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Consumer Perceptions of Food Biotechnology: Evidence from a Survey of U.S. Consumers

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This paper is a descriptive study of consumers' self-reported knowledge, assumptions, and acceptance of genetically modified foods in the U.S. These findings are based on a national survey of consumers. Our findings demonstrate a rather low level of awareness among most Americans about bioengineered foods. Most Americans tend to view the use of biotechnology in food production with guarded optimism. While a majority believe that biotechnology will benefit many people, they also feel that the dangers of genetic modification warrant strict regulation of the technology. In general, there is greater support for the use of this technology in plants than in animals and in order to bring tangible benefits to consumers.

The role of biotechnology in the future of agriculture and food is becoming increasingly important. Billions of dollars have been invested to develop new and improved foods, feeds, fibers, and pharmaceuticals. However, consumer reception for genetically modified (GM) foods have been decidedly mixed. For instance, many parts of Europe have seen strong opposition to GM products (Gaskell et al. 1999). In the U.S., the general population does not appear to be polarized between proponents and opponents of GM foods. Most Americans remain relatively unaware or ambivalent about food biotechnology (Gallup 2001; Hallman et al. 2002).

Scientific challenges notwithstanding, consumer perceptions of biotechnology and their acceptance of GM foods are likely to have significant impacts on the future of our food system. This paper reports some general findings about U.S. consumers' awareness, attitudes, and perceptions of food biotechnology and their acceptance of GM food products. It provides insight into the state of public awareness of various biotechnology issues and public perceptions of the risks and benefits associated with the use of this technology in agriculture and food production.

Survey Method and the Data

This study is based on a national survey of public attitudes toward the use of genetic technology in agriculture and food production. The survey was completed in March-April, 2001 by a professional polling firm on behalf of the Food Policy Institute, Rutgers University. To develop the survey, the Institute solicited inputs from more than 50 representatives from academia, government, biotechnology companies, consumer groups, and agribusiness and food companies to identify important topics and issues of interest to stakeholder groups. The survey was also developed to provide comparability to the 1999 Eurobarometer survey, a broad-based public opinion poll administered in 15 European countries.

The sample frame was the non-institutionalized U.S. adult civilian population. A random proportional sample was obtained from the more than 97 million telephone households. Using a computer-assisted telephone-interview (CATI) system, 1203 interviews were completed, which results in a sampling error of ± 3 percent. The average survey time was 24.5 minutes. The geographic coverage of the survey was commensurate with the state population.

About 47 percent of respondents were male and 53 percent were female. Respondents' ages ranged from 18 to 91 years (median = 43 years). About 76.0 percent were white, 9.5 percent African-American, with a smaller representation from other ethnic groups; 6.7 percent did not provide their race. About 55 percent were married and 22.4 percent were single; 4.8 percent did not reveal their marital status. About 37 percent had a high school diploma

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or less, 26.4 percent had completed “some” college, 20.8 percent had a four-year college degree, and 11.7 percent held a graduate degree; the remainder did not respond to this question. About 41 percent reported an annual household income of under \$50,000; 20 percent reported \$50,000 to \$75,000; and 21.1 percent reported over \$75,000; others did not respond. About 72 percent of respondents attended a house of worship; 34.8 percent attend at least once a week. Approximately 33.4 percent identified themselves as liberals or liberal leaning, 47.9 percent as conservative or conservative leaning, and 10.8 percent identified moderates, with the remainder not responding.

To better represent the population, the data was weighted to adjust for race, ethnicity, and education. Weighting factors were derived from comparison data from the 2000 U.S. Census. Except for the reported sample demographics, all other reported univariate statistics are estimates based on the responses of the survey participants and are derived from the weighted data.

What Do Consumers (Think They) Know About Genetically Modified Foods?

The American public has not given much thought to the issue of GM foods. Consistent with the findings of other recent surveys on the subject (e.g., International Food Information Council 2000; Gallup 2001), the vast majority of our survey participants indicate that they have heard very little about this technology. For example, only 13 percent of the respondents report having heard or read “a great deal” about genetic modification. Another 47 percent report having heard or read “some” information on the subject and the rest, 40 percent, report having heard or read little or nothing. Only 41 percent of Americans agree with the statement, “I feel that I am adequately informed about biotechnology.”

