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To be successful both domestically and internationally, biotechnology must establish an acceptable position in the sociopolitical framework. This United States (US) study assessed levels of awareness and acceptance of biotechnology issues among youth (*n* = 283), undergraduate students (*n* = 330), and adults (*n* = 166). The percentage of adults who were aware of how biotechnology would affect food, health, and the environment was almost three times that of youth respondents. It was concluded that consumer groups would most likely be impacted by accurate, unbiased agricultural biotechnology information delivered through the Internet and newspapers that originates from reliable, accessible, and science-based sources.

Key words: adolescents, adult, biotechnology, consumer, genetically modified, GM, undergraduates, youth.

Producers and consumers view the potential of genetically modified (GM) crops from different perspectives. From the producers' perspective, an increase in acceptance has resulted in increased production of GM crops. For example, between 1995 and 2001, the share of US soybean, cotton, and corn acreage planted to GM varieties increased from a negligible amount to over 70% for soybeans, 56% for cotton, and 26% for corn (Huffman, Rousu, Shogren, & Tegene, 2003). According to another report by industry-backed International Service for the Acquisition of Agri-Biotech applications (2003), seven million farmers in 18 countries grew GM crops on 167.2 million acres in 2003, compared with six million farmers in 16 countries on 145.2 million acres in 2002, for an approximate increase of 22 million acres.

From the consumer perspective, domestic and international studies of consumer acceptance reveal a mismatch of acceptance with production. This mismatch potentially threatens the future of agricultural biotechnology and limits options for addressing world food shortages.

Awareness

Globally, biotechnology awareness seems to be highest among consumers in the United States, Canada, and Western Europe and lowest in Southeast Asia, Asia, and Latin America (McCann-Erickson, 2000). At least one study showed that general awareness of biotechnology by European consumers has not increased, but public trust of biotechnological information sources has decreased significantly (European Commission, 2000). However, a recent survey on European agricultural biotechnology views revealed that the percentage of Europeans who reported that they were hearing from both sides equally (opponents and proponents) increased since 2001 (KRC Research, 2003). As indicated in a 2002 report by Agricultural Biotechnological Europe, 48% in the "Big Five" European countries (Germany, France, UK, Italy, and Spain) said that they had heard a "lot" or "some" about biotechnology (KRC Research, 2003). The awareness was highest in Germany (63%) and lowest in Spain (34%).

Several official reports on public opinion and perceptions published in the recent years suggest that US consumers have fewer concerns about GM food than European consumers (Sittenfeld & Espinoza, 2002). Most Americans, however, are not aware of the extent to which biotechnology has already become part of their food supply. In a US-based Gallup poll (2001), researchers concluded that the growing use of GM food had yet to ignite public interest or concern. A Harris poll of 1,015 consumers found only one in seven, or 15%, of adults have taken much interest in the GM food issue (Taylor, 2000).

Consumer acceptance is hindered by limited understanding of modern agricultural practices and the science involved in biotechnology (Falk et al., 2002). Research has shown that if knowledge or experience with a topic is low, it was possible for people to base their perceptions on already-present global attitudes toward the topic (Sanbonmatsu & Fazio, 1990). Ad-

ditionally, research by Schoell and Guiltinan (1995) concluded that consumers' perceptions and attitudes are influenced by friends, family, class, and their culture. Consequently, prevailing cultural attitudes may influence those consumers who have limited understanding of biotechnology.

These cultural attitudes can be articulated by a number of individuals and groups. Hoban (2001) found that consumers in the United States and Japan put the highest trust in independent health and scientific experts. A 2001 study of Americans' sources of specific scientific information (such as global warming or biotechnology) indicated that about 44% of the respondents cited the Internet as their main source and 24% cited books or other printed material. Other sources (magazines, television, newspapers, etc.) remained below 10% (National Science Foundation, 2002). For those US consumers who rely on newspapers as their primary media source, research indicates that biotechnology-related stories frequently may be written by journalists who perceive their levels of scientific knowledge to be higher than assessments indicate (Vestal & Briers, 1999). An inherent danger exists in that journalists lacking adequate knowledge about biotechnology processes may produce media that is biased, yet those media sources can play a role in public agenda-setting, as shown by Marks and Kalaitzandonakes (2001).

