

Consumer attitudes toward biotechnology: Lessons for animal-related applications

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ABSTRACT: Newer techniques of biotechnology, such as recombinant DNA, offer scientists a range of tools to enhance the quality and environmental sensitivity of agricultural production. This article briefly summarizes consumer attitudes toward biotechnology in the United States and Europe. Few U.S. consumers have read or heard a lot about biotechnology, and concern about biotechnology was low on the list of concerns of consumers in the United States. When asked to volunteer food-related concerns, only 2% expressed concerns about the safety of foods modified by biotechnology. People supported applications that benefit the environment, with modifications that provided direct consumer benefits, such as increased nutritional value or better taste, endorsed by slightly fewer people. Most consumer research has focused on plant applications of biotechnology; modification of animals is likely to be

more emotionally charged because the majority of U.S. consumers believe that animals have rights that people should not violate. Few European consumers considered themselves knowledgeable about biotechnology. Knowledge of basic biology seemed to be lacking, putting people at risk for misinformation. Fifty-eight percent or more of Europeans believed that genetically modified plants were fundamentally different from traditional plants and believed their own genetic material would change if they consumed genetically modified food. Communication programs in Europe are challenging because government and industry sources were trusted by few consumers. Experience in the United States indicates that communication can change attitudes. Frequent and effective communication that highlights potential benefits and addresses public concerns is a prerequisite for increasing public acceptance.

Key Words: Biotechnology, Consumer Attitudes, Genetic Engineering

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Introduction

Modern biotechnology can be applied in a broad range of areas, offering advantages to producers, the environment, and human health (Institute of Food Technologists, 2000). Farmers can benefit from increased yields on the same acreage, decreased production costs, less exposure to pesticides and herbicides, and the potential to practice reduced till production (Phipps and Park, 2002; Fawcett and Towry, 2002). Plant breeders have used rDNA technology to develop corn that is nutritionally more dense and easier for animals to digest (Mazur et al., 1999). Consumers could benefit from foods with improved nutritional characteristics, lower levels of natural toxins and increased quality (Gura, 1999; Dowd et al., 1999). In the future, people with allergies may find the proteins that trigger allergic reac-

tions have been removed, allowing consumption of previously prohibited foods (Institute of Food Technologists, 2000). Scientists are also developing feed with lower levels of phytate: this has environmental ramifications because it will reduce phosphorus, nitrogen, and odor from animal waste (Mazur et al., 1999). Additionally, scientists have been able to modify pig saliva to more thoroughly digest nutrients (Golovan et al., 2001). Plants have been developed that remove high levels of salt from the land, thus opening the potential for bioremediation (Zhang and Blumwald, 2001). Because of these potential benefits, producers are planting crops modified by biotechnology and researchers in the corporate and university settings continue to develop new applications. As with any change, however, negative consequences may occur. Palumbi (2001) points out that technology may affect evolutionary change at a cost to society of \$30 to \$50 billion per year. Consumers may view the changes from agricultural applications of biotechnology in food production in a positive or negative light. This paper briefly reviews U.S. and European consumer attitudes toward applications of biotechnology.

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Attitudes Among Consumers in the United States

Scientifically designed consumer telephone surveys conducted for industry, education, and public interest organizations by professional research groups and universities provide a consistent picture of U.S. consumer's knowledge and attitudes toward this technology. In one survey, only 9% of consumers indicated that they have read or heard a lot about biotechnology, with an additional 30% indicating that they have read or heard some and a further 33% indicating they have read or heard a little about biotechnology (Cogent Research, 2002). Only 35% of consumers recognized that foods modified by biotechnology are currently in the supermarket.

Most U.S. consumers have a positive attitude toward biotechnology when they hear the benefits this technology can provide. In telephone interviews conducted with a nationally representative sample of 1,000 adults, only 37% considered genetically engineered food acceptable; however, when the purpose of genetic modification was included, such as raising crops that are resistant to pests or less costly to grow, acceptance increased to between 60% and 70%, respectively (Princeton Survey Research Associates, 2002). Similarly, 71% of consumers indicated they would purchase produce modified by biotechnology to reduce pesticide use, and 54% said they would purchase products modified for better taste in another 1,000-person nationwide telephone survey (Cogent Research, 2002). Furthermore, 61% believed biotech will provide benefits for themselves and their family within the next 5 yr (Cogent Research, 2002).

