Consumer Attitudes Towards Genetically Modified Foods: Development of a Multidimensional Scale

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Abstract

A number of studies have examined consumer attitudes towards the genetic modification of food. This research suggests that consumers develop predispositions across a number of dimensions. However, most studies reported to date have adopted an interview methodology, have used other measures such as attitude towards the brand, or have referred to specific food groups, rather than assess multi-dimensional attitudes towards the issue. Studies using multi-item scales have been rare. There is a need for reliable, valid measurement instruments for assessing consumers' attitude toward genetic modification issues. This paper describes the development of one such scale. After test-retest reliabilities were obtained on an initial pool of 63 items, a 34-item questionnaire was factor analysed using principal components with varimax rotation. This analysis resulted in a final questionnaire containing 16 items measuring five dimensions. These were: Dangers of genetic modification (four items); Knowledge about genetic modification issues (four items); Trust in media information sources (four items); Labeling of food products (two items); and Trust in food information sources (two items). The subscales were found to have acceptable internal reliability, based on Cronbach's alpha.

Keywords: genetic modification, consumer attitudes, scale development

Introduction

The genetic modification and enhancement of food has become a highly politicized issue in most developed nations. It has received considerable attention in the popular press and in the popular scientific literature (e.g. Coghlan, 2001; Kleiner, 2000). Such is the sensitive nature of the issue that some governments have prohibited making public the location of any sites, including farms, where genetically modified foods are being developed or grown, for fear of consumer retribution. Clearly consumers have strong concerns about how genetic modification techniques are applied to the crops we grow and the foods we eat.

Our choice of foods has been generally thought to encompass a variety of influences including personal taste, perceptions of value, functional needs, symbolic interaction, as well as social and cultural factors (Marshall, 1995). There is a growing body of research into consumer attitudes and response toward nutritional information, labeling, and food selection. Researchers have suggested such factors as knowledge, familiarity, source credibility, and a variety of consumer characteristics may all influence consumer response (Li, Miniard and Barone, 2000; Moorman, 1990; Smith, Young and Gibson, 1999; Watson and Wright, 1999).

Despite this interest, academic research studies that address consumer attitudinal responses to genetic modification of food products remain small in number. Some notable exceptions are Bredahl (2001), Bredahl, Grunert and Frewer (1998), Hursti, Magnusson and Algers (2002), Subrahmanyan and Cheng (2000), and Renton and Fortin (2003).

These studies in general suggest that consumers develop predispositions across a number of dimensions. However, research reported to date has adopted an interview methodology (e.g. Hursti, Magnusson and Algers, 2002), has used other measures such as attitude towards the brand or purchase intention (e.g. Renton and Fortin, 2003) or has referred to specific foods (e.g. Bredahl, 2001). Studies using a multi-item scale have been rare (e.g. Subrahmanyan and Cheng, 2000). This situation would suggest the need for reliable, valid measurement instruments for assessing consumers' general attitude toward genetic modification of food. The purpose of this study is to address this need, by identifying issues of concern to consumers, and by developing a survey instrument that can be used to measure multidimensional consumer attitudes toward genetically modified food products.

Background

Genetic modification (GM) involves the deliberate manipulation of genes in order to provide food materials with enhanced features. For example, it has been suggested that certain fruits and vegetables could be modified to contain particular nutrients that improve human resistance to cancer or biological toxins. Other foods might offer increased levels of protein or assist in lowering cholesterol counts (Larson, 1999). However, the major types of gene altering have thus far tended to focus on herbicide tolerance, insect resistance, bacillus thuringiensis (Bt) herbicide resistance, and virus resistance (Papanikolaw, 2000). A growing number of countries are now using such techniques to improve food in a variety of ways.

The production of GM food products is becoming increasingly common (Larson, 1999). Several of the world's biggest companies are investing heavily in GM technology with a view to developing superior products that will enhance their profitability. For example, DuPont, Monsanto, Rhone-Poulenc, and Dow Chemical are just some of the companies continually negotiating agribusiness deals in an effort to position themselves for what they see as the inevitable merging of the food, health, and agriculture industries.

Perceived Problems with Genetically Modified Food and Crops

Few issues generate such an emotive public response as genetic engineering. Although the genetic modification of foods is controversial among consumers, limited research has been undertaken to determine the range and extent of specific objections people may have to its use. Certainly there are perceived physical dangers associated with GM technology but there is also an ethical dimension to the debate over the use of GM to enhance food products that may well be acting as an impediment to the widespread acceptance of GM crops.