Acceptance

Both GM crops and GM foods are better supported in the United States than in Europe. However, the same does not hold true for biotechnology in general. It has been found that although people in the United States are more supportive of GM crops and GM foods, people in Europe are more supportive of genetic testing (Gaskell, Bauer, Durant, & Allum, 1999). Additionally, even though European sentiment towards GM crops is predominantly negative, there is diversity of opinion among consumers in individual European countries. For example, consumer interviews in 1997 and 1999 in Denmark, Germany, the United Kingdom, and Italy determined that preferences for GM products was generally low, but more so in Denmark and Germany than in the UK and Italy (Bredahl, 2001).

In a US-based Gallup poll (August 2001), researchers found that few Americans had heard about biotechnology issues, and only 30% felt that GM foods posed a serious health hazard to consumers. Nearly four in ten (38%) said they opposed GM foods, and a slight majority (52%) supported the use of biotechnology in agricultural and food products.

In a recent Purdue University study, Lusk found that consumers might be willing to pay more for a GM food if they perceive direct personal benefits from the product. For this to occur, Lusk contended that the focus of biotechnological information has to shift towards communicating the potential benefits of the GM food from the consumer's point view rather than just from the producer's point of view (Lusk, 2003).

Most of the studies in GM awareness and acceptance have focused on adult consumers despite youth comprising a significant consumer segment. For example, a survey by Teenage Research Unlimited revealed that in the year 1988, as many as 9 out of 10 teenagers (males and females) shopped for themselves or their families spending $47.7 billion annually on groceries and household products (Blumenthal, 1990). More recently, Catlett (2004) reported that children between the ages of 11 and 13 directly spent $158 billion in 2002. Adolescents' food purchasing habits may have an immediate and long-term effect on the future of GM food. Therefore, it is important to compare the awareness and acceptance of biotechnology across age groups (youth/ adolescents, undergraduate students, and adults).

Purpose of the Study

The purpose of this study was to assess levels of awareness and acceptance of biotechnology issues among youth, undergraduate students, and adults by: (a) comparing adult and youth respondent groups' awareness levels of biotechnology affects on food, health, or environment; (b) comparing media sources utilized by adults and undergraduates to form perceptions about biotechnology issues; (c) comparing acceptance levels (perceptions) of biotechnology practices among adult, youth, and undergraduates; (d) comparing perceptions of youth, undergraduates, and adults towards biotechnology issues; and (e) exploring the relationship between awareness and acceptance of biotechnology practices for adults and youth respondent groups.

Methods

Procedures

Measurement of awareness and acceptance levels for all three respondent groups was accomplished through the use of modified versions of the instrument *Metro News Journalists' Perceptions of Food Biotechnology* (Vestal & Briers, 1999). The instrument was derived from the work of Duhe, Barton, and the North Carolina Nationwide Survey on Biotechnology (as cited in Vestal & Briers, 1999).[1]

Table 1. Comparison of acceptance of genetic modification in selected organisms by adult, youth, and undergraduate student response groups.

	Adult *n* = 140		Youth *n* = 279		Undergraduates *n* = 330		Total *N* = 749		
GM acceptance levels	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***F***
Microorganisms	2.17^{b}	0.79	2.17^{a}	0.83	1.93^{ab}	0.79	2.06	0.81	8.49*
Landscape/forest plants	2.07^{b}	0.79	2.14^{a}	0.88	1.72^{ab}	0.79	1.94	0.84	21.01*
Food crops	2.06^{b}	0.82	2.09^{a}	0.84	1.72^{ab}	0.78	1.92	0.83	17.51*
Animals	2.46	0.86	2.43	0.94	2.40	0.99	2.42	0.94	0.27
Humans	3.00^{c}	0.94	2.67^{ac}	1.01	3.16^{a}	0.98	2.95	1.01	18.06*

Note. 1 = highly acceptable, 2 = somewhat acceptable, 3 = somewhat unacceptable, 4 = highly unacceptable.

** $p < .05$.*

[a] Denotes significant difference between youth and undergraduate students as a result of Tukey Post Hoc tests.

[b] Denotes significant difference between adults and undergraduate students as a result of Tukey Post Hoc tests.