Americans generally view themselves as well-informed about their food system: three-quarters rate their basic understanding of how food is grown as at least “good.” However, this self-assessment appears to be overly optimistic. For example, about half of the respondents reported that they had never heard about traditional crossbreeding when the technique was described in simple terms. In fact, 61 percent of respondents report that they have never

eaten a fruit or vegetable created through traditional crossbreeding; another 11 percent were unsure.

About two-thirds of the survey participants rated their basic understanding of science and technology as “good” or better. However, most respondents seem to have an overly optimistic view of their knowledge of science. Survey participants were asked to answer a number of true-false questions to determine their actual knowledge of basic biological principles and facts. The findings of this exercise highlight the knowledge gap of the broader population regarding the scientific issues involved in biotechnology. For example, 34 percent of our survey participants incorrectly believe “genetically modified foods are created using radiation to create genetic mutations” and another 20 percent were unsure, while 33 percent of them incorrectly believe “it is impossible to transfer animal genes to plants,” with another 16 percent unsure. About one-quarter of the respondents (24 percent) incorrectly believe “ordinary tomatoes do not contain genes, while GM tomatoes do,” and another 19 percent were unsure. Thirty percent incorrectly believe “genetically modified animals are always larger than ordinary animals,” with 11 percent unsure.

Overall, only two out of five respondents correctly answered 6 or more of these basic questions on science. This suggests that the American public is not fully prepared to reach any definitive position on biotechnology based on sound evaluation of scientific information. It may be noted here that efforts to effectively communicate biotechnology issues to the public ought to be based on an accurate picture of what consumers actually know about the technology, what they want to know, and their perceptions and concerns. In this context, Hallman (2000) notes

“the place to start is to recognize that decisions concerning the acceptability of biotechnology have long passed the point of being the sole province of experts or of the scientific community and have entered the realms of public policy and public opinion. Failure to recognize the nature of the differences between experts and consumers in knowledge and perspective regarding biotechnology . . . can lead to poor strategies for providing information to consumers.”

Public Perceptions of Genetic Modification

The American perspective on genetic modification exists in a state of schizophrenic tension, with the majority of people simultaneously expressing optimism about the benefits of biotechnology and concern about the unforeseen consequences of its use. A majority (58 percent) of the American public appears to believe that biotechnology will improve quality of life, and nearly two-thirds (62 percent) acknowledge that GM food "will benefit many people." More than half (58 percent) of those surveyed believe "the risks of GM have been greatly exaggerated."

On the other hand, 56 percent of Americans report the "idea of genetically modified food causes [them] great concern." Many are concerned about the potential for unintended and unforeseen consequences of the technology. Almost three-quarters (74 percent) of Americans believe "the potential danger from genetic modification is so great that strict regulations are necessary." About four-fifths of the respondents believe that due to human fallibility "serious accidents involving genetically modified foods are bound to happen." In fact, nearly half (49 percent) believe that if something did go wrong with GM food, it would be a global disaster. Only one-third of those surveyed feel that genetically modified food "presents no danger for future generations."

The disruption of the ecological balance by the use of genetic technology emerges as a major concern of the American public. For example, 58 percent of Americans believe "we have no business meddling with nature;" 74 percent believe "nature is so complex it is impossible to predict what will happen with GM crops;" and 54 percent feel that "even if genetically modified food has advantages, it is basically against nature."

Concern has been expressed that the introduction of bioengineered plants and animals into the environment could lead to displacement of native species. Such fears about potential destabilization of the ecosystem stems from examples such as the introduction of genetically modified salmon (that grow and mature more rapidly), the highly publicized lab study linking pollen from GM corn (Bt corn) to Monarch butterfly larvae mortality, and incidences such as the mad cow diseases in the U.K. Some are concerned that the development of pest-

resistant GM plants may result in mutations of pests that would be resistant to most pesticides. Other concerns about biotechnology include the potential for adverse effects on human health (e.g., allergenicity or the unintended introduction of undesired compounds into food), corporate control of the food system, and the immorality of "playing God" with living organisms.

