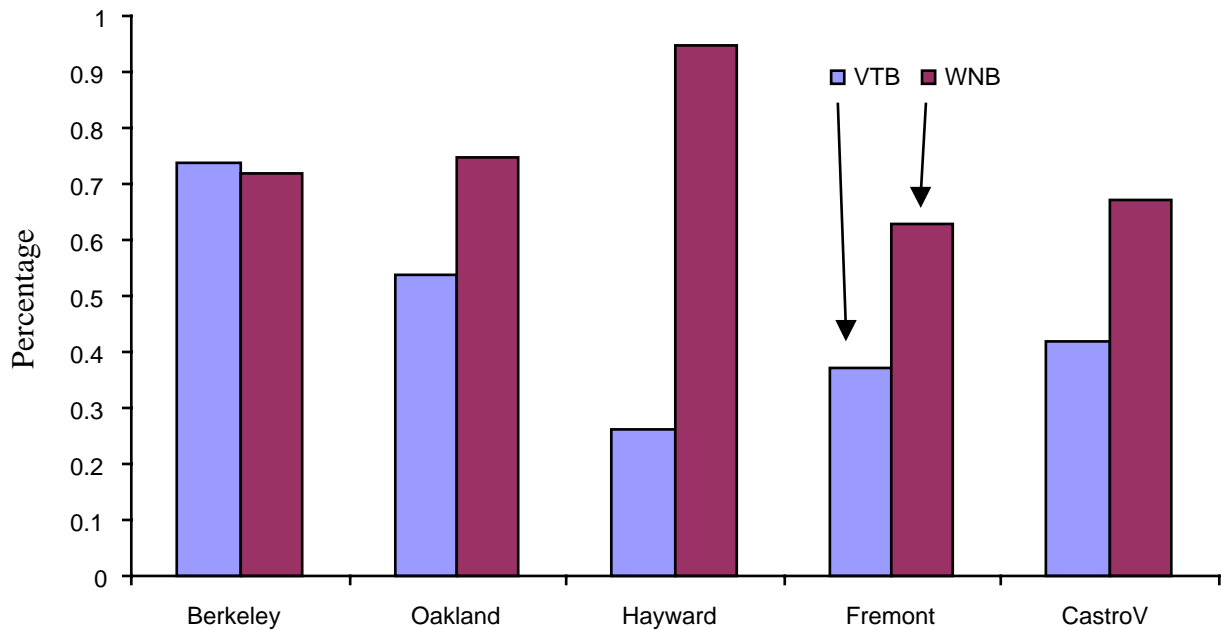


Figure 4. Consumers who would VTB and WNB by location

Although people surveyed from the Berkeley farmers market were not included in the data so far, an analysis further supports the hypothesis that greater knowledge is correlated with negative opinion. Berkeley farmers market subjects were more knowledgeable ($k=3.73$) than any other group, and were greatly opposed to consumption and cultivation of GE foods (VTB:WNB = 0.93:0.87). This is to be expected since farmers markets shoppers are likely trying to avoid food grown from large-scale industrial agriculture, which includes GE foods.

The survey also recorded about the consumer's main source of information. Consumers who were the most knowledgeable (k within the top 20th-percentile group) about GE foods said they got their information from "independent" sources, the radio, or word of mouth. Subjects who relied on newspaper and television for their information were least knowledgeable (k within the bottom 20th-percentile group). The Internet and "word of mouth" shouldn't be used as predictors of knowledge or opinion, because people are more likely to seek sources that agree with their own interests. By this logic, people who obtain information from the Internet or "word of mouth" are likely to keep ideas and opinions close to what they already have.