[c] Denotes significant difference between adults and youth as a result of Tukey Post Hoc tests.

Population and Sample

The youth population ($n = 283$) included students enrolled in biology classes at local high schools from the Lincoln and Omaha, Nebraska areas. Undergraduate responses ($n = 330$) were gathered from agricultural communications students at 11 land-grant universities in 10 states. These included Clemson University, Oklahoma State University, Texas A&M University, Michigan State University, Western Illinois University, Kansas State University, Washington State University, and Texas Tech University (Wingenbach, Rutherford, & Dunsford, 2003).

Undergraduate respondents represented six majors. Specific areas of self-reported majors included those in agricultural education (79 or 23.9%), other colleges of agriculture majors including poultry, forestry, food sciences, or agribusiness/agricultural economics (78 or 23.6%), agricultural communications (66 or 20%), liberal arts (52 or 15.8%), animal science (29 or 8.8%), and health-related fields (18 or 5.5%). Three (0.9%) respondents were undecided about their major.

Adult respondents ($n = 166$) for this study mainly represented five categories of professions from Colorado and Nebraska. Adult respondents described their occupational responsibilities as school administrator (4.2% or 7), 7–12 grade educator (15.1% or 25), 9–12 grade educator (6% or 10), extension educator (44% or 73), and dietician (1.8% or 3). Thirty-seven did not specify their professions.

[1] *The authors used a paper survey for this study. A web-based version of the survey instrument (in this instance used to survey Texas journalists) is available at* http://www.ag-communicators.org/surveys/btmedia.asp

Results

Awareness Levels

The percentage of adults (49 or 34.5%) who were reportedly aware of how biotechnology would affect food, health, and environment was almost three times (proportionally) that of youth respondents (35 or 12.9%). A chi-square comparison ($df = 2$, $\chi 2 = 39.27$, $p < .000$) indicated this difference was significant. However, there emerged little difference in the percentage of adult (77 or 54.2%) and youth (145 or 53.5%) respondents who felt that they were only somewhat aware of affects of biotechnology on food, health, and environment. Finally, the percentage of youth (91 or 33.6%) who were reportedly not aware of how biotechnology would affect food, health, and environment was three times that of adults (16 or 11.3%).

Acceptance Levels

Tukey Post Hoc tests indicated a statistically significant difference between the mean responses of youth ($M = 2.17$) and undergraduate students ($M = 1.93$), and between adults ($M = 2.17$) and undergraduate students, regarding their acceptance level of genetic modification of microorganisms. However, the means were within the same scale range (1.50–2.49) and therefore not practically significant (Table 1). The same was true for the responses to acceptance levels of genetic modification of landscape/forest plants, food crops, and humans. The respondents from all three groups were somewhat accepting of genetic modification of food crops ($M = 1.92$)

Table 2. Comparison of levels of importance placed on biotechnology research by adults, youth, and undergraduate students.

	Adult *n* = 131		Youth *n* = 272		Undergraduates *n* = 317		Total *N* = 720		
Research importance levels	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***F***
Reduction of pesticides	2.00[c]	0.75	2.34[ac]	0.72	1.85[a]	0.77	2.06	0.78	32.17*
Benefits to environment	1.85[b]	0.75	1.92[a]	0.79	1.45[ab]	0.63	1.70	0.75	34.67*
Control of released genes	1.97[c]	0.85	2.33[ac]	0.81	1.98[a]	0.83	2.11	0.84	15.90*
Safer foods	1.87[b]	0.76	1.87[a]	0.79	1.55[ab]	0.69	1.73	0.76	17.08*
Harming the environment	1.82[b]	0.79	1.90[a]	0.92	1.51[ab]	0.73	1.71	0.83	17.37*
Additional nutritional value	1.97[c]	0.77	2.32[ac]	0.78	1.90[a]	0.74	2.07	0.78	24.13*

Note. 1 = extremely important to 4 = not at all important.

** p < .05.*

[a] *Denotes significant difference between youth and undergraduate students as a result of Tukey Post Hoc tests.*

[b] *Denotes significant difference between adults and undergraduate students as a result of Tukey Post Hoc tests.*

[c] *Denotes significant difference between adults and youth as a result of Tukey Post Hoc tests.*

followed by that of landscape/forest plants (*M* = 1.94), microorganisms (*M* = 2.06), and animals (*M* = 2.42). They were somewhat unaccepting of genetic modification of humans (*M* = 2.95; Table 1).