Modifications by biotechnology were seen as risky by few U.S. consumers. When asked in an open-ended question about food safety concerns, only 2% volunteered concerns about genetically modified food (Cogent Research, 2002). In contrast, concerns about foodborne disease and safe handling were mentioned by 41% and 42%, respectively. Others found that the public considered specific environmental risks from genetic modification important. When asked whether a series of risks were very, somewhat, or not at all important, the potential for genetic material introduced through this newer method to contaminate traditional plants was considered a very important risk by 64% of consumers (Pew Initiative, 2002). Other potential risks and the percentage of consumers considering the risk very important included the potential to create superweeds (57%), to develop pesticide-resistant insects (57%), to reduce genetic diversity (49%) and the potential that modified plants could harm others (48%).

The percentage of consumers holding a positive view toward biotechnology decreased in the 5 yr preceding the writing of this article. In 2002, 61% of consumers responded that they expect to receive personal benefits from biotechnology, whereas, in 1997, 78% held that view (Cogent Research, 2002). Similarly, 71% of consumers in 2002 indicated they would purchase products

modified to reduce pesticide use, but, in 1997, 77% said they would buy these products.

This attitude change could have resulted from media coverage of biotechnology that focused on unanticipated and uncontrolled potential risks. The Center for Media and Public Affairs analyzed coverage of biotechnology in national television news programs, newspapers, news wires, magazines, local television news, and talk shows in 1997, 1999, and 2001. Coverage increased from less than 1% of articles in 1997 to 6% in 1999 and 12% in 2001. A content analysis of articles in 1999 found claims of harm were described in 70% of the articles, whereas discussions of benefits were only in 30% of the stories (International Food Information Center, 2000). Discussion of harm focused on environmental or human health, whereas benefits were generally limited to increased production. This is not likely to be an important benefit to consumers where food is available in abundance. In 2001, articles on Starlink corn represented 73% of articles on biotechnology, while the ability to detect biotechnology components was the focus of 11% of the articles and labeling of biotechnology foods was discussed in 10% of the articles (International Food Information Center, 2002). Negative comments exceeded benefits by an 8:1 ratio. Although Starlink corn led to no known human illness, the potential for an allergic response was frequently mentioned. Furthermore, the presence of Starlink in human food illustrated that modified plant products approved for animal but not human use could be in a wide variety of human foods.

Many consumers valued potential benefits made possible by biotechnology. When specific benefits were identified, 74% ranked cleaning toxic pollutants as very important (Pew Initiative, 2002). Other potential benefits and the percentage of consumers considering the benefit very important included reducing soil erosion, 73%; using less fertilizer, 72%; developing drought-resistant plants, 68%; developing disease-resistant trees, 67%; and using less pesticide, 61%.

Few consumer studies have focused on animal applications of biotechnology. Early work found that 80% of consumers believed animals have rights that people should not violate (Hoban and Kendall, 1993). Unfortunately, the researchers did not explore the nature of these rights. Consumers may have little knowledge as to how animals are currently produced and handled. When specifically asked, fewer than 40% of consumers indicated support for traditional crossbreeding practices. In contrast, when asked about the techniques of biotechnology in conjunction with specific benefits, over 40% expressed support for using biotechnology to produce leaner meat, and over 50% supported the use of biotechnology to enhance animal disease resistance.

Sociologist Thomas Hoban has speculated that a number of factors will make consumer response to animal applications of biotechnology more sensitive than response to plant applications (personal communication, January 2003, slide set). The emotional bonds peo-

ple have with companion animals and the popularity of animal cartoon characters has led people to anthropomorphize animals. Furthermore, although plants are not mobile—yet pollen is airborne—modified animals may accidentally escape from captivity and modify wild species. People may also be concerned that once scientists were able to modify animals, humans will be next. These considerations suggest that public acceptance of animal modifications will be strongly influenced by the importance of the benefits from modification and the ability to control and contain the introduced trait.