Who Can the Public Trust?

Despite having reservations, Americans do not seem inclined to turn back the clock on biotechnology. Less than one-third (32 percent) report that they would sign a petition against biotechnology and only 35 percent believe it would be better if "we did not know how to do genetic modification at all." Public trust, however, weighs heavily in the debate over GM foods. While three-quarters of Americans agree that regulation of GM products is needed, 59 percent believe the government is not equipped to properly regulate GM foods. Public confidence in the scientists associated with biotechnology is quite low: only 38 percent of Americans agree that "scientists . . . know what they are doing, so only moderate regulations on genetic modification are probably necessary." Further, almost three-quarters (73 percent) feel that "most GM foods were created because scientists were able to make them, not because the public wanted them." The American public is quite skeptical of the biotechnology companies: about two-thirds (68 percent) believe that "companies involved in creating GM crops believe profits are more important than safety."

Insistence on the Right to Know

Nine out of ten Americans believe that GM foods should have special labels. However, only slightly more than half (53 percent) of those surveyed say they would actually take the time to look for fruits or vegetables that were not genetically modified and 37 percent of them indicate that the information that produce is genetically modified will not affect their purchase decision. About 48 percent of those surveyed indicate that they will be less willing to buy GM produce. However, the overwhelming majority of the public wants full information about the foods they buy or consume so that they

have personal control over their consumption decisions (Hallman 2000). For example, nearly 70 percent of our survey participants indicate that they would be unhappy if they were served GM foods in a restaurant without their knowledge.

Consumer Acceptance of Genetically Modified Foods

The American public seems to be undecided on the issue of GM foods, with majority of people not having an entrenched viewpoint. Further, pinpointing public sentiment on this issue is difficult, due to the sensitivity of responses to the framing of questions (see Hallman et al. [2000] for discussion on this issue). To further complicate the assessment, the public has decidedly different responses to the presentation of genetic modification in abstract, non-contextualized terms versus specific applications of this technology (i.e., in the context of specific products with defined attributes). This is not surprising, since consumers have yet to directly receive any benefit from agricultural biotechnology. To date, tangible benefits of this technology have accrued to the producers via enhanced input traits such as lower production cost due to greater pest resistance (and, hence, reduced pesticide use), herbicide resistance, drought tolerance, and higher yield (Riley and Hoffman 1999). Specific examples include GM corn containing the Bt (*Bacillus thuringiensis*) pesticide, channel catfish with greater resistance to enteric septicemia, and salmon that grow more rapidly (and are thus less expensive to raise) than their non-GM counterparts (Pew Initiative on Food and Biotechnology 2001).

The “second wave” of food biotechnology promises to bring enhanced output traits or benefits valued by end users. Examples range from more drought-tolerant turf grass to crops with greater nutritional value, cow’s milk with reduced lactose, and even crop- or livestock-based vaccines or hormones. A notable and often-cited GM food that was unsuccessfully presented to consumers is the *Flav Savr* tomato developed by Calgene, Inc. Marketed in 1994, the tomato was bioengineered to ripen longer on the vine (to yield better flavor) and remain firm longer after harvest.

Some authors (Riley and Hoffman 1999; Adelaja and Schilling 1999; Pew Initiative 2001) note the potential application of biotechnology to develop nutraceuticals or “functional” foods that promote health and wellness. However, consumer acceptance of these bioengineered foods with enhanced attributes is an open question.

Plant versus Animal Genetics

While not resoundingly supportive of the technology, Americans clearly demonstrate greater support for the genetic modification of plants than of animals. While 58 percent of our respondents approve (16 percent strongly) of creating hybrid plants via biotechnology, only 28 percent of them approve (7 percent strongly) of genetic modification of animals (Table 1). Conversely, whereas 22 percent of Americans view genetic modification of plants to be “morally wrong,” the majority (55 percent) find genetic modification of animals to be morally objectionable (Table 2). About 58 percent of Americans believe that biotechnology will improve the

Table 1. Consumer Approval of Genetic Modification of Plants and Animals (%).