Importance Levels

Statistically significant differences were observed between the mean responses of youth (*M* = 2.34) and undergraduate students (*M* = 1.85), and between adults (*M* = 2.00) and youth (*M* = 2.34), regarding the level of importance placed on biotechnology research on reduction of pesticides (Table 2). However, the difference was not significant in practical terms. The same was true for biotechnology research on control of released genes and for additional nutritional value. Further, though the difference between the mean responses of adults (*M* = 1.87), undergraduate students (*M* = 1.55), and youth (*M* = 1.87) regarding the importance of biotechnology research on safer food was statistically significant, there existed no practical significance. The same could be said for the importance of biotechnology research on harming the environment (Table 2). A statistically significant difference was observed between the mean responses of adults (*M* = 1.85), undergraduate students (*M* = 1.45), and youth (*M* = 1.92) regarding the importance of biotechnology research on benefits to environment (Table 2).

Information Sources

Newspapers emerged as the most popular media source utilized by both adults (73.8% or 104) and undergraduates (76.7% or 253) for information on biotechnology

Table 3. Comparison of media sources utilized to learn about biotechnology by adults and undergraduates.

	Age group				
	Adults *n* = 141		Undergraduates *n* = 330		Total *N* = 471
Media sources used	**Freq.**	**%**	**Freq.**	**%**	**Total**
Newspaper	104	73.76	253	76.67	357
Scientific journals	57	40.42	107	32.42	164
Technical publications	66	46.81	57	17.27	123
Popular magazines	64	45.39	144	43.64	144
Internet	83	58.86	192	58.18	275

(Table 3). The Internet was cited as another important source by 58.9% (83) of adults and 58.2% (192) of the undergraduates in the study. Popular magazines emerged as yet another important source with a little less than one half of the adult (64 or 45.4%) and undergraduate respondents (144 or 43.6%) relying on them for information (Table 3). Technical publications were a common source of information for adults, with nearly one half (66 or 46.8%) of the respondents relying on them. However, only about 17.3% (57) of the undergraduate students cited technical publications as their source of information. Additionally, use of scientific journals was reported relatively higher for adult respondents (57 or 40.4 %) than for undergraduates (107 or 32.4%; Table 3).

There emerged statistically significant differences in mean responses between youth and undergraduates

Table 4. Comparison of the level of faith in statements about biotechnology made by various spokespersons between youth and undergraduate respondent groups.

	Youth *n* = 274		Undergraduates *n* = 327		Total *N* = 601		
Faith in statements	***M***	***SD***	***M***	***SD***	***M***	***SD***	***t***
Food companies	2.52	0.66	2.37	0.67	2.44	0.67	2.77*
Biotechnology companies	2.31	0.76	2.19	0.73	2.24	0.74	2.05*
Government agencies	2.53	0.87	2.31	0.76	2.41	0.82	3.28*
Farm groups	2.30	0.71	2.00	0.65	2.14	0.69	5.43*
University scientists	2.04	0.72	1.83	0.68	1.92	0.70	3.71*
Celebrities	3.30	0.83	3.60	0.64	3.46	0.75	-5.05*

Note. 1 = very high, 2 = high, 3 = low, 4 = very low.
** $p < .05$.*

Table 5. Comparison of obstacles to acceptance for using biotechnology in food production by adults and youth respondent groups.

	Adults *n* = 137		Youth *n* = 278		Total *N* = 415		
Obstacles	***M***	***SD***	***M***	***SD***	***M***	***SD***	***t***
Religious/ethical concern	3.16	1.27	3.10	1.23	3.12	1.24	0.50
Fear of genes moving unchecked	2.72	1.10	3.00	1.03	2.91	1.06	-2.62*
Fear of food safety	2.85	1.05	2.63	1.00	2.70	1.03	2.12*
Fear of environmental harm	2.76	1.13	2.56	1.06	2.63	1.08	1.77

Note. 1 = very high, 2 = high, 3 = neutral, 4 = low, 5 = very low.
** $p < .05$.*

regarding faith in statements made by different spokespersons. However, there existed no practical significant differences between all responses except for those made about faith in statements by celebrities. Even though both youth ($M = 3.30$) and undergraduate students ($M = 3.60$) had the least faith in statements made by celebrities, undergraduates were more skeptical (very low) of those statements than were youth (low). Responses from both youth ($M = 2.04$) and undergraduate respondent ($M = 1.83$) groups indicated that they had highest faith in the statements about biotechnology issues made by university scientists (Table 4).