People who strive to influence government policy have called for mandatory labeling of foods or ingredients that result from genetic modification (Nestle, 1998). Some advocate labeling so that consumers can choose or avoid products produced by this technology; others argue that labeling is essential for consumers to know what they are selecting. Focus groups held by the United States Food and Drug Administration found that some consumers are concerned that they have unknowingly consumed genetically modified foods, whereas consumers in other focus groups said the widespread use of modified corn and soy products with no known ill effect was comforting (Levey and Derby, 2001; Teisl et al., 2002). Although the mandatory labeling of any food or ingredient modified by biotechnology was an important consideration among some consumers in focus groups (Levey and Derby, 2001; Teils et al., 2002), focus group findings represent the attitudes of participants and not necessarily the attitudes of the population (Krueger, 1994). Survey findings from a statistically representative sample of U.S. consumers indicated that mandatory labeling was not a high priority among U.S. consumers. When asked whether there was information not currently on a food label they would like to see, 76% responded “No.” Of those who wanted additional information, most cited nutritional information, with only 1% asking for information on genetic engineering (Cogent Research, 2002). When asked on another survey to select one item from a list of potential label additions, 17% chose labeling concerning whether the product was genetically altered; 33%, concerning whether pesticides were used in production; and 8%, whether the product was imported; 16% responded that they needed no additional information, and 15% said they did not know (Bruskin Research, 2001).

Attitude studies indicate that mandatory labeling may mislead consumers into thinking there is a significant difference between the biotechnologically modified and traditional food. In a survey sponsored by the Center for Science in the Public Interest, consumer perception of the safety of food was affected by including a term related to gene or biotechnology. If a label on a loaf of bread included the statement “contains genes from wheat,” 15% of consumers considered the bread not as safe as bread without such a statement and 35% did not know about the bread safety (Bruskin Research, 2001). If the loaf of bread included the statement “contains genetically engineered wheat,” 31% considered

the bread not as safe as one without this statement and 28% did not know. Response to the terms *biotechnology* and *genetic engineered* was comparable; however, the terms had been used interchangeably throughout the survey. When a benefit for modification was provided, “contains genetically engineered wheat—reduces pesticide use,” 21% considered the engineered product safer than a product without such a label, 28% considered it not as safe, and 22% indicated they did not know. Few consumers indicated they would be willing to pay more for labeling of genetically modified food, with 44% saying they would pay nothing more.

Most consumers (59%) support the U.S. Food and Drug Administration position that mandates labeling if an allergen is introduced into the food or if the food changes in nutritional value, composition, or safety (Cogent Research, 2002). A proposition requiring mandatory labeling on food and ingredients modified by genetic engineering was rejected by 73% of Oregon voters (Monsanto, 2002). That this labeling would provide no new useful information to consumers and would be costly to implement were believed to be major factors contributing to the defeat of the measure.

Attitudes Among Consumers in Europe

Attitudes among European consumers have been polled periodically by the Directorate-General for Education and Cultures’ “Citizens’ Center” as requested by the European Commission’s Directorate-General for Research. The study was carried out in every country of the European Union between November and December of the year prior to the publication date. Few Europeans (11%) considered themselves informed about biotechnology (INRA, 2000). Questions related to facts of biology indicate that basic knowledge was lacking among the general population. In 1999, only 34% of European consumers correctly responded that genetically modified animals are not always larger than conventional animals. Only 35% responded that the following statement is false: “ordinary tomatoes do not contain genes while genetically modified tomatoes do” (INRA, 2000). Furthermore, only 42% recognized that eating genetically modified fruit does not change your personal genes, with 24% believing human genes would be changed, and the remaining uncertain. For comparison, 46% of U.S. consumers recognized that ordinary tomatoes also contain genes and 62% knew that eating genetically engineered fruit did not change a person’s genes (Hoban, 1998). European consumer response to these questions in 1996 and 1999 was similar, except for the question on change in personal genetic codes, where more consumers responded correctly in 1996 (48%) compared to 1999 (42%) (INRA, 2000). When basic knowledge is lacking and the belief persists that the consumption of modified fruit can change human genetic material, it is no wonder that European consumers are concerned about potential risks associated with eating genetically modified food.

Only about half of European consumers were aware of biotechnology's many applications (INRA, 2000). Slightly over half, 56%, were aware that genetic modification could be used to make plants resistant to insect attack. About half were aware that these tools could be used to detect diseases or prepare human or animal medications. Only 28% knew that biotechnology could be used to clean toxic spills.