	Strongly Approve	Somewhat Approve	Somewhat Disapprove	Strongly Disapprove	No Answer
GM Hybrid Plants	16.0	41.8	18.9	17.7	5.5
GM Hybrid Animals	7.0	20.7	24.7	42.8	4.8

Table 2. Moral Acceptability of Genetic Modification of Plants and Animals (%).

	Morally Wrong	Not Wrong	It Depends	No Answer
GM Hybrid Plants	22.0	70.0	2.5	5.5
GM Hybrid Animals	55.1	36.7	4.0	4.2

quality of life for people. Only 26 percent of Americans believe that this technology makes the quality of their lives worse.

Tangible Benefit versus Abstract Concept

As shown in Figure 1, approval for genetic modification of identifiable plant products with specified

benefits is significantly higher than it is for the abstract concept of plant genetic modification. For example, while only 58 percent of Americans reported approval for plant genetic modification (presented in the abstract), more than three-quarters approve (47 percent strongly) of genetically modified grass that requires less frequent mowing. Figure 2 reveals a similar pattern for animal-based

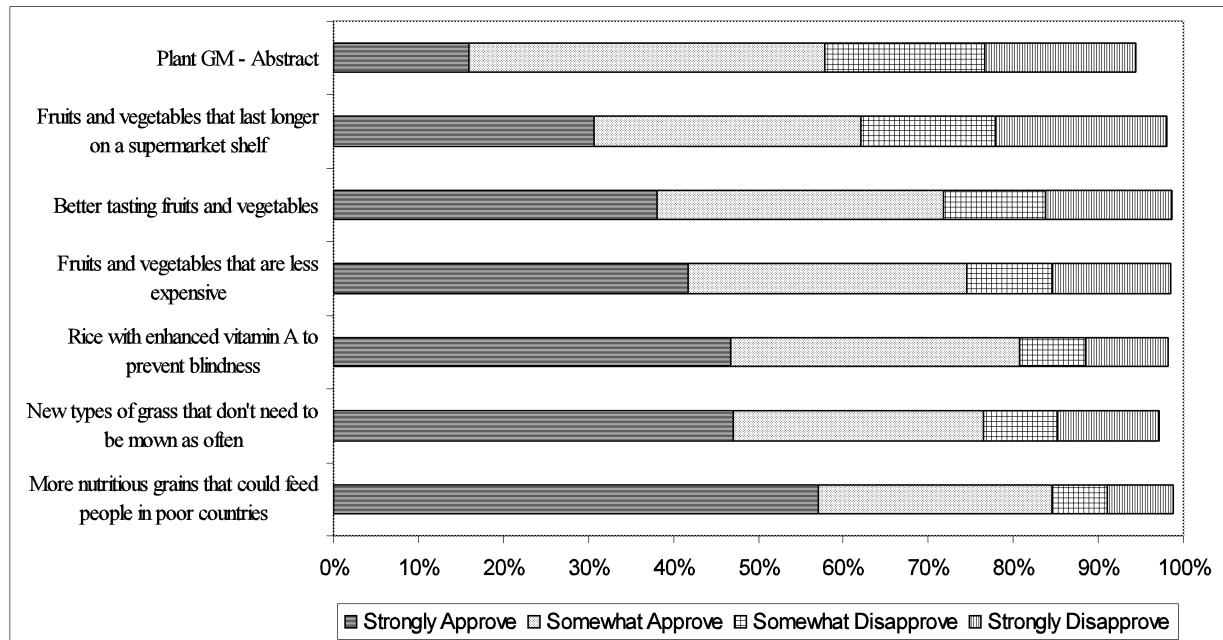


Figure 1. Consumer Approval of Plant Genetics: Tangible Benefits vs. Abstract Concept.