Obstacles

Both adult ($M = 3.16$) and youth ($M = 3.10$) respondent groups considered religious/ethical concerns as the least important obstacle to their acceptance of biotechnology production (Table 5). There was a statistically significant difference in the mean responses of adults and youth when considering obstacles regarding fear of genes moving unchecked into the environment ($M = 2.72$, $M = 3.00$, respectively) and fear of food safety ($M = 2.85$, $M = 2.63$, respectively). This difference, however, was not practically significant.

Relationship Between Self-reported Awareness and Acceptance

A statistically significant, positive correlation ($r = .12$–$.29$, $p < .01$) existed between self-reported awareness and acceptance levels for all the biotechnological practices except for those concerned with genetic modification of humans ($r = –0.43$). In the case of humans, there emerged a negative correlation; however, it was not statistically significant.

Implications and Future Research

The self-reported awareness levels of adults were opposite those of youth. Youth were much less aware of how biotechnology will affect food, health, and environment than were adults. Additionally, in this study there was a positive relationship between awareness and acceptance levels of biotechnology. Therefore, it may also be worthwhile to test the biotechnology knowledge levels of respondents to examine relationships between their tested knowledge and acceptance levels of biotechnology.

Both youth and undergraduate respondent groups had a high degree of faith in statements made by university scientists and much less faith in statements made by

celebrities regarding biotechnological issues. This was consistent with Hoban's (2001) study that indicated consumers in the United States and Japan put the highest trust in independent health and scientific experts.

A large number of respondents (both adults and undergraduates) cited newspapers and the Internet as sources for learning about biotechnology. This finding is similar to findings of a 2002 study by the National Science Foundation. An opportunity exists to capitalize on the high degree of faith in university scientists and the frequent use of newspapers and Internet for biotechnology information. Perhaps credible information from university scientists available to consumers on the Internet has the potential to impact biotechnology awareness. Further, university scientists providing valid scientific biotechnology reports or briefs to journalists could influence the biotechnology awareness of consumers.

A limitation of the study was that the generalization from the three respondent groups to the general consumer population might be suspect because of the contexts that they represent (agricultural sciences, food sciences, extension education, agricultural communications, etc.). Indeed, the warnings of Fischhoff and Fischhoff (2001) that "there can be no simple description of the public's opinion about biotechnology" (p. 155), bears repeating after analyzing the results of this study. Therefore, this study should be replicated with a cross-section of respondents that more closely represents national and international consumers.

Similar to the findings of Sanbonmatsu and Fazio (1990), it was evident in the study that those who reported being not aware, or somewhat aware, still had opinions. It is unclear whether these opinions were shaped by influence from family and friends. Future research should explore the impact or influence of all of these groups on respondents' awareness of biotechnology.

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References

Blumenthal, D. (1990). When teenagers take over the shopping cart. *FDA Consumer*, *24*, 32–36.

Bredahl, L. (2001). Determinants of consumer attitudes and purchase intentions with regards to genetically modified foods: Results of cross-national survey. *Journal of Consumer Policy*, *24*, 23–61.

Catlett, L. (2004, March). *New frontiers that change everything*. Paper presented at Nebraska Governor's Ag Conference, Kearney, NE. Available on the World Wide Web: http://marketjournal.unl.edu/archive/040313.shtml

European Commission. (2000, April 27). *Questions and expectations on biosciences: Commission to promote debate* (Eurobarometer 2000 summary report). Available on the World Wide Web: http://europa.eu.int/comm/resarch/prss/2000/pr2704enann2.html

Falk, M.C., Chassy, B.M., Harlander, S.K., Hoban T.J., McGloughlin, M.N., & Akhlaghi, A.R. (2002). Food biotechnology: Benefits and concerns. *American Society for Nutritional Sciences*, *132*(6), 1384–1390.