Despite the hype, GM is far from being a panacea for crop producers, consumers, and corporations. There are a number of problems that continue to plague the development of the industry. For instance, there have been problems with GM crops spreading into other areas. One media report suggested that Monsanto successfully sued a Canadian farmer for growing GM canola plants on his property without having purchased the seeds from the firm. He

claimed that the seeds had been transported from nearby fields and had become mixed with his own (Coghlan, 2001).

There are also fears that plants with toxic-resistant genes might possibly cross-pollinate with other crops. In one case, a pesticide gene that had only been approved for use in maize for animal feed apparently jumped into a variety of corn grown for human consumption. The gene was later found in foods such as taco shells, resulting in a recall of about 800 different products in the United States (Kleiner, 2000). Such negative reports in the popular science literature continue to drive a negative public perception of GM foods and agricultural products. Monitoring of such public perception requires a valid and reliable measure of consumer attitudes.

Scale Development

In order to develop a valid and reliable measure of consumer attitudes towards genetically modified foods, a four-stage process was followed. The methodology is a modification of the empirical approach outlined by Churchill (1979). As such, it uses a more "traditional" approach to scale development, in contrast to newer techniques such as those developed by Rossiter (2002). In Stage 1, a survey of the literature was undertaken, in order to identify the domain of the construct through identifying issues and concerns that have been identified in previous publications. The 14-item scale previously developed by Subrahmanyan and Cheng (2000) was also incorporated into the pool. This process generated an initial pool of 72 items. In Stage 2, a panel of five independent judges assessed the items for relevance to the issue of GM food. After eliminating items that were not positively assessed by four of the five judges, 63 items remained.

In Stage 3, a sample of 174 respondents completed the questionnaire on two occasions separated by a two-week gap. The questionnaire consisted of the 63 items identified in Stage 2, presented in a seven-point semantic differential format with "Strongly Agree" and "Strongly Disagree" as the bipolar anchors. From this, 163 usable responses were obtained. From this data, test-retest correlations were calculated for each item. This procedure resulted in 34 items that had correlations above 0.50. These items were retained for Stage 4. In Stage 4, a sample of 356 respondents completed the 34-item questionnaire. Of these, 349 usable responses were obtained. These items were factor analysed using principal components with varimax rotation. This factor analysis procedure was repeated three times, each time those items that did not load clearly onto one factor, or comprised a single item factor, were eliminated. This resulted in a final questionnaire containing 16 items.

Table 1. Rotated Factor Matrix and Item Reliability

	I	II	III	IV	V
The use of genetic modification in food is dangerous	**.926**	-*	-	-	-
There will be negative long-term environmental effects of the use of genetically modified crops	**.879**	-	-	-	-
Eating genetically modified food is risky	**.871**	.126	-.142	.112	-
Genetic modification of plants can harm the environment	**.833**	-	.242	.142	-
I am well informed about biotechnology	.112	**.870**	-	-.121	-
I consider myself knowledgeable about genetics and biotechnology	.266	**.790**	-	-	-
I lack knowledge about genetically modified food	.219	**-.710**	-	-.137	.135
I am personally informed about the use of genetic modification in food production	-	**.694**	-	-.316	-
I trust newspapers as a source of information providing advice about food	-	-	**-.813**	-	.110
I trust television news and current affairs as a source of information providing advice about food	-	-.107	**-.785**	-.168	-
I do not trust the information concerning biotechnology provided by mass media sources	.165	-	**.638**	.198	-
It is important to trust those responsible for regulating the risks of genetic modification in food production	-	-.356	**.555**	-.246	.116
I think that genetically modified foods should be clearly labeled as such	.112	-.155	-	**.839**	-
Genetically modified foods should be labeled so that consumers can decide whether or not to buy them	-	-	.248	**.764**	-
I trust the government as a source of information providing advice about food	-.137	-.134	-.241	-.149	**.844**
I trust a doctor as a source of information providing advice about food	-	-	.162	.397	**.776**

* loading < 0.10

Factor Structure

The final factor structure of this 16-item questionnaire is shown in Table 1, with factor loadings above 0.50 shown in bold type. This shows a clear five-factor solution, with no item loading significantly on more than one factor. The factors were described as: Factor I - Dangers of genetic modification (four items), Factor II - Knowledge about genetic modification issues (four items), Factor III- Trust in media information sources (four items), Factor IV - Labeling of food products (two items), and Factor V - Trust in food information sources (two items).