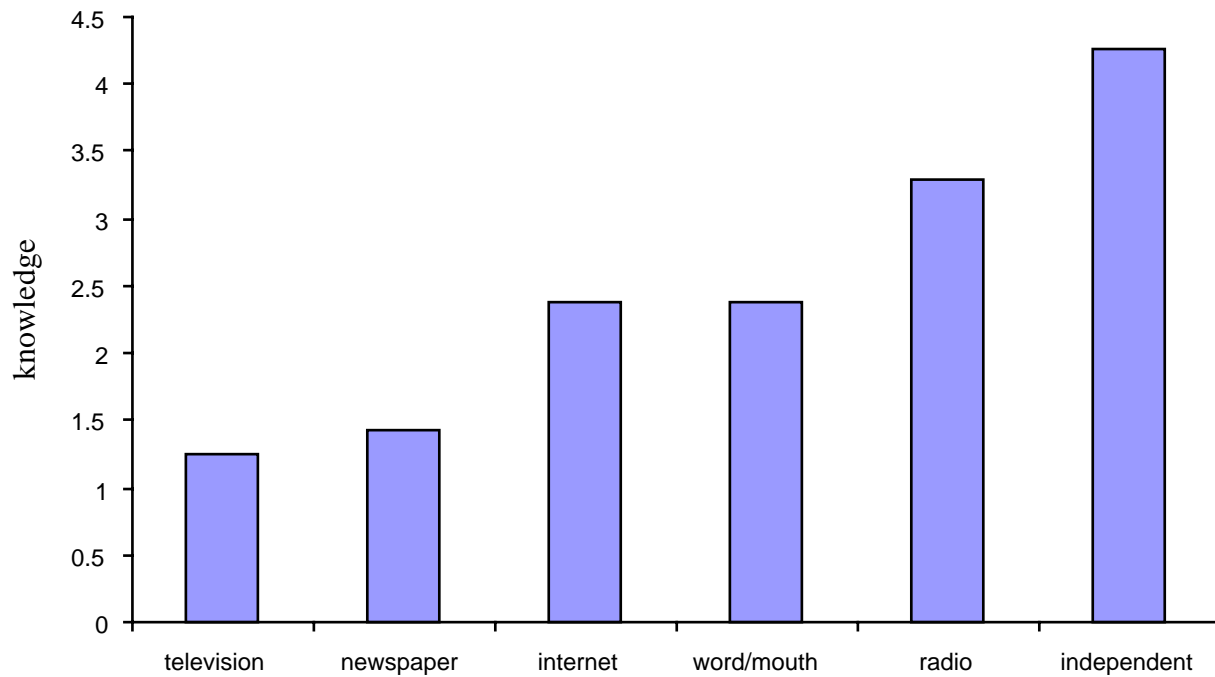


Figure 5. People who relied on television and newspaper as their main sources of information had the lowest knowledge scores.

Discussion

These results illuminate the need to educate Alameda county consumers about GE foods before introducing a ballot initiative (only 54% would VTB). Education outreach should be directed toward areas where consumers are less informed about GE foods, in cities such as Hayward, Fremont, and Castro Valley. However, because of large population size and lack of sampling variation, the data from Berkeley and Oakland are biased in that they may appear more knowledgeable and opposed to GE foods than they really are. Berkeley and Oakland consumers are generally more politically progressive than other areas of Alameda county which might also explain why they are more knowledgeable and opposed to GE foods than consumers in Hayward, Fremont, and Castro Valley. Results indicate that consumers with environmental concerns are more likely to vote to ban GE crops than consumers with only health concerns, so educational outreach should include and emphasize information about potential environmental damages. Although the people who had economic concerns were also very opposed to GE crop cultivation, politically conservative areas such as Fremont or Livermore might favor economic growth over environmental protection, in which case other information, such as potential health

risks, could be used as well.

The findings of this study contradict the idea that consumer opposition to GE foods is based on ignorance (Cook et. al. 2004) or on a media that mainly emphasizes negative issues (McCluskey & Swinnen 2002). On the contrary, consumer opposition appears to be correlated with greater knowledge, and people who rely on mainstream media sources are generally less knowledgeable and also less opposed to GE foods than people who get their information from the radio or independent sources. The results could be consistent with the idea that the public has lost faith in "impartial science" (Bucchi & Neresini 2003), if skeptical consumers are looking to independent sources for information, and as a result becoming more knowledgeable and more opposed to GE foods.

This study does not address the causal relationship between knowledge and opinion. Causation could be determined in a follow-up study by asking how subjects formed their opinions about GE foods. Also, this study does not ask about potential benefits of genetic engineering. Additional studies could include opinion questions about perceived benefits, so that any correlation between knowledge and positive opinion could be observed as well. Based on the findings of this study, it is highly likely that there is a causal relationship between knowledge and opinion, although it will require further research to better understand exactly how they are related.

It is important to understand that GE crop cultivation is a part of a larger scale, resource-and-chemical-intensive industrial monocrop agriculture system that is contributing to accelerating rates of soil erosion (Berger & Iams 1996) and loss of biodiversity (FAO 1996). A report by the Polaris Institute summarizes that "like the Green Revolution of the 1960s, the introduction of monocrop agriculture for the production of GE crops is bound to destroy traditional farming systems in Third World Countries" (Clarke 2004). With or without genetic engineering technologies, feeding the world's hungry will require agriculture systems that promote biodiverse, small scale farming that produces food for local markets (Shiva 2004). Physicist Frijtof Capra suggests a precautionary approach to genetic engineering with an understanding that "biological forms and functions are not simply determined by a genetic blueprint but are emergent properties of the entire epigenetic network." Capra is adamant that "the overriding motivation for genetic engineering is not the advancement of science, the curing of disease, or the feeding of the hungry. It is the desire to secure unprecedented financial gain" (Capra 2002).

As long as profit is the main driving force behind large agriculture corporations, genetically engineered crops will continue to be a tool to promote a global food system of industrial monoculture farming and the environmental destruction associated with it.

It is not surprising that GE food has been allowed into the U.S. food market without much public opposition, considering how much lobbying power the biotechnology industry has in government. For example, in 2000, Monsanto gave \$1.1 million in campaign contributions (81% to Republicans) and spent \$7.8 million on lobbying, and in 2002 contributed more than \$1 million to block an Oregon law requiring the labeling of GE foods (CRP 2004). In addition, regulatory agencies often have positions filled by GE-friendly officials, such as former Monsanto lobbyist, Linda Fisher who helps head the U.S. Environmental Protection Agency. In addition to aggressive lobbying and industry-friendly government officials, Monsanto has used bribery as a tactic to penetrate into foreign markets (DOJ, USSEC 2005). In a time when government bodies have been infiltrated by special interests and large corporations have betrayed public trust, it becomes more important for local communities to take control of their own food security by supporting locally grown agriculture and withdrawing support to large scale industrial farming. For this reason, anti-GE measures should be adopted wherever possible to counter the corporate assault on food security.

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