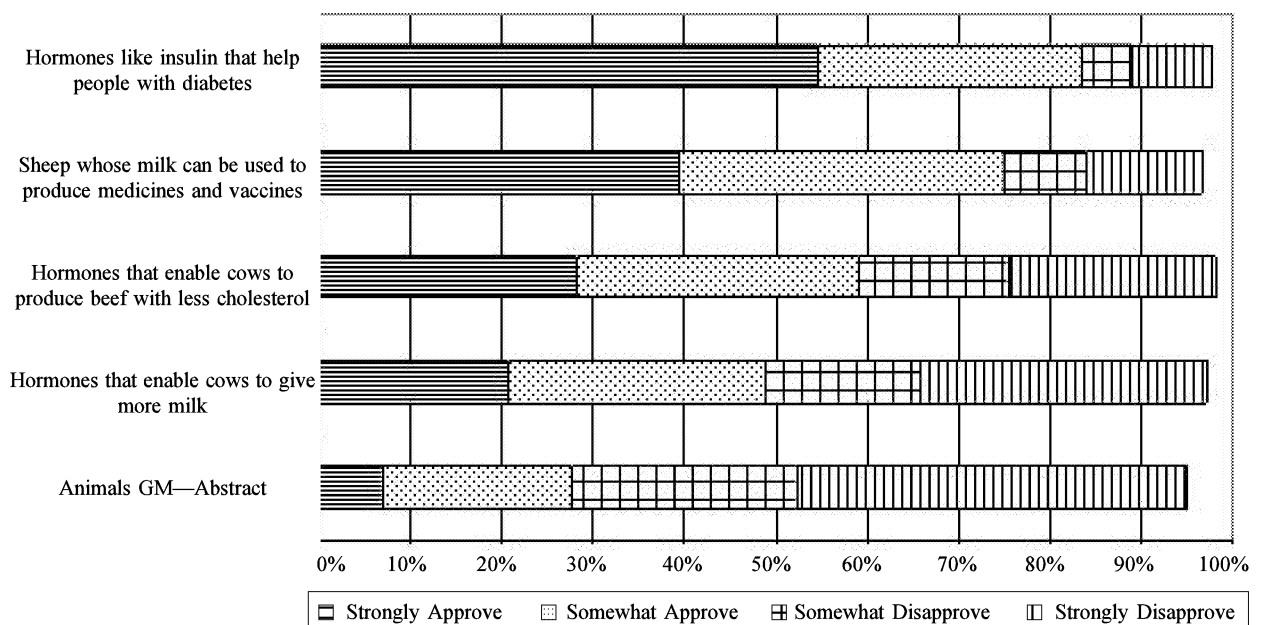


Figure 2. Consumer Approval of Animal Genetics: Tangible Benefits vs. Abstract Concepts.

genetic modification. Whereas only 28 percent of Americans approve of creating genetically modified hybrid animals, 59 percent approve of using genetic modification to create sheep whose milk can be used to produce medicines and vaccines. These findings suggest that a majority of the public does not have an entrenched view about biotechnology. They prefer to see this technology being used for very well-defined purposes, particularly to bring tangible benefits to society.

Conclusions

Proponents of biotechnology argue that in addition to producer benefits, this technology is poised to bring to market new and improved products that will benefit the consumers. Opponents of genetic technology counter that the risks of genetic modification are not fully known and that unintended harm to humans and the environment are possible. As biotechnology continues to make its way into our food system, proper understanding of public perceptions of this technology and acceptance of bioengineered foods is becoming increasingly important.

Genetically modified foods (or food production in general, for that matter) is not a front-runner among issues the typical American tends to think about today. It follows that most Americans have not made any significant effort to learn about the technology or its applications and are thus relatively unaware of its use in food production. When forced to think about genetically modified foods, Americans respond with both optimism and caution. For the majority of Americans with no entrenched viewpoint in favor of or against GM foods, opinions tend to be held with little conviction and are subject to change. Indeed, pinpointing public sentiment on the issue is challenging due to technical reasons (i.e., sensitivity to terminology used and the context within which the technology is pre-

sented.) as well as the fact that viewpoints are uncrystallized and malleable. While the majority of Americans are not inclined to dismiss the potential value of food biotechnology, most are similarly convinced that the full range of potential impacts of genetic modification is not known, and oversight and regulation of GM practices is necessary.

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