When asked to rate on a scale of 1 to 4 whether an application was useful, risky, or should be encouraged, the applications considered most useful were cleaning toxic spills, rated 3.24; using genetic material to detect disease, 3.4; and preparing human medicines 3.27 (INRA, 2000). The applications considered most risky were food production, 3.0, and the cloning of animals to produce medicines and vaccines, 2.92. Those applications European consumers felt should be encouraged were cleaning of toxic spills, 3.17; cloning animals whose milk can be used to produce medicines, 3.01; and detecting hereditary diseases, 3.01. Production of foods received a rating of 2.19.

Although some may interpret the relatively low score for food applications as meaning Europeans are not supportive of food applications, an examination of the question consumers were asked indicates that another interpretation is possible. Benefits of the genetic modification of food were described as "to give them a higher protein content, to keep them longer, or to change the taste." These benefits may not be very appealing to European consumers. Food applications that offer more compelling benefits may be better received.

Both food and nonfood applications of biotechnology were viewed as having some degree of risk. Even an application perceived as risky, such as cloning animals, received a high rating for "should be encouraged," 3.01 out of 4, because of the potential benefit. This suggests that Europeans may accept changes from biotechnology if the benefits were viewed as important.

When asked who is doing a good job in the area of genetic modification, most European consumers supported the work of consumer organizations, 70%; followed by newspapers, 59%; and environmental organizations, 58% (INRA, 2000). The same study showed that the government and the food industry were considered to be doing a good job by only 45% and 30%, respectively. Similarly, few European consumers, 3% to 4%, indicated that they trusted information from international or national public authorities, respectively. Consumers expressed the greatest trust in information from consumer organizations, 26%, and medical professionals, 24%.

Attitude Change

People can change their attitudes in response to information from a credible source. Trusted information sources are described as knowledgeable, concerned with public welfare, truthful, and with a "good track record." Less-credible sources are characterized by exaggera-

tion, distortion, and vested interest (Frewer, et al., 1996). Consumers in the United States considered health authorities, such as the American Medical Association or the American Dietetic Association, as the most credible, followed by university scientists and regulatory groups like the FDA (Hoban, 1994).

Many groups are involved in education in the United States. An industry organization has funded television advertisements that address the benefits of this technology. Professional societies, such as the American Dietetic Association and the Institute of Food Technologists, have prepared material for their members, the media, regulators, and the public. Universities and colleges also have outreach programs to keep the public informed about new developments.

Consumer surveys taken following outreach programs show increased recognition that biotechnology can be used to reduce pesticides, produce healthier foods, produce hardier crops, and develop new medicines. For example, a brief video describing the potential risks and benefits of biotechnology followed by an open discussion presented to community organizations found an increased recognition that biotechnology offers society both risks and benefits (Bruhn and Mason, 2002). The majority of those participating in the program felt that society would benefit from the applications that this technology could provide.

The biotechnology industry's monitoring of consumer response to television advertisements that describe some of the beneficial applications of this technology found that 1 in 10 consumers could describe a food- or crop-related benefit. Tracking attitudes from March 2000 to July 2002 found that the consumer awareness that biotechnology could be used for various applications increased. Agreement that biotechnology allowed farmers to grow more food to feed the world's population increased from 61% to 70% (Council for Biotechnology, 2001). Agreement that biotechnology could be used to develop hardier crops that are able to grow in poor conditions, such as drought, increased from 58% to 65%. Similarly, recognition that biotechnology could be used to develop healthier foods, such as foods that are lower in fats or higher in nutrients increased from 45% to 54%. Recognition that biotechnology could be used to reduce the need for chemical pesticides increased from 42% to 48% (Council for Biotechnology, 2001).

Implications

The key to consumer acceptance of modifications by biotechnology directed toward plant or animal application is perceived risk and benefit. These studies indicate that consumers expect human, animal, and environmental safety to be protected. The studies discussed indicate that consumer attitudes are more likely to be positive when people understand why animals or plants are modified, they view the potential benefit as important, and neither the animal nor the environment is harmed. Although consumers in the United States

have positive attitudes, few are aware of all of the potential applications under development. European consumers are less aware, and many do not trust regulators or the food industry. Discussions with community leaders provide an opportunity to respond to consumer concerns and address both risks and benefits. Advertisements can increase public awareness of potential benefits. Messages that highlight potential benefits, address consumer concern, and are delivered by trusted, knowledgeable sources are critical to long-term acceptance.

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