Internal consistency reliabilities were calculated for the five subscales identified in Table 1. The Cronbach alpha values for each subscale were: I - Dangers of genetic modification (0.88), II - Knowledge about genetic modification issues (0.77), III- Trust in media information sources (0.67), IV - Labeling of food products (0.73), and V - Trust in food information sources (0.81).

Conclusion

This paper has presented preliminary results in the development of a multi-dimensional scale designed to assess consumer attitudes towards genetically modified foods. The final 16-item scale appears to have a clear multi-dimensional structure and acceptable internal reliability. The coverage of such publicly expressed concerns as potential dangers, level of knowledge, trust in media and other sources of information, and labeling issues, suggest the scale has construct validity. However, extensive validation and subsequent norm development has yet to be completed. This will involve a series of validation studies to verify that the scale behaves as expected, as well as estimating the distribution of scores across the population.

References

Bredahl, L. G., 2001. Determinants of Consumer Attitudes and Purchase Intentions with Regard to Genetically Modified Foods – The Results of a Cross-cultural Study. Journal of Consumer Policy, 24 (1), 23-61.

Bredahl, L. G., Grunert, G., and Frewer, L. J., 1998. Consumer Attitudes and Decision Making with Regards to Genetically Engineered Food Products – A Review of the Literature and a Presentation of Models for Future Research. Journal of Consumer Policy, 21**,** 251-277.

Churchill, G. A. Jr., 1979. A Paradigm for Developing Better Measures of Marketing Constructs. Journal of Marketing Research, 16, 64-73.

Coghlan, A., 2001. Keep Your Distance: Canada Warns That Modified Crops Can Spread Further Than Thought. New Scientist Online News, 24 November 2001. Available from http://www.newscientist.com/hottopics/gm/gm.jsp?id=23181700, accessed 23 June 2004.

Hursti, U-K. K., Magnusson, M. K., and Algers, A., 2002. Swedish Consumers' Opinions about Gene Technology. British Food Journal, 104 (10/11), 860-872.

Kleiner, K., 2000. Unfit for Humans: Corn has been Contaminated with a Potentially Harmful Protein. New Scientist Online News, 2 December 2000. Available from http://www.newscientist.com/hottopics/gm/gm.jsp?id=22671100, accessed 23 June 2004.

Larson, K., 1999. Special Report: Genetic Modification and the World Food Market. Cereal Foods World, 44 (7), 474-476.

Li, F., Miniard, P. W., and Barone, M. J., 2000. The Facilitating Influence of Consumer Knowledge on the Effectiveness of Daily Value Reference Information. Journal of the Academy of Marketing Science, 28 (3), 425-436.

Marshall, D., 1995. Better Liked than Right: Trustworthiness and Expertise as Factors in Credibility. In Marshall, D. (Ed.), Food Choice and the Consumer. Glasgow: Blackie.

Moorman, C., 1990. The Effects of Stimulus and Consumer Characteristics on the Utilization of Nutrition Information. Journal of Consumer Research, 17 (December), 362-374.

Papanikolaw, J., 2000. Use of Transgenic Crops to Plateau Before Growing. Chemical Market Reporter, 10 April, 22.

Renton, M., and Fortin, D. R., 2003. Consumer Acceptance of Genetically Modified Foods in New Zealand. British Food Journal, 105, 42-59.

Rossiter, J. R., 2002. The C-OAR-SE Procedure for Scale Development in Marketing. International Journal of Research in Marketing. 19, 305-335.

Smith, A. P., Young, J. A., and Gibson, J., 1999. How Now, Mad-Cow? Consumer Confidence and Source Credibility During the 1996 BSE Scare. European Journal of Marketing, 33 (11/12), 1107-1122.

Subrahmanyan, S., and Cheng, P. S., 2000. Perceptions and Attitudes of Singaporeans Towards Genetically Modified Food. Journal of Consumer Affairs, 34 (2), 269-290.

Watson. J. J., and Wright, K., 1999. Consumer Ethnocentrism and Attitudes Toward Domestic and Foreign Products. European Journal of Marketing, 34, (9/10), 1149-1166.