Fischhoff, B. & Fischhoff, I. (2001). Publics' opinions about biotechnologies. *AgBioForum*, *4*(3&4), 155–162. Available on the World Wide Web: http://www.agbioforum.org/

Gallup Poll News Service. (2001, August 6). *Biotech food remains fairly obscure to most Americans: Less than a third fear it poses serious health risks*. Available on the World Wide Web: http://www.gallup.com/content/login.aspx?ci=4771

Gaskell, G., Bauer, M.W., Durant, J., & Allum, N.C. (1999). World apart? The reception of genetically modified foods in Europe and the U.S. *Science*, *285*(5426), 384.

Hoban, T. J. (2001, June). *Social acceptance of food biotechnology*. Paper presented at proceeding of the Institute of Food Technologists Annual Meeting, New Orleans, LA. Chicago, IL: Institutes of Food Technologists.

Huffman, W.E., Rousu, M., Shogren, J.S., & Tegene, A. (2003, June–July). *Consumers' resistance to genetically modified foods in high income countries: The role of information in an uncertain environment*. Paper presented at the 2003 International Consortium on Agricultural Biotechnology Research (ICABR), 7th ICABR International Conference on Public goods and Public Policy for Agricultural Biotechnology, Ravello (Italy).

International Service for the Acquisition of Agro-Biotech Applications. (2003). *Preview—global status of commercialized transgenic crops* (ISAAA Briefs no. 30, executive summary). Available on the World Wide Web:

http://www.isaaa.org/kc/CBTNews/press_release/briefs30/es_b30.pdf

KRC Research. (2003). *European views on agricultural biotechnology: An overview of public opinion*. Commissioned by Agricultural Biotechnology Europe. Available on the World Wide Web: http://abeurope.dynamicweb.dk/images/files/Public_opinion_overview_on_biotechnology.pdf

Lusk, J.L. (2003). Effects of cheap talk on consumer willingness-to-pay for golden rice. *American Journal of Agricultural Economics*, *85*(4), 840–856.

Marks, L.A. & Kalaitzandonakes, N. (2001). Mass media communications about agrobiotechnology. *AgBioForum*, *4*(3&4), 199–208. Available on the World Wide Web: http://www.agbioforum.org/

McCann-Erickson WorldGroup. (2000). *Lack of consensus and understanding reveal opportunity for marketers to shape and define biotech debate*. Available on the World Wide Web: http://www.mccann.com/news/pr18.html

National Science Foundation. (2002). *Science and engineering indicators—2002*. Available on the World Wide Web: http://www.nsf.gov/sbe/srs/seind02/c7h.htm

Purdue News. (2003). *Consumers value genetically modified foods that directly benefit them*. Available on the World Wide Web: http://news.uns.purdue.edu/html4ever/031024.Lusk.rice.html

Sanbonmatsu, D. & Fazio, R. (1990). The role of attitudes in memory-based decision making. *Journal of Personality and Social Psychology*, *59*(4), 614–622.

Schoell, W., & Guiltinan, J. (1995). *Marketing: Contemporary concepts and practices* (6th ed.). Englewood, NJ: Prentice Hall.

Sittenfeld, A. & Espinoza, A. (2002). Costa Rica: Revealing data on public perception of GM crops. *Trends in Plant Sciences*, *7*(10), 468–470.

Taylor, H. (2000, June). *Genetically modified foods: An issue waiting to explode?* (Harris Poll #33). Available on the World Wide Web: http://www.harrisinteractive.com/harris_poll/index.asp?PID=96

Vestal T. & Briers, G. (1999, December). Knowledge, attitudes and perceptions of journalists for newspapers in metropolitan markets in the United States regarding food biotechnology. *Proceedings of the 26th Annual National Agricultural Education Research Conference* (pp. 405–419). Orlando, FL. Available on the World Wide Web: http://aaaeonline.ifas.ufl.edu/NAERC/1999/NAERC-99-Table of Contents.html

Wingenbach, G., Rutherford, T., & Dunsford, D. (2003). Selected college students' knowledge and perceptions of biotechnology issues reported in mass media. *Journal of Applied Communications*, *86*(3), 7–23.